TENDER SPECIFICATION

BHEL: PSSR: SCT: 2253

FOR

Erection, Testing and Commissioning and Trial Operation including Supply and Application of Final Painting and Handling of materials at site BHEL stores / Client's Stores/ Storage Yard, transporting to site of erection of Electrical, C&I works

for

Flue Gas Desulphurization (FGD) System

At

1 x 800 MW North Chennai Thermal Power Plant Stage-III, Chennai,

TECHNOCOMMERCIAL BID - Consists of Book- I & Book- II

Book- I Consists of

- **Notice Inviting Tender**
- **Volume-IA: Technical Conditions of Contract**

Book-II consists of

- **Volume-IB: Special conditions of Contract,**
- **Volume-IC: General conditions of Contract**
- **Volume-ID: Forms & Procedures**

VOLUME –I BOOK - I

BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)
Power Sector – Southern Region
TNEB Road, Pallikaranai, Chennai – 600 100

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

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

VOLUME-IA PART – I CHAPTER – I
PROJECT INFORMATION

1	Name of the Project	:	1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III.
2	Station Capacity	:	800 MW
3	Type of project	:	Brown field
4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
5	Site Location	:	In the premises of North Chennai Thermal Power Station (NCTPS).
6	Location co-ordinates	:	80° 19' E to 80° 20' E Longitude 13° 13' N to 13° 18' N Latitude
7	Nearest Village	:	Ennore & Puzhudhivakkam Village
8	Nearest Town & City	:	Chennai (35 Km)
9	State Capital	:	Chennai (35 Km)
10	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai –Vijayawada Line
11	Nearest Airport	:	Chennai (~ 60 Km)
12	Nearest Seaport	:	Ennore (~ 3 Km)
13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri highway
7	**Site Conditions**	:	
A	Annual Maximum Mean Temperature	:	45 Deg C
B	Annual Minimum Mean Temperature	:	15 Deg C
C	Design Ambient Temperature	:	30 Deg C
D	Ambient Temperature (for Efficiency Guarantee)	:	38 Deg C
E	Relative Humidity for design / efficiency	:	36-90%
F	Plant Elevation above MSL	:	10 m above MSL
G	Mean Wind Speed	:	5.8 km/h
H	Wind Pressure		As per the latest revision of IS 875/1987
I	Earthquake Zone	:	Zone-III as per IS- 1893 (Part-IV)

VOLUME-IA PART – I CHAPTER – II

SCOPE OF WORKS

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.)

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.

1.2.1. 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, supply and application of final painting and handing over of complete Electrical, C&I works for the Flue Gas Desulphurization(FGD) system and its auxiliaries at 1X 800 MW North Chennai Stage III.

1.2.2.	**SCOPE OF WORKS:** The broad scope of Electrical, C&I covered in this tender are Erection and Commissioning of Transformers (all types), HT & LT Switchgears, HT & LT Bus Ducts, HT & LT Drives, Control Panels (all types including Remote IO/Control panels), and C&I items including Permanent Nomenclature of individual feeders & Panels etc., laying of HT and LT cables, but not limited to the following. Detail Scope is as mentioned in the BOQ and elsewhere in this specification. **I. SCOPE OF ELECTRICAL WORKS IN GENERAL** **A. Erection, Testing and Commissioning:** 1. All kind of Power Transformers: a. **FGD Transformer & Oil/ Dry type Service Transformers:** These transformers shall be unloaded and stored approximately 500 m from the erection location. Bidder scope includes arranging adequate capacity of low bed trailer and other arrangements for transporting from the storing location and shifting/dragging to the respective transformer foundations. b. 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.

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

d. Completion of Tray, Structural, Conduits & Piping works if any required.

2. HT Bus Ducts (SPBD) of 11KV & 6.6 kV, LT Bus Ducts (NSPBD) of 415 V.
3. Protection Panels of FGD Transformer, FGD Auxiliary transformer, FGD service transformer, LGP/ GHP service transformer other Electrical Protection and Control Panels. HT/LT Switchgears, AC/DC Distribution Boards, Starter Panels, Electrical Control Panels etc
4. Laying and termination of HT cables (11 kV & 6.6 kV), LT Power and control cables and instrumentation cables including supply of ferrules, tag plates, and cable dressing materials as detailed in scope of cabling.
5. Arranging required capacity of portable DG set to cater power supply for carrying out tray and cabling works for equipment located at long distance/ power outage.
6. Fabrication and installation of steel supports wherever required.
7. DG set (750 KVA) and related items.
8. Earthing & Lightning Protection system, Lightning Arrestors. Post Insulators with accessories, Erection of earth flats and earth pits (Test Earth pits/Treated Earth pits) for below–ground earthing of various equipments HT equipment/switchyard equipment/Light masts/Electronic equipment etc.
9. Fire Proof Sealing System and Fire Protection Coating Systems wherever required.
10. Battery & Battery Charger
11. Installation of NGRs
12. Laying of Cable Trays, Cable Racks, PVC Conduit, GI Conduit, Junction boxes, Pushbutton Stations & Starters.
13. Installation and Commissioning of Data Concentrator panels along with its accessories, such as Laptop, etc.
14. Armoured Fibre Optic Cable in GI/ HDPE Pipe.
15. Removal, Calibration and fixing of the instruments in various systems as specified in the BOQ
16. Installation of any other items that have not been specifically indicated, but required for completing the system.

