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

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

VOLUME-IA PART – I CHAPTER – I
PROJECT INFORMATION

	Project Information	
1.	Name of the Project	YADADRI Thermal Power Station
2.	Station Capacity	5X800 MW (Coal based)
3.	Owner	Telangana State Power Generation Corporation Limited (TSGENCO)
4.	Site Location	Site is located 7 km from the NH565 (SH2). Veerlapalem village, Dameracherla Mandal, NALGONDA DISTRICT, TELANGANA STATE
5.	Latitude	16° 42'20.40 N
6.	Longitude	79° 34'41.56 E
7.	Nearest Town	30 Km Miryalaguda
8.	Nearest Railway Station	6.5 Km Damercherla
9.	Nearest Airport	130 Kms (Vijayawada)
10.	**Site Conditions**	
a.	Ambient Temperature	
i.	Daily minimum (average)	10°C
ii.	Daily maximum (average)	47°C
iii.	Design Ambient Temperature	50°C
iv.	Ambient temperature (performance)	38°C
b.	Relative Humidity for design / efficiency	48-84 %
c.	Annual rainfall, mm	600 mm
d.	Plant Elevation above MSL	85 m above MSL
e.	Mean Wind Speed	8 km/h
f.	Wind Pressure	As per the latest revision of IS 875/1987

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

1.2. The Scope of the work will comprise of but not limited to the following:

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

1.2.1. SCOPE OF WORKS-GENERAL:

The scope of work under the specification broadly covers the receipt of materials from site BHEL stores/customer stores/storage yard, handling at stores/storage yard, transportation to site of work, preassembly, erection, testing, pre-commissioning testing and checks, assistance for commissioning and Trial Operation (if applicable), supply and application of final painting and handing over of complete HT and LT Electrical Works for the Flue Gas Desulphurization(FGD) system and its auxiliaries for all five Units and Common Systems of FGD at 5 x 800MW Yadadri Thermal Power Project.

1.2.2. BROAD SCOPE OF HT AND LT ELECTRICAL WORKS:

1.2.2.1. The broad scope of HT and LT Electrical works covered in this tender are Erection and Commissioning of transformers (all types), Switchgears (HT and LT), Busducts(HT and LT), Control panels, commissioning of HT and LT drives, Diesel Generators, HT and LT Cabling, Tray works, Battery, Battery charger, Junction Boxes, Push Button Drives, commissioning of LT Drives and other associated items, including Permanent Nomenclature of individual feeders & Panels etc. Brief details are specified below. Detailed Scope is as mentioned in the BOQ and elsewhere in this specification.

A. Erection, Testing and Commissioning:

i. Erection, Testing and commissioning of Power Transformers including but not limited to the following.

a. **FGD Transformer:**

i. 55MVA FGD Transformers and its accessories. (Note: 55MVA Transformer tanks are already placed on the foundation)

ii. During every filling of Oil from storage tank to transformer, required testing of oil shall be carried out in NABL accredited labs if required within the quoted price.

iii. Transformer Oil drain piping works upto the tank/collection sump as required.

iv. Completion of Structural works if any as required.

b. Other Transformers

ii. 11 kV and 3.3 kV HT Switchgears

iii. HT Bus Duct

iv. Control Panels

v. Laying and termination of HT cables including supply of ferrules, tag plates, and cable dressing materials as detailed in scope of cabling. Arranging required capacity of portable DG set to cater power supply for carrying out tray and cabling works for equipment located at long distance.

vi. Fabrication and installation of steel supports wherever required.

vii. Erection of earth flats and earth pits for above ground earthing of HT equipment.

viii. Installation of other items that have not been specifically indicated, but required for completing installation.

ix. 415 V LT Switchgears, 415 V AC & 220 V DC Distribution Boards, Starter panels.

x. Electronic Control panels/ Starter panels/ Scanner panels.

xi. LT Bus Ducts.

xii. Battery & Battery Charger panels.

xiii. DG sets with Steel Chimney and Acoustic enclosure/canopy.

xiv. Laying and termination of LT Cables including supply of ferrules, tag plates and cable dressing materials as detailed in scope of cabling.

xv. Laying of special cables like CAT 5, CAT 6, fiber optic cables and splicing of OFC cables.

xvi. Cable Trays & Accessories and tray supports.

xvii. Local Push button stations, local starters, Junction boxes, etc.

xviii. Earth flats for aboveground earthing of equipment and Earthing the equipment with the nearby earth pits as per site requirements.

xix. Installation of above ground earthing grid, earthing of equipment/cable racks/ trays etc. as applicable

xx. Installation of Lightning protection (as applicable).

B. Commissioning of the following which are erected by other contractor

1. HT motors
2. LT motors
3. Bi-Directional Drives, Control panels, insulators, special instruments, etc. erected by Mechanical / other contractor.
4. LT Unidirectional drives, Bidirectional drives & Electrical hoists

5. Control panels, special instruments, etc. erected by Mechanical/ other contractor.

Note: If any peripheral Electrical item associated with the above said main equipment which was not erected by other contractor but it is required for complete commissioning shall be erected and commissioned by the contractor.

C. Others:

1. Painting including supply of paints, as detailed in scope of respective item/ equipment.
2. Contractor shall have valid electrical license to carry out the work indicated in the BOQ.
3. Arranging required capacity of portable DG set to cater power supply for carrying out tray and cabling works for equipment located at long distance.
4. Supply of consumables as per the relevant clauses elsewhere specified in the tender.
5. Embossing Permanent nomenclature on individual feeders/Trays/LT panels/LT Equipment/other LT Systems as per site requirement.
6. Necessary arrangements for Protecting and safe guarding the Erected equipment from any damages and pilferages.

1.2.2.2. Scope of bidder also covers on getting Electrical Inspector/statutory authority's approval for charging of all HT and LT installations erected by them.

1.2.2.3. The scope of work covers identification of items at stores / yards, checking, reporting the damages if any, loading, transportation, unloading at Contractor's stores / working yard, keeping in safe custody in contractor's stores, pre-assembly, calibration, checking, erection, testing and commissioning, supply of consumables like electrodes, gas, cable dressing materials, tag plates, PVC sleeves for wire marking, lugs (specific sizes), specific type of fasteners, paints and its consumables. Deployment of skilled / unskilled manpower, engineers / supervisors, T & P, Material handling equipment's, testing instruments, returning of un-used materials / items to BHEL stores.

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

1.2.2.5. The scope of specification covers the material receipt from BHEL stores, transportation to erection site, installation, testing and commissioning of the electrical equipment, hardware, software (data concentrator) communication along with accessories as detailed in Bill of Materials.

1.2.2.6. If any item or equipment not covered but requires be erected / commissioned, the same shall be carried out by the contractor. Equivalent unit rate for those item or equipment shall be considered wherever possible from the BOM.

1.2.2.7. **Note:** The scope of works under the contract covers complete HT and LT Electrical Works for the Flue Gas Desulphurization (FGD) system and its auxiliaries for all five Units and Common Systems of FGD at 5 x 800MW Yadadri Thermal Power Project, as specified in earlier paragraphs.

However, only for the purpose of return of Security Deposit as per GCC clauses 1.11 and 2.24.2, and refund of Retention Amount as per GCC clause 2.22.2, Stage-I (Unit 1 & 2) and Stage II (Unit 3, 4 & 5) works shall be considered separately.

Note: Detailed BOM in system-wise and BHEL unit wise with detailed specification of various equipment's and items are given in the VOLUME- IA PART-I CHAPTER-IX. The rate schedule is the summary of BOM i.e. consolidated list of BOM. Contractor shall go through the detailed BOM and specification before filling the rate in the rate schedule.

FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT CHAPTERS IN THIS BOOK

VOLUME-IA PART – I CHAPTER – III
Facilities & CONSUMABLES in the scope of Contractor / BHEL

Sl. No.		Description	Scope of BHEL	Scope of Bidder	Remarks
	PART-A-ESTABLISHMENT				
1.3.1.1.	**A**	**FOR CONSTRUCTION PURPOSE:**			
	1.	Open space for office	Yes		
	2.	Open space for storage	Yes		
	3.	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
	4.	Bidder's all office equipment, office / store / canteen consumables		Yes	
	5.	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
	6.	Firefighting equipment like buckets, extinguishers etc.		Yes	
	7.	Fencing of storage area, office, canteen etc. of the bidder		Yes	
1.3.1.2.	**B**	**FOR LIVING PURPOSES OF THE BIDDER**			
	1.	Open space	Yes		
	2.	Living accommodation		Yes	
1.3.1.3.	**C**	**ELECTRICITY**			
	1	Electricity For construction purposes (to be specified whether chargeable or free)	Yes		
	1.a	Single point source	Yes		Free of Charges
	1.b	Further distribution for the work to be done which include supply of materials and execution		Yes	
	2	Electricity for the office, stores, canteen etc. of the bidder within the plant premises		Yes	

Sl. No.		Description	Scope of BHEL	Scope of Bidder	Remarks
	2.a	Distribution from single point including supply of materials and service		Yes	
	2.b	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
	2.c	Duties and deposits including statutory clearances for the above		Yes	
	2.d	Demobilization of the facilities after completion of works		Yes	
	3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc.		Yes	
1.3.1.4.	**D**	**WATER SUPPLY**			
	1	For construction purposes:	Yes		Free of Charges
	1a	Making the water available at single point	Yes		Free of Charges
	1b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.5.	**E**	**Water supply for bidder's office, stores, canteen etc.**			
	1	Making the water available at single point		Yes	
	2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.6.	**F**	**LIGHTING**			
	1	For construction work (supply of all the necessary materials) At office storage area, At the preassembly area, At the construction site/area		Yes	

Sl. No.		Description	Scope of BHEL	Scope of Bidder	Remarks
	2	For construction work (Execution of the lighting work/ arrangements) At office Storage Area, At the preassembly area, at the construction site/area		Yes	
1.3.1.7.	**G**	**COMMUNICATION FACILITIES for site operations of the bidder**			
	1	Telephone, Fax, internet, email etc. (min 2 Nos of PC & Printer) – 2 Data entry operator with computer knowledge		Yes	
1.3.1.8.	**H**	**COMPRESSED AIR SUPPLY**			
	1	Supply of Compressor and all other equipment required for compressor & compressed air system including pipes, valves, storage systems etc		Yes	
	2	Installation of above system and operation & maintenance of the same		Yes	
	3	Supply of the all the consumables for the above system during the contract period		Yes	
	PART-B -ERECTION FACILITIES				
	1	Engineering works for construction			
	2	Providing the erection drawings for all the equipment covered under this scope	Yes		
	3	Drawings for construction methods		Yes	In consultation with BHEL
	4	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes	Yes	Yes	In consultation with BHEL
	5	Shipping lists etc for reference and planning the activities	Yes	Yes	In consultation with BHEL

Sl. No.		Description	Scope of BHEL	Scope of Bidder	Remarks
	6	Preparation of site erection schedules and other input requirements		Yes	
	7	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
	8	Weekly erection schedules based on Sl No. 6		Yes	In consultation with BHEL
	9	Daily erection / work plan based on Sl No. 7		Yes	In consultation with BHEL
	10	Periodic visit of the senior official of the bidder to site to review the progress so that works is completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	In consultation with BHEL
	11	Preparation of preassembly bay		Yes	
	12	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder themselves			Not Applicable

1.3.3. LAND

1.3.3.1. Minimum Open space will be provided at free of charges to the contractor within the plant premises or adjacent to the plant boundary for construction of temporary office shed, contractor's stores shed(s). Contractor shall adopt pre-engineered / pre-fabricated constructions made of steel with single / double skin, insulated for un- insulated roof and wall coverings (fabricated out of permanently color coated metal sheets) for his site office, covered store or any other temporary building. Alternatively, contractor can adopt readymade 'porta cabin" or similar construction.

1.3.3.2. BHEL shall not provide to the contractor any residential accommodation to any of their Labour/Staff and the contractor has to make their own arrangements. Only Land for Labour colony will be provided by BHEL adjacent to the plant boundary to contractor at free of cost. Contractor has to make their own arrangements for labour colony.

1.3.3.3. Contractor has to furnish the details of requirements of area of space for his office, stores, storage shed, labour colony etc. at site before starting the work to BHEL Site Engineer.

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

1.3.4. ELECTRICITY:

1.3.4.1. The construction power (415V) will be provided at a single point for construction purpose free of charge. Construction power shall be provided from the nearest Substation / tapping point within the plant premises. For the purpose of measurement of power consumed, the contractor shall provide Energy meter with valid calibration certificate. Distribution from this source to different locations is to be arranged by the bidder at their cost.

1.3.4.2. Electricity for labour colony will be provided at single point on chargeable basis at the prevailing rate of TSGENCO. Distribution from this source to different locations is to be arranged by the bidder at their cost.

1.3.4.3. Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor. Demand charges if any to be borne by the contractor.

1.3.4.4. Provision of distribution of electrical power from the given points to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State/ BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.

1.3.4.5. BHEL is not responsible for any loss or damage to the contractor 's equipment as a result of variations in voltage / frequency or interruptions in power supply.

1.3.4.6. Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.8 shall be provided by the contractor at their cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.

1.3.4.7. Contractor has to make their own arrangements for their electricity requirement for their labour colony at their cost if Electricity is not provided by TSGENCO.

1.3.4.8. As there are bound to be interruptions in regular power supply, power cut/load shedding in any construction sites, contractor should make their own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown /failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency

1.3.5. CONSTRUCTION WATER

1.3.5.1. Water (Raw water) required for construction purposes will be provided at one single point within the plant area at free of charge for construction purpose and

bidder has to make their own arrangement for further distribution by arranging required pipes, valves, pumps, etc.

1.3.5.2. Water (Raw water) for labour colony shall be provided at single point on chargeable basis at the prevailing Government Tariff and bidder has to make their own arrangement for further distribution by arranging required pipes, valves, pumps, etc.

1.3.5.3. Incase non-availability of water, the contractor shall make their own arrangements of water suitable for construction purpose to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make their own arrangements for their water requirement for their labour colony at their cost.

1.3.6. **DRINKING WATER:** Bidder shall provide drinking water at the work spot at their cost.

1.3.7. **ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:**

1.3.7.1. Contractor has to provide at BHEL office, minimum two computers per package and printers along with refilling of cartridges whenever required (along with one operator per PC) for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate. Computers shall have minimum configuration of minimum Windows 7 OS, 4GB RAM and Internet Explorer 8 or above.

1.3.8. **CONSUMABLES:**

1.3.8.1. Such of those consumables as indicated as consumables provided by BHEL alone will be provided to the contractor by BHEL free of charge for erection activities. Other required consumables like electrodes, all gases, and other materials for this scope of work are to be arranged by the contractor at their cost.

1.3.8.2. All the required electrodes (in their scope) as approved by BHEL shall be arranged by contractor at their cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.

1.3.8.3. All electrodes including stainless steel electrodes required for shall be arranged by the contractor at their cost. The bidder shall use the Customer approved quality welding electrodes only.

1.3.8.4. The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless steel), all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks,

scaffolding and pre-assembly materials, hardware items etc. required for temporary works such as supports, scaffoldings, bed are to be arranged by them. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by them.

1.3.8.5. All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

1.3.8.6. In the event of failure of contractor to bring necessary and sufficient consumables, BHEL shall arrange for the same and the entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.

1.3.9. MATERIAL SUPPLY:

1.3.9.1. BHEL will supply the materials/equipment indicated in the weight schedule from their respective manufacturing units which are to be executed/incorporated in the permanent system.

1.3.10. POSSESSION OF GENERATORS:

1.3.10.1. As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the tenderer / contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have adequate diesel operated generator sets for welding to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting. No separate payment shall be made for this contingency.

1.3.11. LIGHTING FACILITY (with ELCB):

1.3.11.1. Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, pre assembly yard and contractor's material storage area etc. at their cost.

1.3.12. GASES:

1.3.12.1. All the required gases like Oxygen / Acetylene / argon /Nitrogen required for work shall be supplied by the Contractor at their cost. It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of these gases. Non-availability of gases cannot be considered as reason for not attaining the required progress.

1.3.12.2. BHEL reserves the right to reject the use of any gas in case required purity is not maintained.

1.3.12.3. The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.

1.3.12.4. The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.

1.3.13. ELECTRODES SUPPLY AND STORAGE:

1.3.13.1. The bidder shall use the BHEL / Customer approved quality welding electrodes only.

1.3.13.2. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.

1.3.13.3. Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate. Contractor shall submit weekly/ fortnightly/ monthly statement/ report regarding consumption and available stock of all types of electrodes for avoiding stoppage of work on consumable scarcity.

1.3.13.4. Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at their own cost by the contractor.

1.3.13.5. All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at their cost.

1.3.13.6. In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's first subsequent bills at market value plus departmental charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.

1.3.13.7. BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at their cost without loss of time.

1.3.14. OTHER FACILITIES:

1.3.14.1. Adequate waterless urinals [at least 2 nos per level] shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like with proper disposal arrangement.

1.3.15. MATERIALS /CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR AT THEIR COST FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENTS/ITEMS.

1.3.15.1. All welding electrodes, filler wires, gases shall be arranged by the contractor a their cost.

1.3.15.2. Supply of paints, Ferrules, lugs for sizes up to 2.5 sq mm shall be in the scope of the contractor within the quoted rate.

1.3.15.3. Other items

1. Provision for Temporary scaffoldings
2. Insulation tapes
3. Paints required for primer coating & final coating and for protective coating. paint of approved colour, consumables like thinner brushes, emery paper etc.,
4. Solder wire (Lead 60/40)
5. Protocol / calibration report sheets as per BHEL format
6. PVC wire marker sleeves and tag plates
7. Panel / JB sealing compound material (for cable entry from bottom / top of panel)
8. Materials required for cable dressing
9. Anchor fasteners for wall mounted cable trays & JBs wherever required.

1.3.16. TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS

1.3.16.1. CABLE LUGS:

Type	Solderless Crimping Type
Material	Copper/ Aluminium
Whether Tinning required (for copper cable lugs)	Yes
Thickness of Tinning	10 Microns
Applicable Standard for LT cables	IS:8309

1.3.16.2. FERRULES:

Colour of Ferrules	Yellow/White
Colour of Engraving	Black

1.3.16.3. TAGS:

Material	Al/Fiberglass/Stainless Steel
Markings	Engraving/Embossing/Printing

1.3.17. **POWER REQUIREMENT:**

1.3.17.1. For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum kW demand before starting the work at site to BHEL Site Engineer.

1.3.18. CONTRACTOR'S OBLIGATION ON COMPLETION:

1.3.18.1. On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at their cost. In the event of their failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

VOLUME IA PART I CHAPTER IV
T&PS AND MMEs TO BE DEPLOYED BY CONTRACTOR

1.4. T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR:

Major T&P and testing equipment given in the below list is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity/ numbers as mutually agreed at site for major T&Ps, have to be adhered to.

1.4.1. Tentative list of Major T&P shall be deployed for execution within quoted Price:

a. Oil Filtration Machine with all accessories 10 to 12 KL/hr capacity: As required

b. 40 KL capacity oil storage tank with all accessories: As required

c. Sufficient quantity of Nitrogen Gas (with 99.999% purity and Dew point-50 or better) has to be arranged for top up during preservation of Transformers till the oil filling.

d. Mobile Crane min. 14 T like Farana or equivalent – As required

1.4.2. T&Ps mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity / numbers as mutually agreed at site for major T&Ps, have to be adhered to. Numbers / time of requirement of T&Ps will be reviewed time to time by BHEL site and contractor will provide required T&Ps / equipments to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation and certification regarding capacity etc. prior to dispatch of heavy equipments. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P's during the contract period will be mutually agreed in line with construction requirement.

1.4.3. Computerized ferrules printing machine (min – 01 No.) shall be provided for making printed ferrules for all the cables.

1.4.4. EQUIPMENT REQUIRED FOR TESTING, COMMISSIONING & OPERATION:

The tentative list of testing equipment shall be arranged by contractor in sufficient number to carry out the job simultaneously in more than one area within the quoted rate.

i. Sufficient quantity of ARC FLASH suits suitable for HV voltages to be arranged by contractor for personnel involved in the testing, commissioning and initial O&M of HV Electrical equipment

ii. Insulation tester:
   a) Motorized Megger - 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohms (make: Kyoritsu) with PI option.
   b) Hand operated Megger - 0.5 KV/1.0 KV/2.5 KV, 0- 1000 M Ohms

iii. Earth resistance tester 0 to 1, 10, 100 ohms
iv. Transformer oil test kit
v. Torque wrench
vi. Voltmeter AC 0 - 125 - 250 - 625 V AC
vii. Ammeter AC 0 - 2A - 10A AC
viii. Wattmeter - ac/dc - 0 - 125 - 250 V 0-5-10A.
ix. Multimeter - analogue: AC V 2.5V - 2500V, AC A - 100 mA - 10 A
DC V 25.V - 2500V, dc A - 50mA - 10A
x. Digital Multi meters (make: Fluke) AC 0V-600V, DC 0V-300V
xi. Resistance - 0 - 200 M ohms
xii. Digital: voltages AC & DC - 100mv - 1000 V
Current 10-mA - 10A Resistance - 0-20 M ohms
HT cables Fault locator • HT cable straight through jointing kits – 02 Nos (min) for each cable sizes • HT cables jointer for straight through jointing and end termination on 24x7 basis • High vacuum oil filtering machine of 5 to 6 KL/hr (1 no) and 1KL/Hr for transformer
xiii. VARIAC - 1 /3 phase - 5A, 15A 3 phase - 10A, 20A.
xiv. Primary injection kit - 0-10000 A.
xv. Relays testing kit for Secondary injection test (Make: Omicron)- 0-5A.
xvi. HV Test kit - 50 KV AC 400kVA.
xvii. Wheat stone bridge - 0.05 m ohm - 100 ohm.
xviii. Oscilloscope
xix. Air compressor.
xx. Oil Tank for transformer oil filtration
xxi. Winding inductance/capacitance test kit
xxii. 220V DC power pack for control supply required for testing of panels
xxiii. Vacuum pump.
xxiv. Phase sequence meter - 110V - 450V - 25 to 65Hz.
xxv. Frequency meter - 0 - 115 - 230 - 4500 - 45 - 601/s.
xxvi. Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A.
xxvii. Tachometer etc.
xxviii. mA Source
xxix. Tan Delta Test kit – Only if HV transformers are include in rate schedule
xxx. Oil specific gravity and PPM measuring Equipment-Only if HV Transformers are included in rate schedule
xxxi. Dew point measurement instrument kit
xxxii. 3 Phase relay testing kit (Of type omicron etc.) To be brought when required

xxxiii. Contact resistance measurement kit

xxxiv. Micro Ohm meter

xxxv. Equipment's for SFRA Test (of required kV on either side)

xxxvi. Equipment for DGA test on Transformers (Guidelines attached in elsewhere in this specification)

xxxvii. HT discharge rod (min 11 kV) – 3 sets (min)

xxxviii. Lockout Tagout (LOTO) system for implementing during testing, commissioning & initial operation of Electrical equipment

xxxix. Insulating Rubber mats & Hand gloves (as required)

xl. Transfomer oil particle count test kit – As required

Note: *The list mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity /numbers as mutually agreed at site for major T&Ps, have to be adhered to.*

1.4.5. 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 up to 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

S.No.	INSTRUMENT / TOOL	RANGE	ACCURACY
		Philips Current 20 mA to 20 A DC	± 0.5% + 1 digit
		Hcl Current 200 mA to 010 A AC	± 1% + 1 digit
4	Vibration Measuring Equipment	Velocity up to 50 mm/sec.	± 0.5% mm/sec
		Displacement up to 300 microns	± 2 microns
5	Secondary Injection Kit	Up to 5A	± 0.5mA
6	Motor operated Megger	up to 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 to10mm	± 0.01 mm
13	Hand operated Megger 500V / 1000V/2.5 KV	Up to 1000 M Ohms	± 5% at Centre Scale ± 10% at end of Scale
14	Motorized Megger 2.5 KV	Up to 1000 M Ohms	± 5% at Centre Scale ± 10% at end of Scale
15	Earth Resistance tester (Tester)	0 to 1, 10 Ohms	± 5% at Centre Scale range
16	AC tongue Tester	0 to 1000A AC	± 3%

S.No.	INSTRUMENT / TOOL	RANGE	ACCURACY
17	DC Tongue Tester	0 to 300A DC	± 5%
18	High Voltage test Kit	Up to 50 KV AC -50 ma capacity	± 10%
		Up to 70 KV DC	± 10%
19	DC Ammeter	0 to 300 A	
20	DC Voltmeter	0 to 500 V	
21	Micro Ohm meter	10A and 100 A	
22	Primary Injection kit	0-10000A	
23	Single Phase Variac	0-15 Amps	
24	Motor Direction tester		
25	DC Tong Tester (mA)	0-500 mA	
26	Contact Resistance Tester for Breaker contact Resistance measurement		
27	Motorized Megger 5kV	10000 Mega Ohms	

Note:

1. For loading and transportation, all necessary T & P such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor. All the tools & plants required for this scope of work, except the tools & plants provided by BHEL are to be arranged by the contractor within the quoted rates.
2. **Note for Contractor's Instruments:**
   a. The contractor shall arrange all the above T&P, equipment and instruments as indicated except testing instruments which are proprietary in nature.

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

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

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

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

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

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

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

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

j. Wherever frequent calibration is required; contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments.

1.4.6. PROTECTION / HANDLING OF TOOLS AND PLANT ARRANGED BY THE CONTRACTOR

1.4.6.1. Equipment, vehicles, tools and plants and materials brought to site by the contractor from their resources shall have distinctive identification marks and the contractor shall intimate the description and quantity to BHEL in writing.

1.4.6.2. All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without extra cost necessary enclosures containers and protective materials for proper storage of materials inside, whenever so instructed by the purchaser without any extra cost.

1.4.6.3. No material or equipment or tools etc., shall be taken out of the work-site without the written consent of BHEL.

1.4.6.4. BHEL shall not be responsible for the safety and protection of the materials of the contractor and the contractor shall make their arrangements for proper watch and ward for their materials.

1.4.6.5. Until such time the work is taken over by BHEL, the contractor shall be responsible for proper protection including proper fencing, guarding, lighting, flagging, and watching. The contractor shall during the progress of work properly cover up and protect any part of the work liable to damage by exposure to the weather and shall

take every reasonable precaution against accident or damage to the work from any cause.

1.4.7. In the event of non-mobilisation of Tools, Plants, Machinery, Equipment, Material or non-availability of the same owing to breakdown and as a result progress of work suffered, BHEL reserves the right to make alternative arrangement (available or higher capacity) in line with SCC clause no. 4.2.1.7 and hire charges shall be applicable as under:

i. **BHEL provides its own Capital T&P:** If BHEL provides owned T&P then BHEL, hire charges (as per BHEL norms) will be recovered from the contractor as per the prevailing BHEL Corporate hire charges applicable (as enclosed in Volume I Book I TCC- Volume IA Part II) as per following cases:

- In case the T&P is specifically listed in "T&Ps to be deployed by Contractor", 'Rates of hire charges applicable to outside agencies other than contractors working for BHEL' will apply.
- In case the T&P is not specifically listed in "T&Ps to be deployed by Contractor", 'Rates of hire charges applicable to contractors working for BHEL' will apply.

The hire charges of Capital Tools & Plants are exclusive of operating expenses e.g., Operator, fuel & Consumables and the same shall be arranged by the contractor at his cost.

ii. **BHEL provides hired T&P:** In all cases other than that specified in Sl No. i above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor.

VOLUME IA PART I CHAPTER V
T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

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

1.5.1. BHEL may provide either BHEL owned or hired 75T (or above capacity) cranes as per site requirement for erection at the discretion of BHEL.

1.5.2. In the event of providing BHEL owned cranes:

1.5.11.1 BHEL shall provide crane operator at free of charges.

1.5.11.2 Fuel and lubricants are to be arranged by the contractor within the quoted rate.

1.5.11.3 Maintenance for the BHEL own cranes shall be carried out by BHEL. However, all the consumables for the maintenance of BHEL own cranes shall be provided by the contractor within the quoted rates. The Tentative List of consumables required to be provided by contractor from the BHEL/OEM recommended supplier is as below:

a. Engine Oil
b. Fuel Filters
c. Air Filters
d. Hydraulic Oil
e. Hydraulic Filters
f. Gear Oil
g. Engine Oil Filter
h. Oil Separator Filter
i. Rope
j. Grease
k. Maintenance for the BHEL cranes shall be carried out by BHEL. The bidder shall extend support if required for routine maintenance works without any additional cost.

1.5.3. **In the event of providing hired cranes:**

1.5.3.1. Crane Operators for hired cranes will be provided by BHEL, free of charges.

1.5.3.2. Fuel and lubricants are to be arranged by the contractor within the quoted rate.

1.5.4. Cranes provided by BHEL are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.

1.5.5. The availability of crane is likely to be hampered from time to time due to routine preventive maintenance or breakdown maintenance. Contractor has to make alternative arrangement or plan / modify / alter their activities to suit the above

conditions and the contractor will not be liable for any compensation or extension of time due to this non-availability, for maintaining the erection schedule.

1.5.6. In the event of the crane not available for longer duration due to major breakdown or any other reasons, BHEL will reschedule the work in consultation with bidder and direct the bidder to concentrate on other areas till such time the cranes are made available.

1.5.7. Any loss / damage to any or part of the BHEL T&Ps by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.

1.5.8. All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections shall have to be arranged by the contractor at their cost.

1.5.9. Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be in the Contractor's scope.

1.5.10. Apart from the above-mentioned tools, any other tools and plants including suitable Jacks / Hydraulics jacks required for satisfactory completion of the work has to be arranged by the contractor.

1.5.11. For the cranes, the required consolidation and preparation for placing crane for operation (civil work) is under bidder scope and also necessary plates / sleepers required for marching operation shall be provided by the contractor within quoted rates.

1.5.12. For movement of cranes etc., it may become necessary to lay sleeper bed for obtaining leveled safe approach for usage of equipment. It shall be the responsibility of the contractor to lay necessary sleeper's. The sleepers shall be arranged by the contractor at their cost.

1.5.13. The contractor at their cost shall arrange for grouting of anchor points of T&Ps issued to them. Necessary grout materials are to be arranged by the contractor at their cost.

1.5.14. In case of non-availability of any of these equipment, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make arrangement at their cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.

VOLUME-IA PART – I CHAPTER-VI
TIME SCHEDULE

TIME SCHEDULE

1.6.1.1. The entire work of erection testing and commissioning as detailed in the Tender Specification shall be completed within **13 (Thirteen)** months from the date of commencement of work at site.

1.6.1.2. During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.

1.6.1.3. The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

1.6.1.4. The contractor is required to refer Form 15 in Volume 1- BOOK 2 for all the instructions to be taken immediately after receipt of LOI.

1.6.2. COMMENCEMENT OF CONTRACT PERIOD

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

1.6.3. MOBILIZATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIOING ETC.,

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

A. Major Milestones	
Milestone Activity	**Completion from the commencement of works at site**
Completion of Electrical Erection activities of FGD System of Stage-I (Unit#1 and Unit#2)	7th Month
Completion of Electrical Erection activities of FGD System of Stage-II (Unit#3, Unit#4, Unit#5)	8th Month
Readiness for Hot Commissioning of FGD System of Stage-I (Unit#1 and Unit#2)	9th Month
Readiness for Hot Commissioning of FGD System of Stage-II (Unit#3, Unit#4, Unit#5)	10th Month
Balance work completion, punch points liquidation	13th Month
B. Intermediate Milestones	

Completion of Electrical Erection activities of FGD System of Stage-II (Unit#3, Unit#4, Unit#5) (M1)	8th Month
Readiness for Hot Commissioning of FGD System of Stage-I (Unit#1 and Unit#2) (M2)	9th Month

1.6.3.2. In order to meet above schedule in general, and any other intermediate targets set, to meet customer / project schedule requirements, contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL Engineer.

1.6.3.3. In case the project is to be advanced, the erection works in the scope of the contractor is to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.

1.6.4. PENALTY FOR INTERMEDIATE MILESTONES

1.6.4.1. M1 and M2 shall be intermediate Milestones for respective works under each package.

1.6.4.2. In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones with reference to Form 14.

1.6.4.3. Incase delay in achieving M1 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to Maximum 2% executable contract value will be withheld.

1.6.4.4. Incase delay in achieving M2 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to maximum 3% of executable contract value will be withheld.

1.6.4.5. Amount already withheld, if any, against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 milestone.

1.6.4.6. Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @ 10% of RA Bill amount from subsequent RA bills.

1.6.4.7. Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of intermediate milestones shall be adjusted against LD or released as the case may be.

1.6.4.8. In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted in to recovery.

1.6.4.9. **Note:** * Executable contract value-value of work for which inputs/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

1.6.5. CONTRACT PERIOD

The contract period for completion of entire work under scope shall be 13 (Thirteen) months from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier.

1.6.6. GUARANTEE PERIOD

1.6.6.1. GUARANTEE PERIOD FOR STAGE I

The guarantee period of 12 months for workmanship shall commence from the date of successful hot commissioning of FGD system of Stage # 1 (Unit#1 and Unit#2 and the common systems pertaining to FGD System of Stage-I). (Provided all erection, testing, commissioning and pending points works are completed in all respects).

1.6.6.2. GUARANTEE PERIOD FOR STAGE II

The guarantee period of 12 months for workmanship shall commence from the date of successful hot commissioning of FGD system of Stage# 2 (Unit#3, Unit#4 and Unit#5 and the balance common system of the FGD system.) (Provided all erection, testing, commissioning and pending points works are completed in all respects).

VOLUME IA PART I CHAPTER VII
TERMS OF PAYMENT

1.7. Terms of Payment:

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

1.7.1.	Progressive Payment against monthly running bills will be made up to 85 % of the value of **the completed erection** in each package (unit) Pro rata as per Clause no 1.7.2.1.1 to 1.7.2.10.4 of the following table.	
Sl. No.	**Activity / Work Description**	**% of unit rate**
	PRO RATA PAYMENTS (85%)	
1.7.2.1.	**Cable tray and accessories**	
1.7.2.1.1.	Fabrication and fixing / welding / bolting in position	60%
1.7.2.1.2.	Earthing of cable trays	10%
1.7.2.1.3.	Tagging of cable trays (including touch up painting & cable tray numbering on sides)	8%
1.7.2.1.4.	Covering of trays where ever envisaged	7%
	Total =	**85%**
1.7.2.2.	**Cable laying including Earthing wires**	
1.7.2.2.1.	Laying of cables / Wires	45%
1.7.2.2.2.	Glanding and termination (except HT terminations)	15%
1.7.2.2.3.	Testing and charging	10%
1.7.2.2.4.	Dressing and clamping	15%
	Total =	**85%**
1.7.2.3.	**Junction box/Push button station (local)**	
1.7.2.3.1.	Erection including fixing of terminal blocks where ever applicable	75%
1.7.2.3.2.	Name plate fixing where ever applicable and labelling (inside and outside)	10%
	Total =	**85%**
1.7.2.4.	**Misc. Structural steel including cable tray supports, Canopies etc., Conduits, pipes etc.**	
1.7.2.4.1.	Fabrication / Pre assembly	45%
1.7.2.4.2.	Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	40%
	Total =	**85%**

1.7.2.5.	**DG sets / Switch Gears / MCC/ PCC / Distribution Boards / Marshalling Box / Starter Units / Electrical Hoists/ Panels/ Cubicles / Desks / UPS / Batteries / Chargers / VFD / LA assy / NGT/NGR/SP/ Circuit breaker/ Miscellaneous Equipments/ etc.**	
1.7.2.5.1.	Placement, Alignment and coupling / interconnection where ever applicable, erection of associated accessories etc	50%
1.7.2.5.2.	Pre-commissioning checks and tests	10%
1.7.2.5.3.	Charging, Loop testing and commissioning	15%
1.7.2.5.4.	System commissioning	10%
	Total =	**85%**
1.7.2.6.	**Earthing / Lightning protection strips, Earthing pits**	
1.7.2.6.1.	Fabrication, erection, alignment, welding /bolting of earthing / lightning protection strips; earth pits Completion	60%
1.7.2.6.2.	Testing / commissioning	25%
	Total =	**85%**
1.7.2.7.	**LT/HT Bus Ducts**	
1.7.2.7.1.	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc. complete with supporting structure and earthing.	50%
1.7.2.7.2.	Pre commissioning checks	20%
1.7.2.7.3.	Testing & Charging	10%
1.7.2.7.4.	Final Painting	5%
	Total =	**85%**

1.7.2.8.	**Oil Filled Transformers (FGD Transformers and other Transformers)**	
1.7.2.8.1.	Placement on foundation and alignment (Note: in case placement is already done, this payment is to be done after completion of alignment)	25%
1.7.2.8.2.	Erection of associated auxiliaries / assemblies, oil filling, earthing, including branch trays and piping work, etc	25%
1.7.2.8.3.	Dry out including oil filtration	15%
1.7.2.8.4.	Pre-commissioning checks	10%
1.7.2.8.5.	Testing, Charging	5%
1.7.2.8.6.	Final Painting	5%
	Total =	85%
1.7.2.9.	**Testing / Commissioning of Equipment (like HT/LT motors, actuators, misc equipment, etc) erected by other agencies.**	
1.7.2.9.1.	Local testing (Including oil filtration for ESP transformers)	40%
1.7.2.9.2.	Remote testing, Loop testing, and commissioning	40%
1.7.2.9.3.	System commissioning	5%
	Total =	**85%**
1.7.2.10.	**Other items**	
1.7.2.10.1.	Rubber mats / Display Boards / Miscellaneous items / etc. on installation	85%
1.7.2.10.2.	Specialized Commissioning Services - on pro rata basis.	85%
1.7.2.10.3.	Civil Works / structural works - Prorata on completion of actual work.	85%
1.7.2.10.4.	Termination, HT Termination, Straight through jointing etc : on pro rata basis	85%
1.7.3.	Further 15 % payment on pro-rata basis common to all PG shall be released on achievement of the following stage / milestones events for the **erected items in the Unit** as mentioned in the following table below:	
	STAGE / MILESTONE PAYMENTS (15%)	**% of unit rate**
1.7.3.1	Slurry preparation system commissioning	2%
1.7.3.2	Absorber Tower wet commissioning	2%
1.7.3.3	Flue Gas path commissioning	2%
1.7.3.4	Gypsum dewatering system commissioning	2%
1.7.3.5	Hot Commissioning of FGD System	2%
1.7.3.6	Area cleaning, temporary structures cutting/removal and return of scrap	1%
1.7.3.7	Punch List points/pending points liquidation	1%

1.7.3.8	Submission of 'As Built Drawings'	1%
1.7.3.9	Material Reconciliation	1%
1.7.3.10	Completion of Contractual Obligation	1%
	Total for Stage / Milestone Payments (15%)	**15%**

1.7.4. Measurement of Work

1.7.4.1 Measurement of Work as per GCC clause 2.6 shall be done separately for Electrical Works of Stage I and Stage II.

1.7.5 RETURN OF SECURITY DEPOSIT

1.7.5.1 On completion of Guarantee Period of Stage-I as defined elsewhere in the tender specifications, the Security Deposit Amount corresponding to the works of Stage-I shall be returned to the contractor in line with clause 1.11 and 2.24.2 of GCC provided all the requisite documents like Final Bill, No Claim certificate, etc. for release of Security Deposit are available for the works pertaining to Stage-I.

For this purpose of return of Security Deposit pertaining to Stage-I works, actual value of works executed for Stage-I shall be considered.

1.7.5.2 Balance Security Deposit shall be returned in line with GCC upon fulfillment of all other contractual obligations as per terms of the contract.

1.7.6 REFUND OF RETENTION AMOUNT

1.7.6.1 Retention Amount pertaining to Stage-I works shall be released along with Final Bill of Stage-I as per clause 2.22.2 of GCC.

1.7.6.2 Balance Retention Amount shall be released as per clause 2.22.2 of GCC.

Note:

NO CLAIM WHAT SO EVER MAY BE, WILL BE ENTERTAINED UNDER THIS CONTRACT, AFTER DULY SIGNING THE FINAL BILL ALONG WITH MEASUREMENT BOOKS AND ACCEPTED BY BHEL.

VOLUME-IA PART – I CHAPTER-VIII
TAXES AND DUTIES

1.8.0 Taxes and Duties:

1. **All taxes and duty other than GST & Cess and BOCW Cess**

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

2. **Goods and service Tax (GST) -**

   For GST Registered bidder:

2.1. The successful bidder shall furnish proof of GST registration under GST Law, covering the supply and services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work. The bidder to specify in their offer the category of registration under GST i.e. Regular dealer or composite dealer**.**

2.2. Bidder's price/rates shall be exclusive of GST & GST Compensation Cess (herein after termed as GST).

2.3. Vendor / Contractor require to ensure that all Input Tax benefits as per existing laws have been considered.

2.4. Price quoted by the ***composite dealer*** shall be considered as inclusive of GST. In the event of any change in the status of vendor / Contractor from composite to regular dealer after the submission of the bid but before completion of supply of services or goods, Contract value shall be amended to remove the embedded GST and any ITC benefit arising due to change of status, which shall be passed on to BHEL. GST paid on the amended contract value shall be reimbursed at actuals against the Tax invoice if BHEL is able to take input tax credit. However, no reimbursement of GST shall be made if BHEL is not able to take input tax credit. The decision of BHEL in this regard will be final and binding on the vendor/contractor.

2.5. It is the responsibility of the vendor / contractor to adhere to all the provisions of E-Invoicing under GST Act (if applicable). As per the E-Invoicing provisions vendor / Contractor has to generate IRN and QR Code from the E-Invoicing system and the same need to be printed in the invoice submitted to their customer. Invoices that do not comply to the above requirements, will not be accepted by BHEL. If the successful Bidder is not falling under the preview of E-Invoicing, then he has to submit a declaration in that respect along with relevant financial statements. However, applicability of E-invoicing, shall be

verified from the E-Invoicing portal on submission of vendor / Contractor GSTN. BHEL shall reimburse GST only if all the provisions of E-invoicing are complied with.