17. VFD System

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

1. 11 kV & 6.6 kV Switchgear panels and 415 V LT switch gear panels.
2. HT motors,
3. LT motors,
4. Bi-Directional/ Uni-Directional Drives, Pneumatic/ Motor Operated Valves/ Actuators/ Power Cylinders/ Controllers and Relief Valves, Control panels, insulators, special instruments, etc. erected by Mechanical/ other contractor
5. Temperature Elements of all the HT Drives (Checking the healthiness)

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 within the quoted rate.

II. SCOPE OF WORK FOR CONTROLS AND INSTRUMENTATION IN GENERAL

Erection, Testing and Commissioning

1. Installation of DCS panels, other control panels (both local/Remote), VFD Panels, local instrument enclosures/racks, etc.
2. Minor Alignment, Electrical Interconnection, Testing and Commissioning of Panels mentioned in Sl.No. 1 above.
3. All Types of Field Instruments like Electronic Transmitter (Pressure, differential pressure, Level (DP type), Flow), Level transmitter (Ultrasonic type, Radar type, etc.), Temperature transmitter, Pressure/ Differential Pressure Gauges, Level Gauge- Float type and Magnetic type, temperature elements and gauges, RTDs, Temp. Indicator, Weight Transmitter, Flowmeter-Magnetic type, Density meter, Flow Indicator, Firefighting/Protection System Instrumentations, etc.
4. Installation of SO2 Analyser, Ph Analyser, Low temperature Oxygen Analyser, CEMS (SOX/ NOX/ CO/CO2 Analyser) at Chimney, Particulate Emission Analyser, Dust Analyzer, Instrument & junction boxes to be erected, Mercury Analyser, etc under the supervision of OEM, as applicable.
5. All type of hardware like impulse pipes, Fittings, Manifolds and Accessories, cable trays & tray supports, instrument airline, etc.

6. Fabrication and installation of steel supports and GI Pipes wherever required.
7. Vibration Monitoring System (VMS).
8. Laying and Termination of LT Power/Control/Instrumentation/Special type of cables.
9. Treated Earth Pits for Electronic Earthing
10. Microprocessor based panels, DCS system and its accessories like system panels, Network Panels, Network Enclosures, EPABX, Wireless communication, UPS with battery and charger, PCs, Laptops, Printers, Computer Furniture etc.
11. Solenoids, Solenoid Operated Valves, etc.
12. Laying & Splicing of Optical Fibre Communication Cables with/without conduits as specified by BHEL Site Engineer.
13. All UPS, Inverters, ACDB, Battery, Battery Chargers, DCDB, etc.
14. All type of Local/ Remote control panels and LGB, LIE, LIR, TTE Network Enclosures, Junction Boxes, Pushbutton stations.
15. Supply of all consumables required for installation as detailed elsewhere in the contract.
16. Installation of any other items that have not been specifically indicated, but required for completing the system.

Note:

i. If any peripheral C&I 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. Contractor shall have valid license to carry out the work indicated in the BOQ.

ii. BHEL will provide OEM's technical support for commissioning of various proprietary type special instruments/systems like Vibration Monitoring System, VFD, Flue Gas Analyzers, etc. The contractor shall carry out the works as per instructions of BHEL/ OEM's Engineer.

III. OTHERS:

1. Dismantling of existing panel, Modification works in panels, etc.
2. Any work including wiring, cabling, testing, etc. for Integration of ST relay panel/control panel with existing panel, etc.

	3. Painting including supply of paints, as detailed in scope of respective item/ equipment. 4. Embossing Permanent nomenclature on equipment erected/Trays/ panels/wherever required as per site requirement. **IV.** Contractor shall have valid electrical license to carry out the work indicated in the BOQ. **V.** Necessary arrangements for Protecting and safe guarding the Erected equipment from any damages and pilferages till handing over.
1.2.3.	**Scope of bidder also covers getting Electrical Inspectorate/ statutory authority's approval as applicable for charging of all HT installations erected by them.**
1.2.4.	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, pre-commissioning, testing and commissioning, supply and application of final painting, 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 equipments, Testing instruments, returning of un-used materials / items to BHEL stores. Make of the Paint and welding electrode are subject to BHEL/Customer approval.
1.2.5.	It is not the intent to specify herein all details of material. Any item related to this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.
1.2.6.	The scope of specification covers the material receipt from BHEL stores, transportation to erection site, installation, testing and commissioning of the electrical and C&I equipment, hardware, software (data concentrator) communication along with accessories as detailed in Bill of Materials.
1.2.7.	If any item or equipment not covered but requires to 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 BOQ.
1.2.8.	The following are specific exclusions from this work. a. Erection of Dampers, Pneumatic/ Motor Operated Valves, Electrical Actuators, HT/ LT Drives b. Attachment welding of thermocouple pads, Flow Nozzle, Orifice Plates and Control Valves c. Root Valves on the instruments tapping points