2.6. It is the responsibility of the vendor/ Contractor to issue the Tax Invoice strictly as per the format prescribed under the GST Act within the prescribed time period in order to enable BHEL to avail input tax credit within the due date. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge. Tax invoice should also contain below details

a. Contractor Name and Contact details.
b. GST No of Contractor
c. PAN No of Contractor
d. Document Type: Tax Invoice/ Debit Note/ Credit Note
e. Category: B2B / B2C (B2B is only applicable w.r.t BHEL)
f. Customer Name and Contact details / Bill To Details (as mentioned below)
g. Unique Tax Invoice Number
h. Invoice Date
i. IRN No, QR Code, Acknowledgment No and Acknowledgment Date generated from E-Invoice Portal as per E-invoicing provisions under GST Act (If applicable)
j. Place of Supply (as mentioned below)
k. Description of service provided
l. 8 Digit SAC code
m. GST Rate
n. Gross value of Invoice
o. Taxable Value
p. Tax / GST Amount
q. Total Invoice value including GST.

Above are inclusive and not exhaustive list of requirements.

2.7. Bidder should mention the “Bill To “and “Place of supply” as below in the Tax Invoice

Bill To: Location of BHEL Site office

---,

State: ----------
GSTN of BHEL: ----------

Place of Supply: Location of BHEL Site office

---,

State: ----------
GSTN of BHEL: ----------

(Above details will be given later, contractors may contact BHEL, PSSR before billing)

2.8. In case of supply of goods contract, the successful bidder must promptly provide details of the dispatched items on the same day they are removed for shipment to the BHEL site. This intimation must include all relevant information and documents about the goods and a scanned copy of the tax invoice. If any financial liabilities arise for BHEL due to non-compliance with GST laws resulting from the bidder's delay in providing this information, the bidder will be held liable, unless the delay is directly attributable to BHEL.

2.9. BHEL will reimburse the GST amount claimed by the Vendor/Contractor, along with the payment due to the contractor in the RAB, upon receipt of a valid tax invoice. However, if the Vendor/Contractor fails to comply with the GST compliance requirements specified below for any prior invoice, BHEL reserves the right to recover an amount equivalent to the reimbursed GST from subsequent invoices as a corrective measure for statutory non-compliance. Furthermore, the GST amount claimed in any subsequent invoices will be withheld until the statutory compliance for the preceding invoice is ensured.

However, In the case of the Vendor/Contractor's final bill, or in case where single invoice is submitted for the entire contract, BHEL will withhold an amount equivalent to the GST claimed from the invoice value towards pending statutory compliance. This withheld amount will only be released once Vendor/Contractor satisfies the below specified GST compliance requirements.

GST Compliance Requirements:

a. Vendor / Contractor must provide the original copy of Tax invoice /debit note as per the prescribed format under the GST act within the prescribed time period in order to enable BHEL to avail input tax credit within the due date.

b. The details of the invoice or debit note referred to in clause (a) must be furnished/filed by the Vendor/ Contractor in the statement of outward supplies (presently in GSTR1 or IFF) and such details should get reflected in the BHEL GST login (both in GSTR 2A and GSTR 2B) in the manner specified under GST Act.

c. Details of vendor/contractor invoice reflected in BHEL GST login should match with the details in the tax invoice submitted by the vendor/contractor, including the invoice number, invoice date, GSTIN, and place of supply. Additionally, the status of GSTR-1 and GSTR-3B filings must be "Yes."

d. The tax charged in the invoice /debit note referred to in clause (a) must be paid to the Government by the Vendor/Contractor, either in cash or through the utilization of input tax credit.

2.10 In case, any GST credit is delayed/denied to BHEL or BHEL has to incur any liability (like interest / penalty) due to non/delayed receipt of goods or submission of tax invoice after the expiry of timeline prescribed in the relevant GST Act for availing ITC, or any other reasons not attributable to BHEL, Then the same shall be recovered from the vendor/contractor along with interest levied/ leviable on BHEL.

2.11 GST shall be levied on recoveries, wherever applicable and same shall be recovered from payments. BHEL shall issue / raise Tax invoice on contractor/vendors for such recoveries.

2.12 E-way bills / Transit passes / Road Permits, if required for materials / T&P etc., bought into the project site is to be arranged by the Vendor / Contractor themselves. BHEL shall not issue or raise any Road Permit/ E- Way Bill for this purpose. Any claim or demand raised by the GST department for non- generation / non-submission of E-way bill shall be to the contractor/ vendor account

2.13 BHEL shall not reimburse any expenditure incurred by the contractor towards demand, additional liability or interest / penalty etc., raised by the GST department due to issues such as wrong rates / wrong classification of services or goods.

2.14 Where GST is payable by BHEL under reverse charge basis, any demand raised or any interest or penalty levied / leviable by the GST department due to non-submission or delayed submission of invoice by the contractor or for any other reason not attributable to BHEL, the same shall be recovered from the vendor/contractor.

2.15 Tax Deduction at Source (TDS) as per Sec 51 of the CGST Act shall be deducted (if applicable). GST TDS certificate in Form GSTR -7A shall be issued to be contractor. However, GST TDS certificate can be generated only if the contractor accepts the TDS details uploaded by BHEL and files his return. If any specific exemption from GST TDS is applicable to any contractor/vendor, then a declaration to that effect along with relevant documents as may be required by BHEL, substantiating such exemption in line with GST law provisions or notification, shall be submitted by the vendor/contractor.

For GST Unregistered bidder:

2.16 In case, bidder is not required to register under Goods and service Tax (GST) & Cess, the same is to be specified in the offer.

2.17 Successful bidder to furnish a Self-declaration that registration under GST is not required or not applicable as per the provisions of GST Law along with relevant document and provisions in the GST law.

2.18 In case BHEL has to incur any liability (like interest / penalty etc.) due to non-compliance of GST law in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

2.19 TDS under GST (as & when applicable) shall be deducted at prevailing rates on gross invoice value.

2.20 If RCM is made applicable at a later date, GST will be paid by BHEL to the department at applicable rate treating the quoted the price as inclusive of GST if BHEL is not able to take Input tax credit.

2.21 In the event of any change in the status of bidder from unregistered to registered under the GST law after the submission of bid but before the completion of supply of services or goods, the same need to be intimated and all the clauses applicable for Registered bidder need to be followed. The vendor/ contractor is required to pass on the ITC benefit arising due to change of status, to BHEL. Contract value shall be amended accordingly. GST paid on the amended contract value shall be reimbursed at actuals against the Tax invoice only if BHEL is able to take input tax credit.

3 Statutory Variations

3.1 BHEL shall pay statutory variation only for GST, and no other variations shall be payable

3.2 In general, Statutory variation for GST is payable to the Vendor/Contractor during the contract period including extension thereof. Beyond the contract period, BHEL will reimburse the actual applicable tax only if BHEL is able to take the input tax credit. However, the decision of BHEL in this regard will be final and binding on the vendor/contractor

4 New Taxes/Levies –

In case Government imposes any new levy / tax after submission of bid during the tenure of the contract, BHEL shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / tax is applicable to this contract. However, Contractor/ Vendor shall obtain prior consent from BHEL before depositing new taxes and duties.

Any benefits arise out of new tax levies and/or abolition of existing taxes must be passed on to BHEL.

The decision of BHEL in this regard will be final and binding on the vendor/contractor.

5 Direct Tax

5.1 Vendor/ Contractor is required to update himself on its own and comply with provisions of Indian Income Tax Act as notified from time to time. Purchaser shall not be liable towards liability of income tax accruing to the vendor/contractor of whatever nature including variations thereof, arising out of this Order/ Contract, as well as tax liability of the vendor/ Contractor and his personnel

5.2 Deductions of Tax at source as per Income Tax Act, at the prevailing rates shall be effected by the Purchaser before release of payment, as a statutory obligation, if applicable. TDS certificate will be issued by the Purchaser as per the statutory provisions. The Vendor/Contractor has to mention their Permanent Account Number (PAN) and GSTIN in all invoices.

6 BOCW Act & BOCW Welfare Cess Act

6.1 Contractor's price/rates shall be exclusive of BOCW Cess .

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

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

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

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

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

6.6 Contractor shall make remittance of the BOCW Cess as per the Act in consultation with BHEL as per the rates in force (presently 1%). BOCW remittance should be made only after obtaining prior consent from BHEL. BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.

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

VOLUME IA PART I CHAPTER IX
WEIGHT SCHEDULE/BOQ

1.9. BILL OF QUANTITY (BOQ)

1.9.1. BOQ

ITEM NO.	DESCRIPTION	UOM	QUANTITY
A. BHEL - HEP, Bhopal			
A.1	**ERECTION AND COMMISSIONING OF HT SWITCHGEARS**		
A.1.1	FGD SWBD (0CM) 3150 A,3.3KV, Indoor, Metal Clad (VM-12) type, Vaccum Break Switch, incomer outgoing feeders with Bus PT alongwith associated loose supplied itmes; SWBD consists of 26 panels of suitable 15 shipping sections. Overall panel size approx. 20880mm (L) x2349mm (D) x2805mm (H). Approximate weight of various shipping sections, L 820mm=1250kg; L 640mm=2500kg; L 1220mm=1600kg; L 600mm=200kg	Set	1
A.1.2	FGD SWBD (0CN) 3150 A,3.3KV, Indoor, Metal Clad (VM-12) type, Vaccum Break Switch, incomer outgoing feeders with Bus PT alongwith associated loose supplied itmes; SWBD consists of 26 panels of suitable 14 shipping sections. Overall panel size approx. 20880mm (L) x2349mm (D) x2805mm (H). Approximate weight of various shipping sections, L 820mm=1250kg; L 640mm=2500kg; L 1220mm=1600kg; L 600mm=200kg	Set	1
A.1.3	FGD SWBD (0CP) 2000 A,3.3KV, Indoor, Metal Clad (VM-12) type, Vaccum Break Switch, incomer outgoing feeders with Bus PT alongwith associated loose supplied itmes; SWBD consists of 17 panels of suitable 10 shipping sections. Overall panel size approx. 13500mm (L) x2349mm (D) x2805mm (H). Approximate weight of various shipping sections, L 820mm=1250kg; L 640mm=2500kg; L 1220mm=1600kg; L 600mm=200kg	Set	1
A.1.4	FGD SWBD (0BN) 3500A, 11KV, Indoor, Metal Clad (VM-12) type, Vaccum Break Switch, incomer outgoing feeders with Bus PT alongwith associated loose supplied itmes; SWBD consists of 38 panels of suitable 21 shipping sections. Overall panel size approx. 31920mm (L) x2349mm (D) x2805mm (H). Approximate weight of various shipping sections, L 820mm=1250kg; L 640mm=2500kg; L 1220mm=1600kg; L 600mm=200kg	Set	1
A.2	**Checking and commissioning of the following erected by Mechanical agency**		
A.2.1	11kV HT Motors	Nos	3
A.2.2	3.3kV HT Motors	Nos	40
A.3	**Earthing Breaker for 11 kV Switchgear**		
A.3.1	Feeder/ Busbar Earthing Breaker (Suitable upto 2500A)	Nos	1
A.3.2	Feeder/ Busbar Earthing Breaker (Suitable upto 3500A)	Nos	2
A.4	**Earthing Breaker for 3.3 kV Switchgear**		
A.4.1	Feeder/ Busbar Earthing Breaker (Suitable upto 2000A)	Nos	2
A.4.2	Feeder/ Busbar Earthing Breaker (Suitable upto 2500A)	Nos	2
A.4.3	Feeder/ Busbar Earthing Breaker (Suitable upto 3150A)	Nos	4
A.5	**Networking System**		

ITEM NO.	DESCRIPTION	UOM	QUANTITY
A.5.1	Data Concentrator Panel Data concentrator panel along with loose items size 800mm(W) x800mm(D) x 2000mm(H) approx weight 200kg	Set	2
A.5.2	Laying and Termination of D link 4 pair PVC, CAT 5 Lan cable	Mtrs	5000
A.5.3	FO Cable includes fixing of fibre optic components and termination kits LIU, face plates, cabinets, SC coupler, grounding etc.	Mtrs	5000
A.5.4	OFC Cable splicing	Nos	32
A.5.5	PC for prot. Relay parameterisation (EWS,OWS)	Nos	4
B. BHEL - Rudrapur			
B.1	11kV-3500 A SPBD BUSDUCT, SIZE - 3.15tk x 500 mm (height) x 1350 mm (width) x 3720 mm (length) for standard size, Conductor size - Channel Box (2 x 152.4 x 51.6 x 8.1 tk) mm, aprox weight 150 kg/mtr and includes Seal-off Bushing, Rubber Bellows, Aluminium Splice Plate & Flexibles, Copper Flexibles, Support Steel Structure, Space Heater arrangemnt, Grounding.		
B.1.1	In the section of FGD Transformer 1 & 2 to 0BN 11 KV board	Mtr	150
C. BHEL - Jhansi			
C.1	**Erection and Commissioning of Transformer**		
C.1.1	8 MVA, 11/3.6 kV 3 phase, ONAN Cooled Dyn11, FGD Auxiliary Transformer with HV/LV/LVN bushings, Marshalling Box, Conservator (air cell type), Silica gel breather (Dehydrating Breather (with Silica Gel charge) with oil seal, rollers, Radiators- 1x100% or 2x50%, OCTC on HV side, Buchholz relay, PRV, Shut off valve between Buchholz relay and conservator, Piping. Approximate Dimensions: a. Approx. Overall Dimensions(in mm): 6300(L) x4300(B) x5200(H); Total Weight (Oil Filled) - 25500 kg approx; b. Shipping Dimension of Largest package:3800(L) x2000(B) x2900(H), Weight of heaviest package - 18000kg approx.; Insulating Oil Qty - 6320kg approx. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting	Set	2
C.1.2	16 MVA, 11/3.6 KV 3 phase, ONAF/ ONAN Cooled Dyn11, FGD Auxiliary Transformer, with HV/LV/LVN bushings, Marshalling Box, Conservator (air cell type), Silica gel breather (Dehydrating Breather (with Silica Gel charge) with oil seal, rollers, Radiators- 1x100% or 2x50%, OCTC on HV side, Buchholz relay, PRV, Shut off valve between Buchholz relay and conservator, Piping. Approximate Dimensions: a. Approx. Overall Dimensions(in mm): 7100(L) x5100(B) x5300(H); Total Weight - 40000 kg approx; b. Shipping Dimension of Single largest component:4400(L) x2400(B) x3000(H), Transport Weight (Oil Filled)- 31700kg; Insulating Oil Qty - 11000kg approx. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting	Set	2

ITEM NO.	DESCRIPTION	UOM	QUANTITY
C.1.3	55 MVA, 400/11.25 KV 3 phase, ONAF/ ONAN Cooled, YNyn0, FGD Transformer (A,B), Outdoor with On Load Tap Changers (OLTC)HV/HVN/LV/LVN Bushings, post insulators, neutral bushings, bushing CTs, Turrets, Oil Conservator, Buchholtz relay, Dehydarting Breather & connected pipelines, Cooler control cabinet, common control kiosk, Piping, Rollers, Radiators/Radiator Assembly, Marshalling box, valves, fans & motors, oil pump motors, instruments and all accessories. Approximate Dimensions: a. Approx. Overall Dimensions(in mm): 15200(L) x6030(B) x9920(H); Total Weight - 139150 kg approx; b. Shipping Dimension of Largest package:8150(L) x3100(B) x4200(H), Weight of heaviest package - 75950kg approx. Insulating Oil Qty - 38280kg approx. (44000l approx.). Weight of core and winding assembly-59720kg approx; Weight of tank and fittings-17650kg, bushing, marshalling box, Radiator Bank, Conservator, Header & Pipe Work –16820g approx; * Please refer TCC for scope and other details. (Note: 55MVA Transformer tanks have been placed on the foundation and and lumpsum rate is to be quoted for balance alignment, erection, testing and commissioning which is to be done)	Set	2
C.1.4	2 MVA, 11/0.433 kV, 3 phase, AN cooled/Dyn11, Cast Resin Dry Type FGD Transformer 1EAT01, 1EAT02, 2EAT01, 2EAT02, 3EAT01, 3EAT02, 4EAT01, 4EAT02), Indoor with HV/LV/LVN Bushings, Off Circuit (Bolted links type) Tap Changers, Marshalling box; Approximate Overall Shipping Dimensions in mm :2800(L) x1965(B) x2950(H); Shipping Weight:7000kg approx. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting	Set	8
C.1.5	1 .6 MVA, 11/0.433 kV, 3 phase, AN cooled/Dyn11, Cast Resin Dry Type Limestone Service Transformer, (0EAT01, 0EAT02 and 0BET01, 0BET02), with HV/LV/LVN Bushings, Off Circuit (Bolted links type) Tap Changers, Marshalling box; Approximate Overall Dimensions:2800(L) x2025(B) x2950(H); Shipping Weight:6600kg approx each. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting	Set	4
C.1.6	1 MVA, 11/0.433 kV, 3 phase, AN cooled/Dyn11, Cast Resin Dry Type FGD Service Transformer (5EAT01, 5EAT02), Indoor with HV/LV/LVN Bushings, Off Circuit (Bolted links type Tap Changers, Marshalling box; Approximate Overall Dimensions:2500(L) x1815(B) x2700(H); Shipping Weight:4600kg approx each. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting	Set	2
C.1.7	1 MVA, 11/0.433 kV, 3 phase, AN cooled/Dyn11, Cast Resin Dry Type LHP-GHP Service Transformer (OECT01,OECT02), with HV/LV/LVN Bushings, Off Circuit (Bolted links type Tap Changers, Marshalling box; Approximate Overall Dimensions:2500(L) x1815(B) x2700(H); Shipping Weight:4600kg approx each. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting	Set	2

ITEM NO.	DESCRIPTION	UOM	QUANTITY
D. BHEL-PEM			
D.1	**Laying of HT Cables**		
D.1.1	11kV 1C-630 AL ARM. AL	Mtrs	15000
D.1.2	11kV 3C-240 AL ARM. AL	Mtrs	10000
D.1.3	3.3kV 1C-240 AL ARM. AL	Mtrs	18000
D.1.4	3.3kV 3C-185 AL ARM. AL	Mtrs	6000
D.2	**Termination of HT Cables**		
D.2.1	11KV-1C-630 AL	Nos	50
D.2.2	11KV-3C-240 AL	Nos	50
D.2.3	3.3KV 1C-240 AL	Nos	50
D.2.4	3.3KV 3C-185 AL	Nos	100
D.3	**Jointing Kits**		
D.3.1	11KV-1C-630 AL	Nos	50
D.3.2	11KV-3C-240 AL	Nos	20
D.3.3	3.3KV-1C-240 AL	Nos	10
D.3.4	3.3KV-3C-185 AL	Nos	5
D.4	220 V DC Battery-Each set comprises of bank of 108 cells, Each cell Size 230mmX 368mm X 682mm; Weight of each cell-70.5kg; Overall approx. weight per set without acid 7603 kg; Overall approx. weight with acid 10960kg, Approx. weight includes wooden stillage/ insulator, inter cell connector,etc. .	Set	4
D.5	Float cum Boost Battery charger 220 V DC 2000mm x 1475mm x 1200 mm aprox weight aprox 2700 kg.	Set	8
D.6	11 kV Neutral Ground Resistor (NGR) with NGR Cubicle of size 2500mmx1500mmx800mm and with Supporting Structures. (Approx. weight of NGR Cubicle-1200kg , Approx. weight of NGR Support Structure- 630kg)	Set	2
D.7	3.3 kV Neutral Ground Resistor (NGR) with NGR Cubicle of size 2500mmx1500mmx800mm and with Supporting Structures. (Approx. weight of NGR Cubicle-1200kg , Approx. weight of NGR Support Structure- 630kg)	Set	6
E BHEL-ISG			
E.1	DG Set 1010 kVA (e) 1500 RPM 415V 0.80 pf (lag) consisting of the following: 1. DG Set with Radiator on a common base frame along with necessary fuel piping, supports and accessories. 2.990 Ltrs Fuel Tank and Piping-Fuel tank of 990 Ltr capacity along with Fuel Piping (MS Class 1 inch Pipes). Flushing of tanks and fuel lines at the time of Commissioning. Painting of Fuel lines. Filling of 1000 Ltrs of High Speed Diesel during Commissioning. 3.Silencers and Exhaust Pipes and Accessories-Exhaust Piping(MS Class 200 NB pipes, Class-B), Support and Stack (MS Class 200 NB pipe- Class B) and 10 Meters Exhaust Support Structure(Approx. wt: 12T), Insulation and Aluminium Cladding. 4. Erection of 30 Meters Galvanised Exhaust Pipe Support	Set	2

ITEM NO.	DESCRIPTION	UOM	QUANTITY
	Structure 5.Cables and Accessories 6.Control Panels, DBs, Battery Charger, Battery 7.Consumables - Lube Oil, Coolant and Filters 8. DG AMF Panel-approx. size 1200mmx1200mmx600mm, 10. Distribution Board, 11. NGR on DG Foundation inside the acoustice enclosure. 9.Battery-24V DC, 360 AH (minimum)= Lead Acid type automotive Battery with accessories and stand etc. 10. Battery Charger of rating 24V 40A for recharging engine battery, Dimensiuon is approx. 1200mmx600mmx1200mm. MS stand for the charger to be fabricated at site. 11. Terminal Box With ACB, Protection CTs and Termination of Power Cables. 12. Control Cable laying and termination between the DG AMF Panel, Battery Charger, and Distribution Board and Battery. Installation of Battery and Connection to Engine Starter. 13. Complete Exhaust piping including silencers, pipe supports, with bellows, flanges welding, making bends and accessories, including insulation and aluminium cladding upto entire length of the pipe as per the enclosed drawing (DIA. 350 mm exhaust pipe , 50 mm insulation , 25 SWG Al cladding) and final Painting of the same. Weight 1000 kg each approx. 14. Galvanized pre-fabricated exhaust support structure with base plate , anchor bolts & nuts with necessary hardware as required .The exhaust support structure to be assembled and erected at site. Weight 1000kg approx 15.Engine B-check kit with lube oil and coolant to be filled at site before commissioning of DG Set. 16.Installation of Phase and neutral extension terminal box for one alternator , mounting of three nos PS class Current Transformer on alternator neutral side busbars. Weight 500 kg approx. each 17.AMF Panel size 650mmx1500mmx1800mm approx. Overall Size of DG set approx.: 9000mmx3000mmx3140mm. Overall weight approx. 21.4kg. Draining and filling of Lube Oil and Coolant in the Engine at the time of Commissioning: 200 Litres Lube Oil and 450 Litres Coolant.		
E.2	Canopy dimensions: 9000mmx3000mmx3140mm. and approx. weight: 5210kg. for DG Set ALONG with all lighting fixtures and other accessories	Set	2
F.BHEL-Ranipet			
F.1	**Checking and commissioning of the following erected by Mechanical agency**		
F.1.1	Electrical Actuators	Nos	16
F.1.2	Seal air blower motor for gates and dampers	Nos	18
F.2	**Commisisoning of Motors for Water Pumps**		
F.2.1	Motor for Horizontal End Suction Water Pumps-22KW	Nos	10
F.2.2	Motor for Horizontal Split Case Water Pumps-45KW	Nos	10

ITEM NO.	DESCRIPTION	UOM	QUANTITY
F.3	**Commissioning of GGH Motors**		
F.3.1	75kW	Nos	5
F.3.2	5.5 kW	Nos	5
F.3.3	9.3 kW	Nos	10
F.3.4	22kW	Nos	10
F.3.5	0.75kW	Nos	30
F.3.6	132kW	Nos	5
F.4	Motors of Slurry Pumps	Nos	59
F.5	Inverter panel for GGH (1000 mm x 700 mm (wgt - 170 kg))	Set	5
F.6	**Laying and termination of 1100V, MULTI STRD. CU COND. XLPE INS,FRLS HRPVC (ST-2)INNER SH.,GALV SINGLE ROUND STEEL WIRE ARM,& HRPVC(ST-2)FRLSH OUTER SH. POWER CABLE**		
F.6.1	2C-2.5mm2 [Cu] Power Cable	Mtrs	195000
F.6.2	3C-2.5mm2 [Cu] Power Cable	Mtrs	150000
F.7	**Laying and termination of 1100V, MULTI STRD. AL COND. XLPE INS,FRLS HRPVC (ST-2)INNER SH.,(aluminum single round wire armour & HRPVC(ST-2)FRLSH OUTER SH.**		
F.7.1	1C-400mm2[Al] Power Cable	Mtrs	1000
F.7.2	1C-630mm2[Al] Power Cable	Mtrs	10000
F.8	**Laying and Termination of 1100V, MULTI STRD. AL COND. XLPE INS,FRLS HRPVC (ST-2)INNER SH.,GALV SINGLE ROUND STEEL WIRE ARM,& HRPVC(ST-2)FRLSH OUTER SH. POWER CABLE**		
F.8.1	2C-10mm2[Al] Power Cable	Mtrs	13000
F.8.2	2C-25mm2[Al] Power Cable	Mtrs	5000
F.8.3	2C-50mm2[Al] Power Cable	Mtrs	1000
F.8.4	2C-95mm2[Al] Power Cable	Mtrs	1000
F.8.5	3C-10mm2 (Al) Power Cable	Mtrs	14000
F.8.6	3C-25mm2 (Al) Power Cable	Mtrs	23000
F.8.7	3C-50mm2 (Al) Power Cable	Mtrs	15000
F.8.8	3C-95mm2 (Al) Power Cable	Mtrs	17000
F.8.9	3C-185mm2 (Al) Power Cable	Mtrs	18000
F.8.10	3C-240mm2 (Al) Power Cable	Mtrs	24000
F.8.11	3.5C-25mm2 (Al) Power Cable	Mtrs	30000
F.8.12	3.5C-50mm2 (Al) Power Cable	Mtrs	90000
F.8.13	3.5C-95mm2 (Al) Power Cable	Mtrs	55000
F.8.14	3.5C-185mm2 (Al) Power Cable	Mtrs	2000
F.8.15	4C-10mm2 (Al) Power Cable	Mtrs	4000
F.9	**Termination of LT Power Cables**		
F.9.1	1C-400mm2[Al] Power Cable	Nos	6
F.9.2	1C-630mm2[Al] Power Cable	Nos	66
F.9.3	2C-10mm2[Al] Power Cable	Nos	86
F.9.4	2C-25mm2[Al] Power Cable	Nos	32
F.9.5	2C-50mm2[Al] Power Cable	Nos	6

ITEM NO.	DESCRIPTION	UOM	QUANTITY
F.9.6	2C-95mm2[Al] Power Cable	Nos	6
F.9.7	3C-10mm2 (Al) Power Cable	Nos	92
F.9.8	3C-25mm2 (Al) Power Cable	Nos	152
F.9.9	3C-50mm2 (Al) Power Cable	Nos	100
F.9.10	3C-95mm2 (Al) Power Cable	Nos	112
F.9.11	3C-185mm2 (Al) Power Cable	Nos	120
F.9.12	3C-240mm2 (Al) Power Cable	Nos	160
F.9.13	3.5C-25mm2 (Al) Power Cable	Nos	200
F.9.14	3.5C-50mm2 (Al) Power Cable	Nos	600
F.9.15	3.5C-95mm2 (Al) Power Cable	Nos	366
F.9.16	3.5C-185mm2 (Al) Power Cable	Nos	12
F.9.17	4C-10mm2 (Al) Power Cable	Nos	26
F.10	**Laying and Termination of Control Cables**		
F.10.1	5C X 4.0 SQ MM Cu Control cable	Mtrs	20000
F.10.2	5C X 2.5 SQ MM Cu Control cable	Mtrs	44000
F.10.3	7C X 2.5 SQ MMCu Control cable	Mtrs	30000
F.10.4	10C X 2.5 SQ MMCu Control cable	Mtrs	1000
F.10.5	12C X 2.5 SQ MM Cu Control cable	Mtrs	38000
F.10.6	16CX2.5 SQ MM Cu Control cable	Mtrs	10000
F.10.7	19CX2.5 SQ MM Cu Control cable	Mtrs	1000
F.11	**Installation of Cable Trays**		
F.11.1	150 mm LTCT	Mtrs	7500
F.11.2	150 MM PTCT	Mtrs	6250
F.11.3	300 MM LTCT	Mtrs	6250
F.11.4	300 MM PTCT	Mtrs	1750
F.11.5	450 MM LTCT	Mtrs	3000
F.11.6	450 MM PTCT	Mtrs	1750
F.11.7	600 MM LTCT	Mtrs	25000
F.11.8	600 MM PTCT	Mtrs	4500
F.12	Fabrication and erection of STRUCTURAL STEEL (ISMC 100,150,ISA 50X50X6,65X65X6,ETC.)	MT	97
F.13	**ERECTION OF GS and GI FLATS, GI Wires, etc.**		
F.13.1	GS FLAT 25 X 6 MM	Mtrs	1500
F.13.2	GS FLAT 50 X 6 MM	Mtrs	6000
F.13.3	GS FLAT 75 X 10 MM	Mtrs	5000
F.13.4	FLEXIBLE COPPER BRAID FOR GATE EARTHING.	Nos	8
F.13.5	GI WIRE 8 SWG	Mtrs	8500
F.13.6	GI WIRE 14 SWG	Mtrs	18500
G. BHEL-SBD			
G.1	**ERECTION AND COMMISSIONING OF LT SWITCHGEAR**		
G.1.1	415V FGD PMCC 1EA, Approx. Rating=3200A, Approx. Dimensions:18200mm x 1500mm x 2400mm, Approx. Weight:13100, Total No. of verticals:20, No. of Shipping Sections:12	Set	1

ITEM NO.	DESCRIPTION	UOM	QUANTITY
G.1.2	415 VFGD PMCC 2EA, Approx. Rating=3200A, Approx. Dimensions:18100mm x 1500mm x 2400mm, Approx. Weight:13100, Total No. of verticals:20, No. of Shipping Sections:12	Set	1
G.1.3	415V FGD PMCC 3EA, Approx. Rating=3200A, Approx. Dimensions:17200mm x 1500mm x 2400mm, Approx. Weight:12450, Total No. of verticals:20, No. of Shipping Sections:12	Set	1
G.1.4	415V FGD PMCC 4EA, Approx. Rating=3200A, Approx. Dimensions:17200mm x 1500mm x 2400mm, Approx. Weight:12250, Total No. of verticals:20, No. of Shipping Sections:12	Set	1
G.1.5	415V FGD PMCC 5EA, Approx. Rating=1600A, Approx. Dimensions:12950mm x 1500mm x 2400mm, Approx. Weight:8500, Total No. of verticals:16, No. of Shipping Sections:10	Set	1
G.1.6	415V GYPSUM PMCC, Approx. Rating=2500A, Approx. Dimensions:25200mm x 1500mm x 2400mm, Approx. Weight:17500, Total No. of verticals:32, No. of Shipping Sections:16	Set	1
G.1.7	415V LIMESTONE PMCC, Approx. Rating=2500A, Approx. Dimensions:24150mm x 1500mm x 2400mm, Approx. Weight:18000, Total No. of verticals:28, No. of Shipping Sections:16	Set	1
G.1.8	AC & VENTILATION MCC STAGE-I #0WL, Approx. Rating=630A, Approx. Dimensions:8350mm x 1000mm x 2400mm, Approx. Weight:5600, Total No. of verticals:10, No. of Shipping Sections:5	Set	1
G.1.9	AC & VENTILATION MCC STAGE-II #0WM, Approx. Rating=630A, Approx. Dimensions:8350mm x 1000mm x 2400mm, Approx. Weight:5600, Total No. of verticals:10, No. of Shipping Sections:5	Set	1
G.1.10	EMERGENCY MCC# 0WH (STAGE-I), Approx. Rating=1600A, Approx. Dimensions:13450mm x 1500mm x 2400mm, Approx. Weight:8150, Total No. of verticals:16, No. of Shipping Sections:10	Set	1
G.1.11	EMERGENCY MCC# 0WK (STAGE-II), Approx. Rating=1600A, Approx. Dimensions:14300mm x 1500mm x 2400mm, Approx. Weight:8500, Total No. of verticals:17, No. of Shipping Sections:11	Set	1
G.1.12	LHP GHP PMCC, Approx. Rating=1600A, Approx. Dimensions:14300mm x 1500mm x 2400mm, Approx. Weight:8500, Total No. of verticals:17, No. of Shipping Sections:11	Set	1
G.1.13	FGD SUB DCDB STAGE-1, Approx. Rating=400A, Approx. Dimensions:5100mm x 1000mm x 2400mm, Approx. Weight:3600, Total No. of verticals:6, No. of Shipping Sections:3	Set	1

ITEM NO.	DESCRIPTION	UOM	QUANTITY
G.1.14	FGD SUB DCDB STAGE-2, Approx. Rating=400A, Approx. Dimensions:5100mm x 1000mm x 2400mm, Approx. Weight:3600, Total No. of verticals:6, No. of Shipping Sections:3	Set	1
G.4	DATA CONCENTRATOR SYSTEM Panels along with loose items Approx. dimensions: 800mmx800mmx2500mm, weight=600kg	Set	2
G.5	**ERCTION AND COMMISSIONING OF BUS DUCTS**		
G.5.1	415V NSPBD BUSDUCT FOR FGD PMCC1 : 3200A Approx. wt. per meter IS 130 kg/m	Mtrs	24
G.5.2	415V NSPBD BUSDUCT FOR FGD PMCC2 : 3200A Approx. wt. per meter IS 130 kg/m	Mtrs	24
G.5.3	415V NSPBD BUSDUCT FOR FGD PMCC3 : 3200A Approx. wt. per meter IS 130 kg/m	Mtrs	30
G.5.4	415V NSPBD BUSDUCT FOR FGD PMCC4 : 3200A Approx. wt. per meter IS 130 kg/m	Mtrs	30
G.5.5	415V NSPBD BUSDUCT FOR FGD PMCC5 : 1600A Approx. wt. per meter IS 130 kg/m	Mtrs	30
G.5.6	415V NSPBD BUSDUCT FOR GYPSUM PMCC : 2500A Approx. wt. per meter IS 130 kg/m	Mtrs	16
G.5.7	415V NSPBD BUSDUCT FOR LIMESTONE PMCC : 2500A Approx. wt. per meter IS 130 kg/m	Mtrs	22
G.5.8	415V NSPBD BUSDUCT FOR LHP GHP : 1600A Approx. wt. per meter IS 130 kg/m	Mtrs	22
G.6	LOCAL MOTOR STARTER	Nos	200
G.7	LPBS	Nos	200
H-BHEL PESD			
H.1	Commissioning of uni-directional LT drives of GDW System	Nos	18
H.2	**Laying and Termination of Control Cables**		
H.2.1	3C x1.5 sqmm	Mtrs	4200
J. MISCELLANEOUS ITEMS			
J.1	Treated Earth pit of CI pipe 3000 m long with funel and accessories including all civil works in hardrock by drilling, filling of earth pit with alternate layer of chrcoal & salt as per IE specification and making of brick chamber, with both side plastering, supply and fixing of manhole CI cover plate/RCC Slab etc. complete as per IS 3043 (only 100 mm CI pipe shall be suppled by BHEL)	SET	15

NOTE:

1. The BOQ Ref. no given above may be linked with the BOQ Ref no in Price bid.
2. The Price bid contains the consolidated list of BOQ with brief description of items. The quantity indicated in the BOQ / Price bid is approximate only and is liable for variation. Payment will be as per actual quantity executed as certified by BHEL Engineer.

VOLUME IA PART I CHAPTER X

GENERAL

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

1.10.1 Successful Bidder is requested to furnish the following at PSSR-HQ Chennai immediately after release of Letter of Intent (LOI)

i) Security Deposit

ii) Unqualified Acceptance for LOI, Detailed LOI / Work Order.

iii) Rs.160/- Stamp Paper for preparation of Contract Agreement.

1.10.2 Successful Bidder is requested to furnish the proof of documents for the following at the respective PSSR- Site

i) PF Regn No.

ii) Labour License No.

iii) Workmen Insurance Policy No.

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

1.10.4 PROVIDENT FUND

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

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

1.10.5 OTHER STATUTORY REQUIREMENTS

1.10.5.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act

1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no. along with the first running bill.

1.10.5.2 The contactor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

1.10.5.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Non-compliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.

1.10.5.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (if applicable) to BHEL along with the Final Bill.

1.10.5.5 In case of any dispute pending before the appropriate authority under ID Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.

1.10.5.6 In case of any dispute prolonged / pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

1.10.6 DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN

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

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training. Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each

trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 160 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.10.7 Site Visit by the Bidder

1.10.7.1 The bidder shall, prior to submitting his tender for the work, visit, examine and acquire full knowledge & information and necessary conditions prevailing at the site and its surroundings of the plant premises together with all statutory, obligatory, mandatory requirements of various authorities about the site of works at his own expense, and obtain and ascertain for himself on his own responsibility that may be for preparing his tender

and entering into a contract, and take the same into account in the quoted contract price for the work.

1.10.7.2 The bidder shall satisfy themselves about the following factors:

i. Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.

ii. Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc.

iii. Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there-from.

iv. Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.

v. Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.

vi. The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.

vii. The type of equipment and facilities needed, for and in the performance of the work;

viii. The extent of lead and lift required for the work in complete form over the entire duration of the contract, and

ix. All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

1.10.7.3 The bidder should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.

1.10.7.4 A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

1.10.7.5 The bidder and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property

and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.

1.10.7.6 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequately trained, qualified and experienced supervisory staff and skilled personnel.

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

1.10.7.8 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.

1.10.7.9 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.

1.10.7.10 The contractor shall carry out additional tests, if any, which the Engineer feels necessary because of site conditions and also to meet system specification.

1.10.7.11 The work shall be executed under the usual conditions without affecting power plant construction / operation 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.

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

1.10.7.13 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence. Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for any reasons whatsoever.

1.10.7.14 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.

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

1.10.7.16 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.

1.10.7.17 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.

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

1.10.7.19 Contractor has to work in close co-ordination with other 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 Construction program have to be planned in such a way that the milestones are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.

1.10.7.20 The contractor must obtain the signature and permission of the security personnel of the customer / BHEL 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. Surplus materials including steel item brought at site by the contractors with proper documentation and Gate pass, shall be allowed to taken out of the project premises after completion of relevant works, on certification by BHEL in charge.

1.10.7.21 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.

1.10.7.22 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.

1.10.7.23 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.

1.10.7.24 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.

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

1.10.7.26 Sometimes, it may be required to re-schedule the activities to enable other agencies to commence/ continue the work so as to keep the overall project schedule.

1.10.7.27 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.

1.10.7.28 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

1.10.7.29 On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at his 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.

1.10.7.30 It is the responsibility of the contractor to do the checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer.

1.10.7.31 If any item not covered but requires being executed, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.

1.10.7.32 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.

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

1.10.7.34 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like Boiler, piping, Turbine, Generator erection,

Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope.

1.10.7.35 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.

1.10.8 RECORDS TO BE MAINTAINED AT SITE:

Record of Quantity of FREE/Chargeable items issued by BHEL must be maintained during contract execution. Also reconciliation statement to be prepared at regular intervals.

The under mentioned Records/ Log-books/ Registers applicable to be maintained.

i. Hindrance Register

ii. Site Order Book.

iii. Test Check of measurements.

iv. Steel & Cement Supply and Consumption Daily Register

v. Records of Test reports of Field tests.

vi. Records of manufacture's test certificates.

vii. Records of disposal of scraps generated during and after the work completion.

1.10.9.1. OTHER GENERAL REQUIREMENTS

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

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

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

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

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

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

1.10.10.4. Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc will decide the sequence of erection/commissioning methodology. No claims for

extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection/commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.

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

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

1.10.11.1. During the course of erection, testing and commissioning certain rework / modification/ rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and/ or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously. Payments for such works shall be governed by Cl. No. 1.10.4.3 of TCC and Cl. No. 2.15.1 of GCC.

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

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

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

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

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

1.10.12.3. Contractor shall remove all scrap materials periodically generated from their working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap and recover the cost incurred for the same along with BHEL overheads from the contractor. All the package materials, including special transporting frames, etc., shall be returned to the BHEL stores / customer's stores by the contractor.

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

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

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

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

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

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

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

1.10.14.2. Contractor has to work in close co-ordination with other erection agencies 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.

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

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

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

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

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

1.10.14.8. For other agencies, to commence their work from/on the equipment's 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.

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

1.10.14.10. For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum kW demand.

1.10. 14 .11. On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at their cost. In the event of their failure to do so, the

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

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

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

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

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

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

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

1.10.14.18. Permanent nomenclature/identification on LPBS/Junction boxes/Local Motor Starter boxes/AC Fuse DB/DC Fuse DB/Heater JB/Control panel, LT panel & individual feeders, SP Bus duct, heater JB, Transformers are to be done by the contractor as per the requirement decided BHEL Engineer at site.

1.10.14.19. All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there is no extra cost in this regard. Also refer the clause - ELECTRICAL INSPECTORATE'S APPROVAL below.

1.10.15. ELECTRICAL INSPECTORATE'S APPROVAL

1.10.15.1. Contractor is responsible for getting Electrical Inspector/statutory authority's approval for all electrical installation covered in their scope. This also includes the Electrical equipment that are erected by mechanical contractor for which commissioning assistance is to be provided by the Electrical contractor.

1.10.15.2. All electrical installation covered in contractor's scope which also includes equipment covered in commissioning assistance are to be inspected/approved by the electrical inspector/statutory authority. For getting electrical inspector approval, contractor shall arrange the following:

a. Work Completion certificate for all the equipment covered in the contract

b. Details of Equipment (specification).

c. Test results conducted at site for all the equipment including electrical equipment erected by Mechanical contractor.

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

1.10.15.3. Contractor shall carry out the modifications/rectifications, if any, as suggested by the authority at their cost. However, it is not applicable for equipment erected by Mechanical contractor.

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

1.10.15.5. The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at their cost. Any Expenditure related to documentation shall be borne by the contractor. Contractor shall pay all fees relates to electrical inspectorate approval. However, BHEL shall reimburse all statutory fees on production of receipts (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES and any other statutory fees).

1.10.15.6. Any modification work required by inspector shall be attended by the contractor. Modifications which had raised due to execution deficiencies are at the cost of contractor whereas modifications which are due design change shall be treated as extra work.

1.10.16. SITE INSPECTION

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

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

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

1.10.16.4. Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to

the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

1.10.17. MANPOWER REQUIREMENT

1.10.17.1. Manpower requirement for Erection and Commissioning shall as follows:

a. There shall be a Resident manager as Site In Charge at site, under whom there shall be sufficient area engineers who shall take care of the erection activities.

b. Resident Engineer should have a minimum qualification of Electrical Engineering Degree with minimum 5 years' experience or Diploma in Electrical /Electronic engineering with minimum 10 years of experience in Thermal Power Station.

c. Supervisor should have a minimum qualification of Diploma in electrical engineering or any graduate with minimum 5 years of experience in Thermal Power Station.

d. Lab Technicians should have experience in Thermal Power Stations.

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

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

g. Licensed supervisor-01 No. with valid HT and LT electrical license

h. HT cable jointer-01 No. should be available on 24x7 basis

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

1.10.17.2. There shall be a separate Erection In-charge for HT & LT electrical works. They shall work independently with required manpower, T&P etc., including storage facilities.

1.10.17.3. The Erection In-charge shall have minimum 2 erection engineers who shall be in charge of BUS DUCT, SWITCHGEAR & CONTROL PANELS AND CABLES &TRAYS.

1.10.17.4. Each area engineer shall be provided with minimum four (04) supervisors and adequate number of Technicians / electricians and other erection staff and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately for each package and the minimum requirement shall be as indicated in previous

Clause. Besides, there shall be separate engineers for Planning, Safety and Quality.

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

1.10.17.6. All instructions from BHEL / Customer will be directed to the contractor through the Site in-charge and he shall be responsible for all the contractor's activities at site. The contractor shall name their authorized representative prior to or immediately on commencement of operations at site.

1.10.17.7. The Site In charge shall be present at site during all normal working hours and their contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.

1.10.17.8. The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed suffering delay on this account.

1.10.17.9. The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of their duties the contractor shall remove them from site as directed by Site Engineer.

1.10.17.10. The contractor shall ensure that all their supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.

1.10.17.11. The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.

1.10.17.12. There shall be separate Erection In-charges, each for HT and LT electrical work. They shall work independently with required manpower, T&P etc., including storage facilities

1.10.18. DOCUMENTATION

1.10.18.1. The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval.

a. Bar chart covering planned activities at site

b. Detailed organization chart

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

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

a. Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan.

b. **As built drawings:** After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.

1.10.18.3. VOLUME-IA PART- II CHAPTER -3 of this booklet contains general guidelines for Erection and Commissioning of Electrical works.

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

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

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

1.11.1. FOUNDATIONS, GROUTING AND CIVIL WORKS

1.11.1.1. Foundation for the equipment to be erected shall be provided by BHEL/ clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipment plants shall be carried out by the contractor.

1.11.1.2. 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.

1.11.1.3. The contractor at their cost shall arrange for grouting of foundation bolt holes of equipment as specified in the drawings / specification or as advised by the Engineer of BHEL after preparing the foundation top surface for grouting, all the materials for grouting (sand, gravel & cement including special Cement) shall be arranged by the contractor. The grouting has to be done up to basement level. The required consumables like Portland cement, gravel, sand etc., have to be provided by the contractor at their cost. The required special cement like conbextra, GP1, GP2, PAGAL, shrinkomp etc., or its equivalent as approved by BHEL if required shall be arranged by the contractor at their cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.

1.11.1.4. It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates/shims, and may be required for the erection of the equipment/plants will have to be carried out by the contractor without extra cost.

1.11.1.5. The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipment.

1.11.1.6. Foundation pockets are to be cleaned thoroughly before placing the equipment. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.

1.11.1.7. The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.

1.11.1.8. The certificates of the grout are to be submitted to BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc to be arranged by the contractor including the fine aggregates.

1.11.1.9. Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates/sheets at site by the contractor to meet site requirement. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.

1.11.1.10. Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.

1.11.1.11. The contractor at their cost shall arrange for grouting of anchor points of T & Ps issued to them. Necessary grout materials are to be arranged by the contractor at their cost.

1.11.1.12. Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.

1.11.1.13. Minor civil works like drilling, chipping and punching holes on slabs and brick-walls and grouting related to installation of LIR / LIE / Local Gauge Board, control panels, Junction boxes etc., shall be included in the erection cost of such items. No separate payment is applicable. The scope also includes supply of grouting material. More details regarding scope of civil are given in the respective equipment erection.

1.11.1.14. **PROCEDURE FOR GROUTING:** Contractor has to carry out the grouting as per the work instructions for grouting available at site.

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

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

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

1.12.1. COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS

1.12.1.1. BHEL shall issue materials covered in BHEL scope from their stores at site. The contractor shall collect such materials from BHEL stores and transport to site of work at their cost.

1.12.1.2. The contractor shall inspect such materials as soon as received by the contractor and shall bring to the attention of the Engineer-in-Charge any shortage / damage or other defects noticed before taking over the materials. Materials once taken over will be deemed to have been received in good condition and in correct quantities except for intrinsic defects which cannot be observed by visual and dimensional inspection and weighing.

1.12.1.3. Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.

1.12.1.4. All materials issued by BHEL shall be properly stored and systematic records of receipts, issue and disposal will be maintained. Periodic inventory shall be made available to BHEL Engineer-in-Charge.

1.12.1.5. All materials issued by BHEL shall be utilized as directed by Engineer-in-Charge or most economically in the absence of such direction. The contractor shall be responsible for the return to BHEL Stores of all surplus material, as determined by the Engineer-in-Charge.

1.12.1.6. 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.

1.12.2. STORAGE

1.12.2.1. Materials shall be stacked neatly, preserved and stored in the contractor's shed/ **work area in an orderly manner. In case it is necessary to shift and re-stack the** materials kept at work area/ site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.

1.12.2.2. The equipment should be preferably in its original package and should not be unpacked until it absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.

1.12.2.3. The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinking into around and to circulate air under the stored equipment. This will also help in lifting the packing with fork lift truck.

1.12.2.4. Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when decolonization takes place or regenerated. BHEL shall supply the material and contractor shall replace.

1.12.2.5. Due care should be taken to ensure that the equipment is not exposed to fumes gases etc. which can affect electrical contacts of relays and terminal boards.

1.12.2.6. The storage room and the equipment should be checked at regular interval of three months to ensure protection from termites, mound growth, condensation of water etc. which can damage the equipment.

1.12.2.7. Contractor shall keep BHEL informed about such problem and try to rectify the problem at their cost.

1.12.2.8. All the instrument, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site.

1.12.2.9. Packing material shall be retained if the cubicle to be repacked after inspection

1.12.2.10. 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 with proper identification.

1.12.2.11. Sub-Assemblies:

a. All sub-assemblies should be kept in a separate place where it is easily accessible.

b. Sub-assemblies should have a protective cover in case it is stored without wooden packing / case to prevent accumulation of dust. Silica gel packets should also be kept along with it.

c. Sub-assemblies should not be stacked one above the other.

1.12.2.12. **Loose items (wherever applicable):** The loose items supplied for the main equipment falls into various categories like tools, modules, prefabricated cables, console inserts, recorders, modules and display units, printers, sensors and transducers, PCs, monitors, cable glands, cable ducts, frames are to be categorized and stored separately.

1.12.2.13. Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.

1.12.2.14. Sometimes it may become necessary for the contractor to handle certain unrequired components at Customer's / BHEL's stores in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

1.12.2.15. The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components at site.

1.12.2.16. Contractor has to arrange required fire resistant tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

1.12.2.17. The contractor shall take delivery of item, materials and consumables from the storage yard / stores / sheds of BHEL / customer which are within a radius of 5 kms, after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer. He shall also make arrangements for safe custody, watch and ward of equipment after it has been handed over to them till they are fully erected, tested and commissioned.

1.12.2.18. Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators, Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.

1.12.2.19. The equipment / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

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

THE SCOPE OF THE WORKS 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.)

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

1.13.1. TRANSFORMERS AND NGRs

1.13.1.1. Refer BoQ for details of different types of transformers like oil immersed or dry type and NGRs.

The scope of erection includes minor civil works such as chipping/grouting of support structure, final painting etc.

1.13.1.2. NOTE:

a. Responsibility of contractors to obtain customer protocols with respect to Field Quality Plan.
b. SFRA (Sweep Frequency Response Analysis) test shall be conducted for GT & ST.
c. Before charging the oil filled transformers, Particle Count Test shall be carried out as per latest standards wherever required by BHEL site engineer.
d. Necessary equipment's T&P to conduct the test shall be arranged by the contractor within the quoted rates.
e. DGA Analysis for power transformers oil
f. Frequency of DGA test to be carried out as under.
g. Before commissioning as benchmark value and to ensure that the oil has been properly degassed.
h. Within 24 hrs of charging/operation.
i. Within one week of 1st charging or operation
j. Within 1 month of 1st charging or operation.
k. Every 3 months Log book to be maintained all records of DGA test report.
l. Record of online DGA trends to be recorded.
m. Precautionary measure to be taken before taking oil sample.
n. Since gases content are measured in very low magnitude i.e. in terms of parts per million and also its concentration is effected by various parameters like different solubility coefficients of different gases, exposure to

atmosphere, air, heat, sunlight etc., therefore it is very important to exercise extreme caution during sampling as well as its storage prior to testing.

o. Oil can be sampled through sampling valve near bottom and top of tank. Special care has to be taken not to introduce air, dirt, foreign matter or dirty oil into the sampling container. For this purpose, first 1-2 liters of oil from transformer shall be flushed out through the oil container under a turbulent flow so that all contaminants are removed from the oil path and sampling container shall also be rinsed with oil. Only Stainless steel or glass bottle shall be used for sampling. It is to be ensured that sample is not exposed to light and it should be perfectly tight to prevent any air ingress. If glass container is used it should be dark in color. Shape of the container and sampling method shall be as guided by the BHEL site engineer . Also refer IEC-60475. Alternate sampling procedures as per IEC-60475 is also acceptable.

1.13.2. SCOPE OF WORK OF TRANSFORMER

1.13.2.1. Receipt of transformer and associated loose supplied accessories & Spares including oil in drums from site store/yard, inspection, preservation with N2, transporting the above to respective erection location up to plinth, storage, maintenance of N2 gas pressure in transformer tank, erection of transformer and all the accessories including NGR, cabling from transformer accessories to marshalling KIOSK & OLTC panel, oil filling, oil pressure testing, dry out, pre-commissioning test, commissioning of equipment and final painting and handing over.

Note: Refer Volume-1A, Part-II, and Chapter-3 for General Technical Requirements for erection, testing and commissioning

1.13.2.2. Contractor shall arrange supply of Preservative gas like N2 to maintain the N2 pressure during preservation. (only for preservation purpose).

1.13.2.3. Before loading and transporting the Transformers, contractor shall study the soil condition and identify the route for transportation.

1.13.2.4. Generator Transformer(GT), Station transformer (ST) & Unit Transformer (UT) shall be usually unloaded nearer to the Erection location. The scope of work includes shifting the transformer from this location on to the Transformer foundation and carrying out assembly and testing.

1.13.2.5. All the other transformers except GT,ST & UT shall be transported from BHEL storage yard in a suitable trailer, unloaded at their respective locations and install as per the installation drawing. The contractor will unload the transformers on rails turn the wheels / rollers if necessary for changing over at right angles on rails, roll the transformers to their respective locations and put them on the foundation. The necessary sleepers, winches, jacks etc., required for this operation will be

arranged by the contractor at their cost. The other transformers will be shifted with suitable material handling equipment to the respective location.

1.13.2.6. GT, ST,UT, SAT, UAT and other transformers shall be dispatched to site in several packages which shall be assembled /erected at site. Contractor shall carry out assembly at site and carry out testing as per requirement.

1.13.2.7. Samples of each and every drum of Transformer oil have to be tested and pre-treated to achieve the desired value before filling in to the transformer tank. The entire arrangement for testing the oil sample, filtering whenever required to achieve the desired PPM, BDV within the shortest time shall be made by the contractor. Oil tests as per IS 335 including dissolved gases analysis has to be conducted by contractor for transformers of rating above 200 KV. The job has to be taken up in consultation with BHEL Engineers at site at the cost of the contractor. All the test equipment for testing PPM, BDV of the oil including testing equipment required for the Tan-Delta Test of the transformer winding and HV Bushing shall be arranged by the contractor. HV Bushings shall be tested for capacitance and tan delta test before erection also. Testing instruments required for DEW measurement of N2 gas shall also be arranged by the contractor.

1.13.2.8. The contractor shall arrange suitable filtering machines of capacity 10-12 KL or 5-6 KL / hr capacity or any other suitable capacity as required (Refer Vol 1A, Part 1 Chapter IV) to meet the erection / commissioning schedule. Oil filtration shall be carried out periodically to maintain the BDV value of the transformer until handing over the electrical package.

1.13.2.9. All the T & P, material handling equipment like cranes, Trailer, 1 (one) number of High Vacuum filter machines with adequate capacity 10-12KL/ 5 to 6 KL/hr or any other suitable capacity, vacuum pumps and 5 kV motorized megger and oil tanks of suitable capacity shall be arranged by the contractor at their cost. The transformers may have to be suitably lagged / covered during the drying out operation by the contractor at no extra cost.

1.13.2.10. During oil circulation of the transformer, the contractor shall employ sufficient number of personnel on three-shift operation to take care of the operation of the filter machine as well as safety of the transformer.

1.13.2.11. Unit and Auxiliary Service transformers shall be bolted to the adopter panel/bus duct on the LT sides and the bus bars shall be connected together. The contractor

shall carry out any modification required to match the bus bar or bus duct connection.

1.13.2.12. The contractor shall carry out testing and commissioning works with their own testing equipment and testing teams. Testing shall be done under the supervision of BHEL/customer Engineers.

1.13.2.13. All testing equipment (IMTE) shall be calibrated before putting into service at site. A copy of calibration certificate to this effect shall be furnished to BHEL-Engineer for their verification and approval.

1.13.2.14. All the transformers protective system such as Buchholz relay explosion vent, oil and winding temperature detectors etc., healthiness is to be checked under the guidance of BHEL engineer. All HV bushings will have to be tested for capacitance and tan delta value. All transformers of 220 KV and above shall be tested for capacitance and tan delta value after commissioning.

1.13.2.15. Transformer protective relays are to be checked prior to the commissioning of the transformer.

1.13.2.16. The scope of work shall also include minor civil work such as chipping and grouting of the support structure as well as for the support of the transformer.

1.13.2.17. Final painting shall be carried out for all Transformers. The scope of final painting shall include supply of paints, thinner and other consumables as detailed in the painting clause. No separate rate shall be paid for painting.

1.13.2.18. The contractor shall maintain the equipment erected and commissioned by them until taken over by Customer or till the completion of the contract period.

1.13.2.19. The contractor shall prepare all erection/ commissioning log sheets, protocols/test certificates as per field quality plan, get it signed by the concerned BHEL / Customer Engineer and submit the same to BHEL Engineer as per their instruction.

1.13.2.20. The contractor has to ascertain the quantum of work involved and quote lump sum rate for erection, testing and commissioning of each transformer.

1.13.2.21. Filtration and dry out shall be carried out to obtain value of dielectric strength / PPM, resistivity, specific gravity, dissolved gas analysis, and Tan-Delta test shall be as per recommended value of BHEL. The final tests have to be carried out at approved laboratories like CPRI (before charging of transformer & after charging of transformer) etc. and test certificates are to be submitted to BHEL. If the test results are not satisfactory and if the customer desires to carry out the tests through some other agency, the same shall be carried out at contractor's cost.

1.13.2.22. Contractor shall arrange to paint/stick good quality danger boards where ever required. Required boards shall be arranged by contractor. Name of the equipment erected by the contractor shall be painted boldly as per the agreed

colour scheme on the equipment. value of the transformer until handing over the electrical package.

1.13.2.23. The installation of transformers shall also generally conform to the 'Manual of Transformers' by the Central Board of Irrigation and Power (CBIP).

1.13.3. HT SWITCHGEARS -11kV /3.3 kV / RELAY PANELS AND OTHER CONTROL PANELS INCLUDING DAVR ETC:

1.13.3.1. The HT switchgears panel consists of a fixed portion (and a moving portion) of modular construction having three high voltage chambers namely breaker chamber, bus bar chamber and CT chamber. Instrument panel is a separate low voltage chamber and shall be supplied with different type of protection relays, Instruments like Meters, Transducers, etc., Moving portion comprises of wheel-mounted truck fitted with an operating mechanism, vacuum interrupters & isolating contacts.

1.13.3.2. Refer BoQ for details of different types of HT Switchgears -11kV /3.3 kV & Generator / Transformer Control / Relay Panels and other Control Panels including DAVR etc.

1.13.4. Scope of work for HT Switchgear board & Transformer Control / Relay Panels and other control panels like DAVR etc.,

a. The scope of work shall include receipt of panels, accessories & spares including rubber mats from site stores/yard, inspection, handling of accessories between stores and erection location, storage, erection of accessories, fabrication and installation of base frames wherever required, testing commissioning, touch up painting and maintenance up to handing over.

b. The base frames shall normally be supplied along with the boards. These shall be aligned, leveled and grouted in position as per approved drawings. Wherever the base channels are not available, the same shall be fabricated, erected and painted at site. The material for this shall be supplied by BHEL. Base channels shall be grouted on the opening of the floor. If grouting bolts are required for the panel, the same shall be supplied within the quoted rate. All minor concrete chipping and finishing works are deemed to be included in the scope of the job. If base frame is to be fabricated, separate rate shall be paid on Tonnage basis. Contractor to arrange Anchor bolts if required.

c. For the panels to be mounted on the trenches, channel supports shall be provided across the cable trenches over which the base frames of the panels shall be mounted. Support structures if required shall be fabricated and separate rate on Tonnage basis shall be paid for the fabrication.

d. Panels shall be delivered in different shipping sections. Necessary interconnection of bus bar, inter panel wiring, etc. shall be carried out as part of panel erection.

e. The contractor shall set each section of equipment on its foundation or supporting structures. The contractor shall assemble equipment as required. Skilled

craftsmen arranged by the contractor shall install all equipment with parallel, horizontal and vertical alignment.

f. Generally, the panels shall be supplied with complete Relays/ Instruments and other Components mounted and wired. However, any minor modifications like dismantling of the existing Relays/ Instruments/Components and mounting of new Relays/ instruments /components and rewiring to suit operating conditions, shall be carried out without any extra cost. However, if any major wiring modification is involved inside the panel, the same shall be carried out at extra works basis. Similarly, if any Relays/ Instruments /component supplied as loose for safety transit, same shall be mounted and wired as per site requirement at free of cost as part of scope of the job. However, if the loose supplied Relays/ Instruments/Components are more than 10% of the total quantity, the same shall be carried out at extra works basis. Decision of site engineer shall be final regarding such extra works.

g. The commissioning of Switchgear shall also involve the trial runs and commissioning of all connected equipment like motors and Service Transformer. The contractor shall have to keep their people round the clock, if necessary during the trial runs and promptly take action for any repair, checks and rectification etc. required in the equipment erected by them. (Separate rate shall be paid for commissioning of associated electrical drives as per BOM). Contractor has to co-ordinate with C&I contractors to make the interconnecting cables through.

h. The contractor shall do touch up painting of switchgear panels wherever necessary. This includes supply of paint also.

i. All T&P, Material handling equipment including cranes, Relay Testing/ HV Testing/ Calibration Instruments, primary/secondary injection kits, CRO, frequency counter etc. shall be arranged by the contractor.

j. Subject to availability, BHEL shall provide EOT cranes for the purpose of shifting the panels within the PH building on sharing basis at free of cost. However, the contractor shall arrange operator and other T&P.

k. The contractor shall calibrate and commission all switchgear/panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc.,

l. One-time calibration shall be carried out for Energy meters in NABL accredited lab if required within the quoted price.

m. Initial loading of software and programming required by proprietary type microprocessor-based instruments and protection relays will be done by Original Equipment Manufacturer (OEM). Further injections such as Primary and Secondary injection shall be done by contractor. However overall responsibility lies with the contractor and the contractor shall provide all support like manpower,

standard T&P, Instruments etc for calibration and commissioning of above proprietary type instruments.

n. The contractor shall carry out testing and commissioning works with their own testing equipment and testing teams under the supervision of BHEL/Customer Engineers.

o. All testing Instruments/ Equipment deployed to site shall be calibrated before putting it into service. A copy of calibration certificate shall be submitted to BHEL Engineer for their verification and approval.

p. Switchboards incomer bus may be cables/ connected to SP bus ducts through adapter box. The contractor shall co-ordinate for proper bus bar connection. Any modification required in the bus conductor for matching SP bus duct bus bar shall be carried out without extra cost.

q. The contractor shall co-ordinate with cable jointer and other LT cable-laying agency for proper cable termination and also during HV testing of cable.

r. Contractor shall prepare all erection/ commissioning log sheets, protocols/test certificates as per field quality plan, get it signed by the concerned BHEL/ CUSTOMER Engineer and submit the same to BHEL Engineer as per their instruction.

s. The charged and commissioned equipment shall be maintained by the contractor till the same is taken over by Customer.

t. Any items like lamps, lens, fuse/relays/instruments missed/ damaged from the custody of the contractor shall be replaced by the contractor at their cost. However, in case the damage is not due to reasons attributable to the contractor, BHEL may arrange for free replacement. The decision of BHEL Engineer in charge in this regard will be final and binding.

u. If any removal/ Re-fixing of contactors/relays becomes necessary for the completion of the system, the same shall be done by the contractor at free of cost.

v. Rubber mats for switchgear shall be supplied by BHEL, and these shall be laid, wherever required as part of panel erection. However, sufficient quantity of Rubber mats of required voltage level during testing and commissioning of electrical equipment has to be arranged by contractor for safety point of view.

w. Contractor shall close unused opening at the panel bottom plate with suitable material in consultation with Site Engineer at no extra cost as part of panel erection.

x. Scope of work shall also cover drilling of bottom gland plates for cable entry as required.

y. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments, transducers mounted on the panels.

z. If panels are supplied with monitor, printers, furniture, controller etc., or any loose items or equipment, the erection of above shall be part of respective panel. No separate rate shall be payable for loose supplied items unless specifically given in the BOQ.

aa. The contractor shall arrange watch and ward for the equipment under their custody and erected in location against theft and damage by other agencies working on the same area. Contractor shall arrange to paint/stick good quality danger boards where ever required. Required boards shall be arranged by contractor.

bb. **Note: -**

1. Dimensions & weights indicated in the BOM against various panels are approximate only. There may be variations in the weight and dimensions. Any variation within ±20% shall not be considered for payment. However, for variations beyond ±20%, payment shall be considered proportional to the length of the panel. Variations in depth, height or weight of the panel shall not be considered for payment.
2. Subject to availability, BHEL will provide EOT cranes for the purpose of shifting the panels within the PH building on sharing basis at free of cost. However, the contractor shall arrange operator and other T&P. In addition, refer clauses of VOLUME-IA PART – I CHAPTER – V

1.13.5. BUS DUCTS:

BHEL will supply two types of bus ducts as detailed below.

a) HT Isolated Phase Bus ducts.

b) HT segregated phase bus ducts (11kV / 3.3 kV)

REFER BOQ FOR MORE DETAILS

1.13.5.1. ISOLATED PHASE BUS DUCTS

1. The bus consists of cylindrical/box type conductor made of Aluminum alloy supported on post insulators. Flexible connections and expansions joints are provided at terminal and intermediate points to alleviate stresses due to expansion and to arrest vibration. All the CTs shall be mounted inside the bus ducts.
2. Isolated phase taps connect the potential transformer, surge protection equipment and unit transformer to the main bus. Each phase of protection equipment and potential transformers shall be housed in metal clad cubicles. Delta formation is carried out through delta bus duct.
3. A totally enclosed neutral grounding cubicle is provided to connect the Generator neutral point. The neutral grounding cubicle houses neutral grounding transformer & resistors.
4. Air pressurization equipment unit and Hot air blowing equipment will be supplied with the generator-isolated bus ducts.

5. BHEL will supply one set of shorting bars for generator dry out.
6. The tentative details of bus ducts are as under:
   1. Rated Voltage: 27 kV
   2. Highest System voltage: 36 kV
   3. Type of Bus bar joints: bolted / aluminum welded
7. Any minor drilling or aluminum welding works required at generator end for bolting arrangement of Bellow shall be in the scope of the contractor within the quoted rate.

1.13.5.2. SPVT Cubicle

SPVT Cubicle will be of draw out type with VT mounted on trolleys, complete with accessories like space heater, bus bars, mounting insulators, marshalling box, etc., Each set shall comprise of the following:

a. Single phase dry VT 9 Nos.
b. Surge Capacitor (24 KV, 0.125 micro Farad) 9 Nos

1.13.5.3. LAVT Cubicle

LAVT Cubicle will be of draw out type with VT mounted on trolleys, complete with accessories like space heater, bus bars, mounting insulators, marshalling box, etc., Each set shall comprise of the following:

a. Single phase dry VT 3 Nos.
b. Lightning Arrestor (36 kV, 10 kA) 3 Nos.

1.13.5.4. NG Cubicle

NG Cubicle will be supplied with space heater, bus bars, mounting insulators, marshalling box, etc., and shall house the following:

a. Dry type epoxy cast NG transformer - 1 No.
b. Punched Grid type NG Resistor – 1 No.

1.13.5.5. Bus Duct Supporting Structure

Bus duct supports will be supplied in pre-fabricated condition.

In case any additional supports are required, contractor has to fabricate and erect from raw material supplied by BHEL and contractor will be paid as per the rates quoted for the structure fabrication and erection in the BOQ.

Bus duct supporting structure fabrication from standard steel section involves welding / bolting and hot dip galvanizing. All structure hardware shall be HTS hot dipped / electro-galvanized.

1.13.5.6. SEGREGATED PHASE HT BUS DUCTS (SPBD)

BHEL will supply 11 KV/ 3.3 KV Segregated phase bus duct complete with Aluminum alloy enclosure and conductor, epoxy resin bus support insulator

arrangement, rubber bellows, inspection windows etc. All bolted joints shall have high tensile steel hardware which shall be cadmium plated/ zinc plated and passivated. All conductor bolted joints shall be silver plated.

SP Bus ducts shall be connected to LT side of Station Transformer, Unit Transformer, UAT, SAT, HT Switchboards and associated interconnection etc.,

The tentative details of bus ducts are as under:
Insulation level: 28 kV for 11KV SP
10KV for 3.3KV SP

1.13.5.7. BUS DUCT SUPPORTING STRUCTURES

Each set of bus duct supports is supplied with hot dip galvanized / standard steel sections supporting structure and shall be erected as per drawings. Any additional supports if required shall be fabricated and erected at site. The required material shall be supplied by BHEL free of cost and the further processing like fabrication, zinc phosphate painting; erection shall be carried out by the contractor without any extra cost.

In case any additional supports are required, contractor has to fabricate and erect from raw material supplied by BHEL and contractor will be paid as per the rates quoted for the structure fabrication and erection in the BOQ.

1.13.5.8. SCOPE OF WORKS FOR ERECTION & COMMISSIONING OF BUS DUCTS

The general scope of works for Isolated/Segregated Phase Bus duct is Receipt from BHEL stores/yards, unloading all the bus duct materials and accessories and equipment as indicated in the BOM and relevant drawings at the area where the bus ducts are to be erected, inspection, installation of all the materials, testing and commissioning of total bus duct items, Final Painting and handing over.

Dimensions & weights indicated in the specification / BOM indicated for isolated / segregated phase bus ducts is only approximate. The relevant drawings are enclosed for the purpose of tendering. The contractor has to ascertain the quantum of work involved and quote the lump sum value as called for in the rate schedule.

There may be variations in the weight and dimensions. Any variation in the length of Bus ducts within ±10% shall not be considered for payment. However, for variations beyond ±10%, payment shall be considered proportional to the length of the Bus ducts. Variations in width or height or weight including support structure shall not be considered for payment.

The rate for SP Bus ducts shall include fabrication of supports also. For SP Bus ducts, payment shall be made as per actual length erected. Variations in width or height or weight including support structure shall not be considered for payment.

Detailed scope of work shall as below:

a. Transport of Bus ducts and associated items and equipment from BHEL Stores/ yard to erection site. Cleaning of enclosure and conductors, insulators and other panels before assembly and erection.

b. Placement of embedment and erection and alignment of steel support structures.

c. Assembly and checking of bus duct at ground level if necessary.

d. Fixing of wall bushings/wall frame assembly

e. Providing earthing connections as per site conditions.

f. Minor civil work such as chipping and drilling holes on concrete if necessary and grouting of bus duct support structures including supply of materials required for civil works.

g. Carrying out required level of cleaning inside as well as outside of the bus duct for the purpose of conducting high voltage test before commissioning of the unit.

h. Grouting of bus duct and support structures and connecting to earth grid /earth pits as detailed in the relevant bus duct drawings.

i. Modification if any required in the support structures due to site conditions, the same shall be carried out without any extra cost.(Pockets will be provided during casting in which anchor bolts will be grouted for supporting the structures)

j. Extension of embedment if required and erection of required supports structures as detailed in the drawing.

k. Tightening of all bolts in the joints and flanges by torque wrench to the approved pressure (Anti oxidation compound is to be used for joints and it is in the scope of contractor)

l. Conducting air-tightness test after erection to meet the requirement of BHEL/Customer Standards.

m. Rectification of leakage, if any without any extra charges- For air tightness test, contractor shall arrange necessary pipe, PVC, hoses, fitting, valve, pressure regulator, Rota meters etc., at their cost.

n. Conducting high voltage test for IP/SP bus ducts, short circuit test for IP bus ducts and other tests as per instruction of BHEL engineer after making necessary cleaning inside as well as outside of the bus duct & arranging all testing equipment required for carrying out bus duct testing. Each bus duct pieces will have to be tested for IR value and HV test at working voltage before erection.

o. Fixing of Space Heaters wiring from space Heaters terminal to junction box, taking through rigid/flexible conduit pipe, Fixing of flexible joints, seal off bushing, rubber bellows, CTs wiring ,conduit/GI pipes breather tapping etc. after testing.

p. Fixing of Current transformers and wiring from CT terminal to junction box/Marshalling box, taking through rigid/flexible conduit pipe.

q. Carrying out minor repair, rectification of enclosure and conductors if it has happened during transit without any extra cost.

r. Arranging all T&P material handling equipment required for erection, except those arranged by BHEL.

s. Calibration of all inspection, measuring and test equipment (IMTEs) before using.

t. Minor Drilling / Aluminum welding for matching BUS duct items including seal off bushing enclosure, core, wall frame assembly, CT, termination at transformer end shall be carried out without any extra cost.

u. Furnishing copy of the calibration certificate to the concerned BHEL Engineer for verification and approval.

v. Presentation of necessary log sheets, protocols, test certificate as per Field Quality Plan and getting them signed by BHEL/Customer Engineers, and submitting the same to BHEL as per the instructions of concerned BHEL Engineer.

w. Maintaining the equipment after commissioning till taken over by customer.

x. Carrying out final painting as per the standard color codes recommended by BHEL including supply of paints, thinner and other consumables etc. as required as part of erection. (For more details, refer VOLUME-IA PART – I CHAPTER – XVI (Painting). Name of the equipment shall be painted boldly as per the instruction of site engineer. Any danger boards required to be displayed shall be arranged by the contractor.

1.13.5.9. SCOPE OF WORK SPECIFIC FOR ISOLATED PHASE BUS DUCTS:

1. Erection and commissioning of NG cubicle with all its accessories
2. Assembly, erection and commissioning of SPVT cubicles with its equipment such as lightning arrestors, voltage transformers, fuses, etc.,
3. Erection and alignment of TAP OFF bus ducts for unit transformer, SPVT cubicle etc and formation of Delta at LT side of single phase GTs.
4. Erection and commissioning of Air Blower/drier equipment with all the accessories.
5. Erection and commissioning of air pressurization equipment with all the accessories.
6. Carrying out aluminum welding for bus conductor and on enclosure as detailed in the drawing using MIG/TIG machine with the Aluminum filler wire as per BHEL specification.
7. Providing of MIG/TIG welding machine, aluminum filler wire, Argon gas of high purity and other required consumables as per BHEL standard for efficient aluminum welding, covering supporting insulators with asbestos cloth whenever aluminum welding is carried out near the supporting insulator.

8. Making necessary modifications of make-up pieces, if required, and welding of isolated phase bus ducts along with NGT, SPVT cubicle, UT tap-offs and delta connections.
9. Conducting 10 % X-Ray and 100 % DPT test and arranging the required X-Ray and NDT equipment.
10. Providing well-experienced Aluminum welder to meet the radiography quality.
11. Fixing of neutral side flexible connections to generator and position of neutral CTs after testing.
12. Grouting of bus duct support structures
13. Grouting the ground bus provided on the entire length of entire length of bus ducts, all parts of supporting structures and one end of each enclosure.
14. Carrying out minor repair, rectification of enclosure and conductors if it has happened during transit without any extra cost.
15. Arranging all T&P material handling equipment required for erection.
16. Calibration of all inspection, measuring and test equipment (IMTEs) before using.
17. Furnishing copy of the calibration certificate to the concerned BHEL Engineer for verification and approval.
18. Presentation of necessary log sheets, protocols, test certificate as per Field Quality Plan and getting them signed by BHEL / Customer Engineers, and submitting the same to BHEL as per the instructions of concerned BHEL Engineer.
19. Minor Drilling / Aluminum welding for matching BUS duct items including seal off bushing enclosure, core, wall frame assembly, CT, termination at transformer end shall be carried out without any extra cost.
20. Other requirement for Erection/Commissioning of IP Bus ducts.
    a. Aluminum welders shall appear for test as directed by the BHEL welding Engineer and only test qualified welders shall be permitted to do the welding.
    b. For MIG/TIG welding only high purity argon gas shall be used. If the contractor is unable to arrange the required high purity Argon gas, the same shall be arranged by BHEL on chargeable basis. The cost of gas shall be recovered from the running bills as per BHEL norms.
    c. Aluminum filler wire/rod shall be procured in consultation with BHEL Welding Engineer from approved Vendors of BHEL.
    d. Make up pieces shall be supplied along with bus ducts. Necessary MIG/TIG welding of different sections of enclosures, make up pieces and bus will be carried out at site.
    e. Holes on the flanges may not be adequate or may not match and any additional holes required same shall be drilled at site to facilitate matching of bus duct enclosure flanges including generator flange within the quoted rate.

f. Connecting the Bus duct with other equipment erected by other agencies is in the scope of Bus duct erection.

g. Any minor modification required in the bus conductor/enclosure of the bus duct for matching the switch gear in-comer and transformer adopted box shall be carried out without additional cost.

1.13.5.10. SCOPE OF WORK FOR HT CABLES

1.13.5.10.1. BHEL will supply HT cables (armoured / unarmoured, Aluminium/ Copper) and Instrumentation cables of different sizes and also Termination Kits/ Joint Kits for HT cables.

1.13.5.10.2. The scope of work includes laying & termination of cables, fixing of glands, ferrules, tag plates with necessary numbering and dressing of cable, as per BHEL specification and BHEL engineer's instructions.

1.13.5.10.3. The unit rate for laying of HT cables shall also include fixing of Trefoil clamps and clamping as per BHEL specification. Separate rate shall be applicable for installation of HT Termination/ Joint Kits as indicated in Rate Schedule.

1.13.5.10.4. Termination of HT cable shall be treated as part of installation of HT termination kits and separate rate shall be applicable for the same.

1.13.5.10.5. For all other cables, a composite rate covering laying and termination shall be applicable.

1.13.5.10.6. Unit rate quoted for cable shall cover laying, drilling of holes on the gland plates of the panels/JB or Enlargement of cable entry holes by tapping or any modification required fixing of cable glands, fixing of glands, ferrules termination, and providing tag plates and dressing.

1.13.5.10.7. Unit rates quoted for cabling shall also include supply of clamping/ dressing materials such as Aluminium/GI strips or PVC ties, ferrules, tag plates, lugs up to 2.5 sq. mm. apart from the work mentioned above. Supply of above material shall conform to the specification detailed in general guide lines.

1.13.5.10.8. Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.,

1.13.5.10.9. Ethernet cables shall be isolated from other cables and laid in a separate cable tray as directed by site Engineer.

1.13.5.10.10. The contractor shall provide Tools/ equipment required for the connections and termination of cable wherever necessary. For cable joining, if any, separate rate shall be considered on extra works basis.

1.13.5.10.11. The contractor shall carry out cable dressing and clamping for all the cables laid by the contractor. However, if any other agency laid cables of lesser

quantity for which no separate trays have been allotted, the contractor shall do clamping along with the cables.

1.13.5.10.12. Wherever cable entry holes have not been provided for equipment installed by another agency, the contractor shall co-operate to get the same done.

1.13.5.10.13. During testing and commissioning, if the equipment on which the cables are terminated not functioning, it is the responsibility of the contractor to check and establish in coordination with the commissioning agencies that there is no defect in the cabling, the contractor shall promptly depute their supervisor or technicians to assist the commissioning agencies to check the interconnecting cables.

1.13.5.10.14. Contractor shall carefully plan the cutting schedule for each cable drum in consultation with Engineer such that wastage is minimized and any resultant short lengths can be used where appropriate route lengths are available.

1.13.5.10.15. The approximate number of termination for the purpose of estimation to be assumed as follows: The average run length shall be considered as 150 metres.

1.13.5.11. SCOPE OF CABLE TERMINATION

1.13.5.11.1. The scope of termination shall include termination of cables on various equipment installed by others.

1.13.5.11.2. Re-termination if required during testing/ commissioning shall be carried out without additional cost.

1.13.5.11.3. Scope of termination shall include supply of insulating sleeves. The sleeves shall be fire resistant and long enough to over pass conductor insulation.

1.13.5.11.4. Contractor shall arrange all type of termination and crimping Tools/equipment required for the connections/terminations.

1.13.5.11.5. Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.

1.13.5.11.6. After cable terminations, the debris shall be removed then & there.

1.13.5.12. SCOPE OF WORK FOR FABRICATION OF STEEL MATERIALS

1. Scope of fabrication and installation covers, fabrication and installation of various type of supports for cable tray, Junction Box/Panel, bus ducts etc., with angles and channels of different size.

2. The fabrication steel materials such as angles, channels, plates, etc., shall be supplied in standard lengths by BHEL. Fabrication shall be carried out by the contractor as per schemes in consultation with site engineers.

3. Any minor chipping as required as detailed in VOLUME-IA PART –I CHAPTER -XI, including supply of all cement, sand etc. as required for grouting of supports are in the scope of contractor, the same shall be carried out at free

of cost. After installation of frames, supports the grouting of the same is in the scope of contractor.

4. If nuts, bolts, anchor fasteners required for fixing the racks or frames the same shall be arranged by the contractor at free of cost.

5. For fixing frames or support if any minor grouting is required the same shall be carried out by the contractor. After installation of frames, grouting of the same is in the scope of contractor.

6. A composite unit rate shall be quoted for fabrication and installation of steel, on tonnage basis. The unit rate shall be paid on tonnage basis and no rate shall be paid for the erection of fabricated items i.e. the rate quoted for the steel material includes fabrication and installation. All the fabricated steel materials shall be painted as per the details given in the scope of painting and no separate rate shall be paid for painting. The above rate shall include supply & fixing of fasteners, supply & painting of paints, supply & grouting of grouting material as required.

1.13.5.13. SCOPE OF CIVIL WORKS

1. In addition to the scope of works as detailed in VOLUME-IA PART –I CHAPTER –XI, the following scope of civil works shall be carried out by the bidder within the quoted price. Minor civil works like drilling, chipping for transformer /bus duct foundations and punching & opening in concrete floors, slabs, brick walls, grouting of bus duct columns, base frame of panels, Transformer etc. including supply of cement, sand, concrete etc., cleaning of all debris due to electrical installation.

2. The scope of civil works includes supply of grouting materials like grouting cement, sand etc., and cleaning of all debris.

3. No separate payment will be applicable for above civil works.

1.13.5.14. SCOPE OF CALIBRATION

1. Contractor shall calibrate all the local instruments, panel mounted instruments including transducers, protective relays, Recorders, Indicators etc. that will be supplied along with equipment mounted in or in loose.

2. Contractor shall maintain calibration records as per the BHEL prescribed format.

3. All testing Instruments/ Equipment deployed for calibration shall be calibrated before taking it into service. A copy of calibration certificate shall be submitted to BHEL Engineer for their verification and approval.

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

5. Contractor has to calibrate all the instruments covered in their scope and maintain the calibration records as per the relevant FQP formats.

6. Initial loading of software and programming required by proprietary type microprocessor based instruments and protection relays will be done by Original Equipment Manufacturer (OEM). Further injections such as Primary and Secondary injection shall be done by contractor. However overall responsibility lies with the contractor and the contractor shall provide all support like manpower, standard T&P, Instruments etc for calibration and commissioning of above proprietary type instruments.

7. If BHEL is unable to provide or arrange OEM support for above mentioned proprietary instruments, contractor shall carry out the calibration through authorized agency, at extra cost. The actual cost of such calibration carried out by outside agency shall be reimbursed by BHEL. However if above such calibrator is available with BHEL at site the calibration shall be carried out by the contractor within the quoted rate.

1.13.5.15. LUMPSUM UNIT RATE

Unit rate to be quoted on lump sum basis shall include installation of all loose items which are not explicitly mentioned, but comes as part of the system, integration of total system and commissioning. No separate rate shall be payable for loose items. The quantities of loose supplied items are approximate only. No proportional rate will be applicable for any variation in quantity or for any additional items supplied as part of equipment.

1.13.6. SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY OTHER CONTRACTOR.

1.13.6.1. ALL TYPES OF HT DRIVES

a. Cable identification, checking and meggering.
b. IR value of motor, measurement of winding resistance etc.
c. Measurement of Inductance and capacitance of winding
d. Dry out all the motors if required to improve IR value.
e. Checking direction of rotation of motors and testing and commissioning from local as well as remote.
f. Checking the bushing and HV test/Tan delta test
g. Attending to any defects till the handing over of the unit to customer

Note: For the purpose of successful commissioning of the HT Drives and Generators erected by other contractors, any peripheral Electrical item needs to be erected shall be carried out by the bidder within the quoted rates.

1.13.6.2. PANELS

The panels shall be mostly skid mounted and the skid will be erected by mechanical contractor. The scope of commissioning of Panels covers checking of internal wiring and associated loop cables from panels to field instruments, Push

Buttons, JBs, drives, replacing defective components/instruments/electronic cards etc.

If any loop cables (power or control) are to be laid or replaced, the same shall be carried out at unit rates available in the BOQ.

For commissioning of associated drives, if any, the unit rate will be as per BOQ and this will not be part of panel commissioning.

NOTE:

1. The scope of work also includes collecting the replacement instruments/parts from BHEL/customer stores, stockyard etc.
2. Separate group shall be identified for commissioning. The above group shall be available right from Trial run to full load operation including shift operation.

1.13.7. RIGID & FLEXIBLE CONDUITS

1.13.7.1. Cables shall normally be laid on cable trays. However, in case of shorter routes where trays are not possible, suitable GI pipe/flexible conduits shall be used as per instruction of BHEL Engineer.

1.13.7.2. The scope of works for flexible conduit includes drilling of the holes on the plates fixing of the end connectors, providing suitable supports and fixing tag marks wherever specified as required by BHEL. The supply of suitable clamps, fasteners and tag plates are in contractor's scope.

1.13.8. SCOPE OF WORK OF JUNCTION BOXES/ MARSHALLING BOX/STARTER BOXES AND PUSH BUTTON BOXES:

1.13.8.1. Different type of Electrical Junction boxes/Push button boxes shall be supplied. The scope of installation of Junction boxes/Push button boxes shall be as follows:

a. The unit rate quoted for erection of junction boxes/push button boxes shall include providing necessary supports, drilling of bottom gland plates for cable glands as required, Painting the tag No of JB or fixing a separate tag plate as required on junction boxes/push button boxes, minor chipping, grouting as required for mounting the JBs/PB and supply of all bolts and nuts (Fasteners) including grouting bolts as required for mounting the junction box/push button.

b. Fabrication and fixing of supports shall be on tonnage basis.

c. The contractor shall close all unused holes on the gland plates using GROMMET or other suitable material issued by BHEL, within the quoted rate.

d. All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.

e. If any intermediate JBs are required to terminate power cables for drives, the same shall be installed and also any modification like replacement of

terminals, enlarging gland holes etc. required to accommodate power cables shall be carried out as part of this works.

f. Equivalent Unit rate shall be paid for installation of such JBs. Decision of site engineer will be final regarding the equivalent rate.

1.13.9. SCOPE OF ABOVE GROUND EARTHING & LIGHTNING PROTECTION

1.13.9.1. Earthing scope also covers, earthing of all cable trays, metallic frames of all current carrying equipment, supporting structures adjacent to current carrying conductors, Transformer, Bus ducts, panels, motors, JB, push button boxes etc as required.

1.13.9.2. Drawings of main earth grid to be provided by others would be made available to the contractor to enable them to carry out rest of the earthing system work.

1.13.9.3. Different type of earthing materials shall be supplied by BHEL and the contractor shall lay and connect the earthing materials as per site requirement. Unit rate for earthing material shall be paid on meter basis if appearing in the BOQ.

1.13.9.4. The connection between earthing pads/ terminal to the earth grid shall be made short and direct and shall be free from kinks and splices.

1.13.9.5. Generator neutral from the NGT/NGR cubicle shall be earthed using two dedicated rod electrodes, which shall in turn be connected to the main plant grid.

1.13.9.6. Installation of treated earth pit as per IS:3043 including providing concrete chamber with CI cover(hinge type) and nomenclature/identification of the pit. (Only GI pipe & funnel shall be supplied by BHEL)

1.13.10. SCOPE OF WORK FOR FABRICATION & INSTALLATION OF STEEL MATERIALS

1.13.10.1. Scope of steel fabrication and installation covers, fabrication and installation of various type of supports for Junction Box/Panel, bus ducts etc. with angles and channels of different size

1.13.10.2. The fabrication steel materials such as angles, channels, plates, etc shall be supplied in standard lengths by BHEL. Fabrication shall be carried out by the contractor as per schemes in consultation with site engineers.

1.13.10.3. For fixing frames or supports if any minor grouting is required the same shall be carried out by the contractor. After installation of frames, grouting of the same is in the scope of contractor.

1.13.10.4. Supply of all cement, sand etc. required for grouting of supports is in the scope of contractor.

1.13.10.5. A composite unit rate shall be quoted for fabrication and installation of steel, on tonnage basis. The unit rate shall be paid on tonnage basis and no rate shall be paid for the erection of fabricated items i.e. the rate quoted for the steel material

includes fabrication and installation. All the fabricated steel materials shall be painted as per the details given in the scope of painting and no separate rate shall be paid for painting. The above rate shall include supply & fixing of fasteners, supply & painting of paints, supply & grouting of grouting material as required.

1.13.10.6. Any minor chipping as required as detailed in VOLUME-IA PART –I CHAPTER -XI, including supply of all cement, sand etc. as required for grouting of supports are in the scope of contractor, the same shall be carried out at free of cost. After installation of frames, supports the grouting of the same is in the scope of contractor.

1.13.11. SCOPE OF WORKS FOR LT BUSDUCTS

1.13.11.1. LT Bus ducts shall be of Non-segregated Phase Type, rectangular shape, made out of Aluminium enclosure with Aluminium busbar. The Aluminium busbars shall be supported with insulators. LT Busducts are used for connecting LT Transformers and PCC / MCC and will be supplied in different sectional lengths as per layout.

1.13.11.2. BHEL will supply necessary busduct supporting materials like GI or MS angle/channels along with bus ducts. The support materials supplied may be either prefabricated or of standard length and the same shall be fabricated and installed as per site requirements.

1.13.11.3. The scope of work includes Receipt from BHEL stores/yards, unloading all the busduct materials and accessories and equipment as indicated in the BOM and relevant drawings at the area where the busducts are to be erected, inspection, installation of all the materials, testing and commissioning of total busduct, painting and handing over. Minor civil works like chipping, grouting, including supply of grouting material is also included in the scope of work.

1.13.11.4. The unit rate quoted for E&C of bus ducts shall include fabrication and installation and painting of busduct supports (For MS supports if any). No separate rate shall be paid applicable for the same.

1.13.11.5. If there is any mismatch or inadequacy of the holes on the bus duct flange, the same shall be drilled at site to facilitate matching of bus duct flange with Transformer or PCC/MCC flanges without any extra cost.

1.13.11.6. Length of LT Busducts mentioned in the BOQ is approximate only and payment shall be made as per actual length erected. Variations in width, height and weight (including weight of support structure) will not be considered for payment.

1.13.11.7. Placement of embedment and erection and alignment of steel support structures, Assembly of busduct, Fixing of wall bushings/wall frame assembly, providing earthing connections. Minor civil work such as chipping and drilling holes on concrete if necessary, enlarging of pockets in concrete pedestals and grouting of busduct support structures including supply of materials required for

civil works. Grouting of bus duct and support structures and connecting to earth grid /earth pits as detailed in the relevant bus duct drawings.

1.13.11.8. Modification if any required in the support structures due to site conditions, the same shall be carried out without any extra cost. (Pockets will be provided during casting in which anchor bolts will be grouted for supporting the structures)

1.13.11.9. Carrying out required level of cleaning inside as well as outside of the bus duct for the purpose of conducting high voltage test before commissioning of the unit. Every bus duct piece has to be tested for IR value (for 415 Volts bus ducts) and both IR and HV test at rated voltage (for voltage levels above 415 Volts) before erection. This is in addition to the final IR value and HV testing before charging. After long shut downs, the IR value / HV tests will have to be carried out before charging.

1.13.11.10. Extension of embedment if required and erection of required supports structures as detailed in the drawing. Tightening of all bolts in the joints and flanges by torque wrench to the approved pressure (Anti oxidation compound will be used for joints which will be arranged by contractor). Conducting air-tightness test after erection to meet the requirement of BHEL/Customer Standards.

1.13.11.11. Rectification of leakage, if any without any extra charges- For air tightness test, contractor shall arrange necessary pipe, PVC, hoses, fitting, valve, pressure regulator, rotameter etc., at their cost. Contractors shall tap the air from nearest Instruments air tapping point available at site.

1.13.11.12. Fixing of Space Heaters terminal to junction box, taking through rigid/flexible conduit pipe, Fixing of flexible joints, seal off bushing, rubber bellows, CTs wiring, conduit/ GI pipes breather tapping etc., after testing.

1.13.11.13. Fixing of Current transformers and wiring from CT terminal to junction box/Marshalling box, taking through rigid/flexible conduit pipe.

1.13.11.14. Fixing of Space Heaters and wiring from Space Heaters terminal to junction box, taking through rigid/flexible conduit pipe.

1.13.11.15. Carrying out minor repair, rectification of enclosure and conductors if it has happened during transit without any extra cost.

1.13.11.16. Arranging all T&P material handling equipment required for erection, except those arranged by BHEL.

1.13.11.17. Calibration of all inspection, measuring and test equipment (IMTEs) before using it.

1.13.11.18. Furnishing copy of the calibration certificate to the concerned BHEL Engineer for verification and approval. Presentation of necessary log sheets, protocols, test certificate as per Field Quality Plan (FQP) and getting them signed by

BHEL/Customer Engineers, and submitting the same to BHEL as per the instructions of concerned BHEL Engineer.

1.13.11.19. Maintaining the equipment after commissioning till taken over by Customer.

1.13.11.20. Milli volt drop test is to be carried out for all bolted joints.

1.13.11.21. Carrying out final painting as per the standard color codes recommended by BHEL including supply of paints, thinner and other consumables etc., as required as part of erection. (For more details, refer scope of painting).

1.13.12. SCOPE OF WORKS FOR LT SWITCHGEAR, 415 V- POWER MOTOR CONTROL CENTERS (PMCC)/MCC/DISTRIBUTION BOARDS, ELECTRONIC CONTROL PANEL (ECP), BATTERY CHARGER PANEL AND OTHER CONTROL PANELS:

1.13.12.1. LT MCCs/PMCCs/MCCs are simple module type with isolators and fuses. However, some of the MCCs are Double Front draw out type consisting of circuit breakers unit, contactors/starter fuse switch units, MCB etc., arranged in multi-tier construction.

1.13.12.2. The scope of work shall include receipt of panels, accessories & spares including rubber mats from site stores/yard, inspection, handling of accessories between stores and erection location, storage, erection of accessories, fabrication and installation of base frames wherever required, testing commissioning, touch up painting and maintenance up to handing over.

1.13.12.3. The base frames shall normally be supplied along with the boards. These shall be aligned, leveled and grouted in position as per approved drawings. All minor concrete chipping and finishing works are deemed to be included in the scope of the job. If grouting bolts are required for the panel, the same shall be supplied by the contractor at no extra cost.

1.13.12.4. Wherever the base channels are not available, the same shall be fabricated, erected and painted at site. The material for this shall be supplied by BHEL. If base frame is to be fabricated, separate rate shall be paid on Tonnage basis.

1.13.12.5. For the panels to be mounted on the trenches, channel supports have to be provided across the cable trenches over which the base frames of the panels shall be mounted. The contractor shall carry out fabrication and erection of these support structures. Separate rate shall be paid on Tonnage basis for fabrication and erection of support structures.

1.13.12.6. The MCCs will be located in MCC room at any elevation. All other panels are located in their respective control rooms. The contractor shall take the panels to the desired locations either through floor openings or temporary openings. No claims will be entertained for taking the panels to the location owing to change of route or non-availability of openings as per nearest route.

1.13.12.7. Panels will be delivered in different shipping sections. The contractor shall set

each section of equipment on its foundation or supporting structures and assemble the panels as required. Necessary interconnection of busbar, inter panel wiring, etc. will have to be done by the contractor.

1.13.12.8. Electronic Control Panels (ECP) will be supplied with additional loose items such as Areca Controllers and their accessories. All the items shall be fixed and wired in the panel as per the layout; testing and commissioning shall be as per instructions of the site engineer within the quoted rate. Please also refer the Cl.No. 1.13.12.18

1.13.12.9. Generally the panels shall be supplied with complete Relays/ Instruments and other Components mounted and wired. However, if necessary, dismantling of the existing Relays/ Instruments/ Components, making minor modifications in wiring to suit operating conditions, mounting and wiring of new Relays/ instruments / components shall be carried out without any extra cost. Mounting and wiring of any instruments, meters, relays, push buttons, indicating lamps, contactors etc., if supplied loose for safety in transit, shall also be included in the scope of the job. However, if any major wiring modification is involved inside the panel, the same shall be carried out at extra cost. The decision of BHEL Engineer shall be final in respect of above extra works.

1.13.12.10. The contractor shall do touch up painting of switchgear panels wherever necessary including supply of paints within the quoted rate.

1.13.12.11. The contractor shall calibrate and commission all switchgear/panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc., with well experienced Engineers/ Technicians.

1.13.12.12. MCC/PCC incomer bus shall be connected to main source/PCC of customer. The contractor shall co-ordinate for proper connection at both ends.

1.13.12.13. Erection of Resistance box of DC drives shall be part of erection of DC starter panels.

1.13.12.14. Scope of work shall include drilling of bottom gland plates for cable entry for all the cables to be terminated on the panel, as per requirement.

1.13.12.15. Contractor shall co-ordinate with other cable-laying agency for proper cable termination.

1.13.12.16. The contractor shall close unused opening at the panel bottom plate with suitable material in consultation with Site Engineer as part of panel erection.

1.13.12.17. Rubber mats for Switchgear shall be supplied by BHEL, and these shall be laid, wherever required, by the contractor.

1.13.12.18. If panels are supplied with monitor, printers, furniture, controller etc. or any loose items or equipments, the erection of above shall be part of respective panel. No separate rate shall be payable for loose supplied items unless specifically indicated in the BOQ.

1.13.12.19. The scope of work shall include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels.

1.13.12.20. In certain cases, Switchboards incomer bus shall be connected to busducts, through adapter box. The contractor shall co-ordinate for proper busbar connection. If any modification is required in the bus conductor for matching busduct busbar, the same shall be carried out without extra cost.

1.13.12.21. The commissioning of Switchgear shall also involve the trial runs and commissioning of all connected equipment like servomotors and drives etc., The contractor will have to keep his people round the clock, if necessary during the trial runs and promptly take action for any repair, checks and rectification etc., required in the equipment erected by him. (Separate rate shall be paid for commissioning of associated electrical drives as per Rate Schedule only once for an equipment). Contractor shall re-commission the equipments once commissioned by him in case a need arises. Contractor will not be paid commissioning charges more than once for same equipment. Commissioning engineers / supervisors with other technicians, helpers as required will have to come in shifts during commissioning of plant as per BHEL's requirement.

1.13.12.22. All T&P, Material handling equipment including cranes and Relay Testing/ HV Testing Calibration equipment/ Instruments shall be arranged by contractor.

1.13.12.23. All testing Instruments/ Equipment deployed to site shall be calibrated before putting the same into service. A copy of calibration certificate shall be submitted to BHEL Engineer for his verification and approval.

1.13.12.24. Contractor shall prepare all erection/ commissioning log sheets, protocols/test certificates as per field quality plan, get it signed by the concerned BHEL/ Customer Engineer and submit the same to BHEL Engineer as per his instruction.

1.13.12.25. The contractor shall maintain the charged and commissioned equipment till the same is taken over by customer.

1.13.12.26. If any removal/ Re-fixing of contactors/relays become necessary for the completion of the system, the same shall be done by the contractor at no extra cost.

1.13.12.27. Contractor shall put his watch and ward for the equipment under his custody and erected in location against theft and damage by other agencies working on the same area.

1.13.12.28. Any loose supplied items like lamps, lens, contactor, fuse/relays/instruments etc., missed from the custody of the contractor shall be replaced by the contractor at no extra cost.

1.13.12.29. Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Variations in depth, height or weight of the panel shall not be considered for

payment. Any variation in length within ±20% shall not be considered for payment. If the panels have any variation in length beyond ±20% as compared to actual length indicated in the BOQ, payment shall be considered proportional to the length of the panel only.

1.13.12.30. BHEL shall provide vendors' support for commissioning of proprietary type of microprocessor based instruments, protection relays which require software loading and programmer etc. However overall responsibility lies with contractor and the contractor shall provide all support like manpower, standard T&P, instruments etc. for calibration and commissioning of above proprietary type instruments.

1.13.12.31. The contractor shall carry out testing and commissioning works with their own testing equipments and testing teams. Testing shall be done under the supervision of BHEL/Customer Engineers.

1.13.12.32. Subject to availability, BHEL shall provide EOT crane for the purpose of shifting the panels with in the PH building on sharing basis at free of cost. However, the contractor shall arrange operator and other T&P.

1.13.13. SCOPE OF WORKS FOR BATTERY AND BATTERY CHARGER:

1.13.13.1. GENERAL:

A. The charger and batteries are of heavy duty type, capable of providing normal and emergency DC loads. The cells will be mounted on insulators carried on suitable wooden stands. Tentative details are given in the BOM.

B. BHEL will provide vendor's technical support for commissioning of Battery and Battery charger/ UPS. The contractor shall carry out the works as per instructions of BHEL/ Vendor Engineer.

C. Lumpsum shall be quoted for Erection and commissioning of Battery. No additional payment shall be made for any variation in the number of cells. The rate quoted for erection of battery will include the following works.

1.13.13.2. Collecting the batteries and all the accessories like cable connectors, inter cell connectors, equalizing connectors, rack insulators, fuse box, loop cables etc. from stores and assembling on the racks and fixing all loose supplied items as per drawings.

1.13.13.3. Filling the individual cells with Acid/alkali – if applicable.

1.13.13.4. Arranging suitable resistive load banks for charging and discharging during charging and discharging cycles.

1.13.13.5. Arranging manpower in shift during battery charging and discharging cycles that may be carried out round the clock as per the code of practice, and conducting other routine tests as per IS under the supervision of BHEL Engineer/Vendor Engineer.

1.13.13.6. Modifications or changes if any for the loose supplied items or any minor changes

in wiring.

1.13.13.7. Arranging necessary tools, T&P, Testing equipments required for erection and commissioning of the battery.

1.13.13.8. For laying and termination of cables of battery/ battery charger system, separate rate shall be applicable as per rates in Rate Schedule.

1.13.14. **SCOPE OF WORK FOR BATTERY CHARGER PANELS**:
The scope of work will be in line with scope of work for electrical control panels, as detailed elsewhere in this specification.

1.13.15. SCOPE OF WORK FOR DIESEL GENERATOR SET

1.13.15.1. The DG sets of rating 2000 KVA (e), 3 phase, 415 V set with diesel engine, AVR, Radiator ,Air Intake System, Exhaust system, Fuel Day Tank, battery sets, Acoustic enclosure, panels etc.,

1.13.15.2. Cooling system comprising of radiators, engine mounted water pump, self-contained pipe, thermostat etc.

1.13.15.3. **Fuel system** consisting of PT fuel pump, injectors, fuel filters, self-contained piping.

1.13.15.4. **Lubricating system** consisting of oil pumps, strainers, lube oil cooler, bypass filter, self-contained piping.

1.13.15.5. Air Intake System consisting of dry type filter, air intake manifold with necessary connectors, turbo charger with after cooler.

1.13.15.6. Exhaust system consisting of exhaust manifold, flexible piping, residential silencer etc.

1.13.15.7. The scope of works covers erection of Diesel Generator and erection of all loose supplied items, Acoustic treatment/insulation as detailed in BOM and as per BHEL drawing.

1.13.15.8. Minor civil works like drilling, chipping and punching holes and opening in concrete floors, slabs, brick-walls, and cleaning of all debris, Grouting, supply of cement, sand, concrete etc. required for installation of DG sets shall be included in the erection cost of equipment. No separate payment is applicable.

1.13.15.9. If any major civil foundations/modifications/alterations are required for proper installation of Diesel Generator, the same shall be carried out at extra cost. The decision of BHEL Engineer regarding the above will be final.

1.13.15.10. All T&P, material handling equipments, including crane shall be arranged by the contractor.

1.13.15.11. All calibration and testing instruments required for relay testing, high voltage testing and load testing shall be arranged by the contractor.

1.13.15.12. Separate rate shall be applicable for Erection of cable trays, loop cabling

between Diesel Generator to Control Panel/MCC and between Control Panel to MCC as indicated in Rate Schedule.

1.13.15.13. Obtaining explosive license (if applicable) shall be under the scope of the contractor.

1.13.15.14. Fuel filling in DG till handing over is included in the scope of the vendor. Fuel shall be supplied by BHEL.

1.13.15.15. Supervision during Erection, Pre-Commissioning Checks, Commissioning, Load trials of DG sets and accessories AND also during PG Test of DG Sets and Accessories shall be carried out by the OEM.

1.13.15.16. The DG set shall be maintained by the contractor after commissioning until full load testing is completed.

1.13.16. SCOPE OF WORK FOR LT CABLES LAYING

1.13.16.1. BHEL will supply LT cables (1.1 kV, Armoured / Unarmoured, Aluminium / Copper XLPE/PVC insulated) of different sizes. (Power, control and instrumentation cable).

1.13.16.2. The scope of work includes laying & termination of cables, fixing of glands, ferrules, tag plates with necessary numbering and dressing of cable, as per BHEL specification and BHEL engineer's instructions. All cables shall be identified at both ends, adjacent to the cable glands. In addition, cable shall be identified at all drop / pull pits, manholes, pull boxes, and at major changes of direction in cables tray / trenches and multilayer racking cable routes.

1.13.16.3. Unit rates shall be on meter basis. Unit rate quoted for cable shall cover laying, drilling of holes on the gland plates of the panels / JB or Enlargement of cable entry holes by tapping or any modification required fixing of cable glands, fixing of glands, ferrules termination, and providing tag plates and dressing.

1.13.16.4. Unit rates quoted for cabling shall also include supply of clamping / dressing materials such as Aluminium / GI strips and PVC ties, PVC wire marker sleeves, tag plates, lugs upto 2.5 sq. mm. apart from the work mentioned above. The lugs being used shall be of standard make and shall be procured after getting prior approval of the brand from BHEL engineer. Usage of any other lugs shall entail replacement of the lugs by the contractor at his own cost. Supply of above material shall conform to the specification detailed elsewhere in the tender specifications. Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.,

1.13.16.5. For single core Power cable, fixing of Trefoil clamps shall be treated as part of laying work.

1.13.16.6. If the cables are to be routed on steel angles as per site condition, steel angles will be supplied by BHEL.

1.13.16.7. The contractor shall carry out cable dressing and clamping for all the cables

laid by him. However, if cables like illumination cables or any other cables of lesser quantity for which no separate trays have been allotted and are to be laid on the same trays, the contractor shall do clamping of such cables also along with the cables laid by him.

1.13.16.8. Single core cable used for three phase AC power shall be clamped in trefoil cable at the time of laying itself.

1.13.16.9. The unit rate quoted for cable laying shall also cover the following works.

a. The end termination of cable sizes upto 2.5 sqmm including supply of lugs as required.

b. Enlargement of cable entry holes, if necessary, by chipping/tapping or any modification required fixing of cable glands.

c. Reaming and relocating holes at actual point of entry of cable or conduit in terminal boxes, outlet boxes, pull boxes etc., cleaning off the debris/trapped material from conduit/ducts.

1.13.16.10. In case any existing structure is affected/damaged due to installation work of cables the contractor shall repair the same to the satisfaction of Site Engineer.

1.13.16.11. However any major modification like drilling, tapping etc. are involved in fixing of glands in JBs and Terminal boxes same shall be considered as extra on man hour rate basis as per extra works clause.

1.13.16.12. Minor chipping of concrete floor cutout below panels in order to align the panel's gland plate with the floor cutout shall be done without any extra cost by the contractor.

1.13.17. SCOPE OF WORK FOR CABLES TERMINATION

1.13.17.1. The scope of termination shall include termination of cables on various panels / JBs / Push buttons etc. installed by others also. The contractor shall co-ordinate with such agencies and do the termination, including drilling of gland plates for fixing cable glands, if required.

1.13.17.2. Re-termination if required during testing / commissioning shall be carried out without additional cost.

1.13.17.3. Scope of termination shall include supply of insulating sleeves. The sleeves shall be fire resistant and long enough to over pass conductor insulation.

1.13.17.4. Contractor shall arrange all type of termination and crimping Tools / equipment required for the connections / terminations.

1.13.17.5. Contractor should use sleeve printers for printing sleeve as wire markers. Cut ferrules will not be permitted to be used. Cross ferruling shall be done for all wire terminations.

1.13.17.6. After cable terminations, the debris shall be removed then & there.

1.13.17.7. Necessary lugs above 2.5 sq. mm shall be supplied by BHEL free of cost.

1.13.17.8. Separate rate shall be paid for termination of higher size cables more than 2.5 sqmm. Such cables will be indicated separately in the BOQ/ Rate Schedule.

1.13.18. SCOPE OF WORK FOR CABLE TRAYS & SUPPORTS

1.13.18.1. Scope of cable tray works covers erection various sizes of ladder & perforated trays with tray accessories such as bends(vertical and Horizontal), tees, cross, reducers, coupler plates, fasteners etc.

1.13.18.2. The scope of erection shall also covers erection all type of trays and its accessories such as coupler plates/fixing plates, anchor bolts, fasteners, Tees, Reducers, Bends (vertical and Horizontal), cross etc.,

1.13.18.3. If accessories such as Tees, Reducers, Bends (vertical and Horizontal), cross not supplied, same shall be fabricated wherever required, from the straight Trays. The accessories supplied may be modified to suit site routing as part of work.

1.13.18.4. The scope also covers making offsets by means of cutting standard tray sections and inserting suitable size of trays to match with the existing arrangement.

1.13.18.5. The unit rate for erection of trays shall be on meter basis which includes erection of trays and accessories, fabrication of trays accessories and modification of straight trays, if required.

1.13.18.6. No separate rate shall be paid for any fabrication of tray accessories or any modification on straight trays.

1.13.18.7. If trays covers are supplied same shall be erected after completion of cable laying and no separate payment will be made for fixing these covers. GI strip clamps are to be used for fixing the tray covers.

1.13.18.8. Welded Joints of trays shall be painted with red lead and aluminium paint in turn with bitumen as per IS 3043. The unit rate shall also include supply of paints, thinner, other consumables and brush etc.

1.13.18.9. Cable tray mounting structure shall be welded to the plate inserts or to steel structural beams/ members. Welding of cable tray mounting structure to steel structural beams/ members shall be done with prior approval of Customer/ BHEL Engineer. Cable tray tag number shall be painted on trays.

1.13.19. SCOPE OF WORK FOR RIGID & FLEXIBLE CONDUITS (AS APPLICABLE):

1.13.19.1. Cables shall normally be laid on cable trays. However, in case of shorter routes

where trays are not possible, suitable GI pipe/flexible conduits shall be used as per instruction of BHEL Site Engineer.

1.13.19.2. The scope of works for flexible conduit includes drilling of the holes on the plates, fixing of the end connectors, providing suitable supports and fixing tag marks wherever specified as required by BHEL. The supply of suitable clamps, fasteners and tag plates are in contractor's scope.

1.13.20. LIGHTNING PROTECTION SYSTEM INSTALLATION

1.13.20.1. The scope of works for Lightning Protection system includes installation of vertical air terminations, Horizontal conductors, vertical risers, down conductors, test links, earth electrodes, supply of saddles & clamps, minor civil works etc.

1.13.20.2. HORIZONTAL AND VERTICAL DOWN CONDUCTORS: The horizontal conductors shall be installed on the top of the building with suitable clamps/saddles arrangements. This horizontal conductor shall be connected with down conductors which in turn will be connected to risers through test links. Both horizontal and down conductors shall be supported on the clamps/saddles and spacers which will be fixed on the walls/columns or on top of the parapet walls.

1.13.20.3. The scope of work for horizontal and vertical conductor shall include supply of supports, clamps, saddles, spacers, Anchor fasteners etc.

1.13.20.4. TEST LINKS shall be installed in the vertical down conductors at ground level as shown in the lightning protection drawings. Supply of GI fasteners like washer/bolt/nut required for fixing Test Link and connecting Test Link to earth electrodes through GI Flat by welding also is part of the scope.

1.13.20.5. RISER ROD AND VERTICAL ELECTRODE: Riser Rod and Vertical Electrode, of 40 mm dia, in standard lengths, will be supplied by BHEL. The vertical rod shall be made from the standard length for 3 Mtr and driven into earth. The riser rod shall be suitably fabricated as per requirement and connected to the down conductor and vertical electrode.

1.13.20.6. Excavation of earth for laying of riser rod, welding with vertical electrode and down conductor, refilling of the excavated earth, consolidation etc. shall be part of the work for installation of riser rod. Even if the building plinth area has already been consolidated, the same shall be removed, conductors shall be installed, welded, refilled and consolidated.

1.13.20.7. The scope of work for vertical electrode shall cover driving into the earth with suitable tools, and welding to the riser rod, consolidation etc.

1.13.20.8. VERTICAL AIR TERMINATIONS: The vertical air terminations shall be located in different locations of the buildings. The vertical terminal shall mostly be fixed on the top of peripheral wall using a GI base plate of size 150x150x6 mm. The

vertical air terminal shall be grouted on the wall and minor civil works required for grouting the air terminals including supply of grouting materials are in the scope of Contractor.

1.13.20.9. Supply of base plates, and related civil works, grouting and supply of grouting materials are part of the scope for vertical air terminations.

VOLUME IA PART I CHAPTER XIV
PROGRESS OF WORK

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

1.14.	**PROGRESS OF WORK**
1.14.1.	Refer forms F -14,15 of volume I D (Forms & Procedure) of Volume -I Book-II. Plan and review will be done as per the formats.
1.14.2.	The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall program.
1.14.3.	It is the responsibility of the contractor to provide all relevant information on a regular basis regarding erection progress, labour availability, equipment deployment, testing, etc.
1.14.4.	During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
1.14.5.	Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
1.14.6.	Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise their work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.
1.14.7.	The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if

	any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required.
1.14.8.	The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes / ferrules / lugs) report, cranes availability report and other reports as per Performa considered necessary by the Engineer as per the BHEL formats.
1.14.9.	The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
1.14.10.	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
1.14.11.	Monthly Plan and review will be done as per the Format provided in Form-14. (Any revision in the format during the currency of the contract will also be applicable.)
1.14.12.	The contractor shall submit any other details like Site Organization chart, Progress photographs, Safety implementation report, pending material and any other inputs required from BHEL for activities planned during the subsequent month, etc. as sought by BHEL Engineer.
1.14.13.	The contractor to reflect actual progress achieved during the month and shall be submitted to BHEL, so that slippages can be observed and necessary action taken in order to ensure that the situation does not get out of control will update the construction schedule forming part of this contract each month.

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

TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

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

1.15.1. SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY THE MECHANICAL CONTRACTOR

The scope of commissioning assistance to be provided by the contractor will cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ and in relevant clauses of this TCC.

1.15.1.1. ALL TYPES OF DRIVES:

a. Cable identification, checking and meggering.

b. IR value of Generator, motor, measurement of winding resistance etc.

c. Dry out all the motors if required to improve IR value.

d. Checking direction of rotation of motors and testing and commissioning from local as well as remote.

e. Checking the bushing and HV test / Tan delta test

f. Attending to any defects till the handing over of the unit to customer.

g. Erection of peripheral electrical items required for successful commissioning

1.15.1.2. VOID

1.15.1.3. HOIST/MONORAIL/GANTRY CRANE:

a. Termination of power cable at Junction box & Hoist/Monorail/Gantry Crane control panel. However laying of power cable shall be done by Mechanical agency and payment for the cable termination shall be made by BHEL as per the BOQ rate schedule quoted by contractor.

b. Pre-commissioning checks and commissioning of Hoist/Monorail/Gantry Crane. Providing assistance during load test.

c. Replacement of any defective items like contactor, relays etc. in the control panel shall be carried out without any extra cost. The required material for replacement of defective items shall be provided by BHEL.

1.15.2. **SCOPE OF PRE-COMMISSIONING / COMMISSIONING AND POST COMMISSIONING WORKS:**

1.15.2.1. Scope of pre-commissioning / commissioning starts with the commissioning of various equipment erected by the contractor and making them available to

commission of FGD. The scope of work of various commissioning activities of the FGD System, some of which is referred below (The list below is not exhaustive):

a. Air & Gas tightness test for ducts
b. ACW, DMCW cooling water system readiness
c. Commissioning of Compressor
d. Wet ball mill commissioning
e. RC Slurry pumps commissioning
f. Oxidation blower commissioning
g. Booster Fans commissioning
h. Lime stone handling system commissioning
i. Gypsum handling system commissioning
j. Total water run test
k. Hot Commissioning of FGD
l. Trial Run of FGD

The above activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer / consultant / statutory authorities like boiler inspector, electrical inspector etc.

1.15.2.2. The contractor shall co-ordinate with BHEL and other contractor's during the main plant commissioning to ensure successful commissioning of total plant.

1.15.2.3. The pre-commissioning activitie will start with energizing of power supply systems followed by trial run of various drives. Commissioning operations shall continue till trial operation (if applicable) of the unit. The contractor shall simultaneously start checking cables erected by them to match with the various milestone activities /commissioning program of the project. All these works need specialized testing engineers, supervisors including electricians in each area to co-ordinate with BHEL Engineers and other agencies round the clock to match with commissioning schedule of unit. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted for erection work.

1.15.2.4. The mobilization of testing team shall be planned in time and shall be undertaken round the clock. Contractor shall discuss on day to day / weekly / monthly basis the requirement of testing manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and the cost will be recovered from contractor.

1.15.2.5. Prior to commissioning and after commissioning, protocols have to be made with BHEL / Customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL

commissioning engineers which may involve over time payment which forms part of Contractors Scope.

1.15.2.6. Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at their cost. During commissioning, any improvement rework / rectification / modification due to design improvement / requirement is involved, the same shall be carried out promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.

1.15.2.7. All T&P / instruments required for testing are to be arranged by the contractor.

1.15.2.8. All testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall follow the checklist of BHEL prior to taking up testing & commissioning activities and the activities shall be carried out in accordance with the checklist. All the above will be witnessed by BHEL engineer and the reports signed jointly.

1.15.2.9. The scope of commissioning assistance to be provided by the contractor will cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ.

1.15.2.10. All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. These tests / activities may not have been listed in these specifications.

1.15.2.11. 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 their cost.

1.15.2.12. It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors during pre - Commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

1.15.2.13. It shall be specifically noted that the contractor and employees of the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers / customer officials. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including engineers/supervisors.

1.15.2.14. In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at their cost. If any equipment / part are required to be

inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.

1.15.2.15. Recommissioning of any item listed in BOQ (drives of certain equipments, MOV etc) as per site requirement is to be done by the contractor without any extra claim.

1.15.2.16. The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

1.15.2.17. Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programs made to achieve the schedule agreed with customer.

1.15.2.18. After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance till handing over of sets to customer.

1.15.2.19. During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.

1.15.2.20. The contractor shall carryout any other test not listed in the tender as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

1.15.2.21. It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation (if applicable), even if commissioning of equipment is delayed due to reasons not attributable to the contractor.

1.15.3. SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY OTHER/ MECHANICAL CONTRACTOR:

1.15.3.1. The scope of commissioning assistance to be provided by the contractor will cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ and in relevant clauses of this TCC

1.15.3.2. All types of Drives:

a. Cable identification, checking and meggering.
b. IR value of Generator, motor, measurement of winding resistance etc.
c. Dry out all the motors if required to improve IR value.
d. Checking direction of rotation of motors and testing and commissioning from local as well as remote.

e. Checking the bushing and HV test / Tan delta test
f. Attending to any defects till the handing over of the unit to customer
g. Erection of peripheral electrical items required for successful commissioning

1.15.4. The scope of commissioning works covers commissioning of all instruments covered in the BOQ including loop checking and establishing the operation of instruments / systems to meet plant commissioning / operation. The contractor shall be responsible for overall commissioning of all the instruments and systems covered in the BOQ.

1.15.4.1. Scope of pre-commissioning / commissioning starts with the commissioning of various equipment erected by the contractor and making them available to commission various materials / systems and main power plant. The scope of work of various commissioning activities of the FGD System, some of which is referred below (The list below is not exhaustive):

a. Air & Gas tightness test for ducts
b. ACW, DMCW cooling water system readiness
c. Commissioning of Compressor
d. Wet ball mill commissioning
e. RC Slurry pumps commissioning
f. Oxidation blower commissioning
g. Booster Fans commissioning
h. Lime stone handling system commissioning
i. Gypsum handling system commissioning
j. Total water run test
k. Hot Commissioning of FGD
l. Trial Run of FGD

1.15.5. The above activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer / consultant / statutory authorities like boiler inspector, electrical inspector, TAC, etc.

1.15.6. The contractor shall co-ordinate with BHEL and other contractor's during the main plant commissioning to ensure successful commissioning of total plant.

1.15.7. The pre-commissioning activities of the main power plant will start with run of various equipment and commissioning operations shall continue till the unit is handed over to customer. The contractor shall simultaneously start commissioning activities for the equipment erected to match with the various milestone activities of commissioning programme of the project.

1.15.8. Contractor shall arrange experienced commissioning engineers, supervisors including electrician / instrument mechanics in each area to be associated with BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted. It shall be specifically noted that above employees of the contractor may have to

work round the clock along with BHEL commissioning engineers involving considerable payment of overtime, which forms part of Contractor's Scope.

1.15.9. The mobilization of these commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and necessary recoveries with overhead cost will be made from the bills of the contractor.

1.15.10. After erection of various equipment, prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers.

1.15.11. For electrical works, 415 volts and above, the contractor has to bring qualified electricians and the total work has to be certified by electrical license holder. The expenditures towards work certificate and all statutory requirements connected towards the high voltage system shall be borne by the contractor.

1.15.12. In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost. If 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. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.

1.15.13. During commissioning activities and carrying out various tests, if any of the instruments has to be temporarily erected and commissioned to suit the commissioning activities, the contractor has to carry out the erection of the same. After completion of activities the temporary systems have to be removed and returned to stores and no extra rate shall be paid for this.

1.15.14. All the T&P instruments required for commissioning are to be arranged by the contractor. However, any special instruments, which are of proprietary nature, shall be arranged by BHEL.

1.15.15. 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 the above will be witnessed by the BHEL engineers and

reports signed shortly. Contractor shall follow checklist of BHEL and testing & commissioning activities shall be carried out in accordance with the checklist.

1.15.16. The scope of commissioning shall also cover the commissioning of the equipment / drives erected by the mechanical contractors. (as detailed in the BOQ)

1.15.17. The mobilization of testing team shall be planned in time and shall be undertaken round the clock. The contractor shall discuss on day to day / weekly / monthly basis the requirement of testing manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and the cost shall be recovered from contractor.

1.15.18. Prior to commissioning and after commissioning, protocols have to be made with BHEL / customer. The formats shall be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL commissioning engineers which may involve over time payment which forms part of Contractor's Scope

1.15.19. Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost.

1.15.20. Minimum requirement of Man Power for testing/checking/commissioning works shall be as follows:

	TRANSFORMER	BUS DUCT	SWITCHGEAR/PANEL	CABLING
Engineer	1		1	2
Supervisor	2	1	4	2
Technician	4	2	4	4

The above testing / checking group shall be identified at the Pre-commissioning time. The above commissioning group shall have the knowledge of various systems referred in the tender and possess adequate experience in testing. The above manpower for commissioning is only tentative and if any additional manpower required as per site requirement, the same shall be arranged by the contractor. If the contractor fails to deploy the above Engineer / Supervisor / Technician at appropriate time of commissioning, no payment shall be made against commissioning activities as per terms of payment.

1.15.21. The above commissioning group shall be identified at the Pre-commissioning and commissioning time. The above commissioning group shall have knowledge of various systems referred in the tender and also should have adequate experience.

1.15.22. The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor. Besides the above, there will be separate engineers for Planning, Safety and Quality. For all practical

purposes, each of the above In-charges shall be provided with a PC and good communication facilities.

1.15.23. If the contractor fails to deploy the above Engineer / Supervisor / Technician at appropriate time of commissioning, BHEL Engineer will have the right to withhold the payment towards commissioning activities as defined in terms of payment.

1.15.24. T & P / instruments required for testing are to be arranged by the contractor.

1.15.25. All commissioning / testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall follow the checklist of BHEL prior to taking up testing & commissioning activities and the activities shall be carried out in accordance with the checklist. All the above shall be witnessed by BHEL engineer and the reports signed jointly.

1.15.26. The scope of commissioning assistance to be provided by the contractor shall cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ.

1.15.27. Scope of commissioning of equipment erected by the mechanical contractor

The scope of commissioning assistance to be provided by the contractor will cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ.

The scope of work also includes collecting the replacement instruments / parts from BHEL / customer stores, stockyard etc.

Separate group shall be identified for commissioning. The above group shall be available right from Trial run to full load operation including shift operation.

VOLUME-IA PART- I CHAPTER-XVI
PAINTING

1.16. **FINAL PAINTING**

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

1.16.1.1. The scope of work shall also include supply and application of final painting of all the components, other equipment's etc., erected under the scope of this tender. The painting shall be as required and specified in the **painting schedule** for power plant equipment, structures, piping etc. which forms the part of this tender book.

1.16.1.2. The scope of painting generally includes painting of all steel items such as supports, racks, frames, Transformers, Bus ducts and GCB besides touch up paints wherever required. Full painting shall be required for specific equipment's as per the scope of erection.

1.16.1.3. The scope also includes supply of paints, primers, tools/consumables like brushes, rollers, emery papers, thinner etc., at no additional cost.

1.16.1.4. In the case of steel fabricated items, raw steel after fabrication has to be cleaned and subsequent painting to be carried out.

1.16.1.5. All the exposed metal parts of the equipment including bus ducts, 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 indicated in the Painting Specification 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.

1.16.1.6. All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.

1.16.1.7. Paint shall be applied by brushing or by spray painting as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimal.

1.16.1.8. Spray painting has to be carried out within the Quoted rates for Transformers, Bus-ducts and GCB. Spray painting gun and compressed air arrangement has to be made by the contractor themselves.

1.16.1.9. Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.16.1.10. 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.,

1.16.1.11. The scope of painting includes application of colour bands, lettering the names of the systems equipment; tag Nos of valves, marking the directions of flow and other data required by BHEL within the quoted rate.

1.16.1.12. All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots. Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.

1.16.1.13. Finish coat paint, No of coat and DFT shall be as indicated in the painting specification enclosed in this tender / relevant BHEL document/ customer's specifications. The painting specification which is forming part of this tender as in TCC shall be used as guidelines to be followed.

1.16.1.14. The actual colour to be applied shall be approved by the customer before starting of actual painting work.

1.16.1.15. 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, and the paints should be as per the customer painting specification. 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.

1.16.1.16. No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.

1.16.1.17. Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.

1.16.1.18. Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.16.2 PRESERVATION / TOUCH UP PAINTING

1.16.2.1. Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other consumables like wire brushes, emery paper, cotton waste, cloth etc., at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.

1.16.2.2. Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint is to be applied on all the bare / unpainted surfaces. Touch up painting is generally required for trays, control panels.

1.16.2.3. All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.

1.16.2.4. Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipment under this tender specification right from pre-assembly stage to till the equipment is cleared for final painting.

1.16.2.5. 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.

1.16.2.6. Equipment / items/ components supplied during storage and handling, 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

.