	d. Seal Welding on temperature stub on piping before hydro test. e. Removal of seal welding on temperature stub on piping after successful completion of hydro test. Height of the temp stub to be maintained as per piping drawing. Note: The above exclusions shall not be concluded as final. They are meant for general guidelines. BHEL reserves the right to include or exclude any item which is required for completing the job as per rates indicated in rate schedule. Contractor shall carry out all such jobs as per the instructions of BHEL Site Engineer.
Note: *Detailed BOQ BHEL unit wise with detailed specification of various equipment's and items are given in the* ***VOLUME- IA PART-I CHAPTER-IX and*** *elsewhere in technical specifications. The rate schedule is the summary of BOQ i.e. consolidated list of BOQ. Contractor shall go through the detailed BOQ and specification.*	

VOLUME-IA PART – I CHAPTER – III

FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL

Sl.No.	Description	Scope to be taken care by		Remarks
		BHEL	BIDDER	
	PART-I			
1.3.1.1.0	**ESTABLISHMENT**			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
A	Open space for office	Yes		Free of charges as provided by TANGEDCO
B	Open space for storage/T&P	Yes		Free of charges as provided by TANGEDCO
C	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	At bidder's own cost
D	Bidder's all office equipment's, office/ store/ canteen consumables		Yes	At bidder's own cost
E	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	At bidder's own cost
F	Firefighting equipment's like buckets, extinguishers etc.		Yes	At bidder's own cost
G	Fencing of storage area, office, canteen etc. of the bidder		Yes	At bidder's own cost
1.3.1.1.2	FOR LIVING PURPOSES OF THE SUCCESSFUL BIDDER'S PERSONNEL			
A	Open space for labour colony		Yes	At bidder's own cost
B	Living accommodation		Yes	At bidder's own cost
1.3.1.2.0	**ELECTRICITY**			
Sl.No.	**Description**	**Scope to be taken care by**		**Remarks**
		BHEL	**BIDDER**	
1.3.1.2.1	Electricity For construction purposes	Yes		Chargeable to bidder as per prevailing rate of TANGEDCO

1.3.1.2.2	Single point source (In general)	Yes		Chargeable to bidder as per prevailing rate of TANGEDCO
1.3.1.2.3	Further distribution for the work to be done which include supply of materials and execution		Yes	At bidder's own cost
1.3.1.2.4	Electricity for the office, stores, canteen, labour colony, etc of the bidder which include:		Yes	At bidder's own cost
A.	Distribution from single point including supply of materials and service		Yes	At bidder's own cost
B.	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	At bidder's own cost
1.3.1.2.5	Duties and deposits including statutory clearances for the above		Yes	At bidder's own cost
1.3.1.2.6	Demobilization of the facilities after completion of works		Yes	At bidder's own cost
1.3.1.2.7	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc.		Yes	At bidder's own cost
1.3.1.3.0	**WATER SUPPLY**			
1.3.1.3.1	For construction purposes:	Yes		Chargeable to bidder as per prevailing rate of TANGEDCO
1.3.1.3.2	Making the water available at single point	Yes		Chargeable to bidder as per prevailing rate of TANGEDCO
1.3.1.3.3	Further distribution as per the requirement of work including supply of materials and execution		Yes	At bidder's own cost
1.3.1.3.4	Water supply for bidder's office, stores, canteen, labour colony, etc.		Yes	At bidder's own cost
A	Making the water available at single point		Yes	At bidder's own cost
B	Further distribution as per the requirement of work including supply of materials and execution		Yes	At bidder's own cost
1.3.1.4.0	**LIGHTING**			
1.3.1.4.1	For construction work (supply of		Yes	At bidder's

	all the necessary materials) a. At office storage area b. At the construction site / area c. At the labour hutment			own cost
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) a. At office storage area b. At the construction site /area c. At the labour hutment		Yes	At bidder's own cost
1.3.1.5.0	**COMMUNICATION FACILITIES for site operations of the bidder**			
1.3.1.5.1	Telephone, Fax, internet, intranet, email etc		Yes	At bidder's own cost
1.3.1.6.0	**COMPRESSED AIR SUPPLY**			
1.3.1.6.1	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc.		Yes	At bidder's own cost
1.3.1.6.2	Installation of above system and operation & maintenance of the same		Yes	At bidder's own cost
1.3.1.6.3	Supply of the all the consumables for the above system		Yes	At bidder's own cost
	PART-II			
	CONSTRUCTION FACILITIES			
1.3.2.1.0	**Engineering works for construction**			
1.3.2.1.1	Providing the construction drawings for all the equipment covered under this scope	Yes		Progressively
Sl.No.	**Description**	**Scope to be taken care by**		**Remarks**
		BHEL	**BIDDER**	
1.3.2.1.2	Detailed drawings for construction	Yes	Yes	In the case of bidder, it shall be in consultation with BHEL
1.3.2.1.3	As-built drawings – wherever deviations observed and executed and also based		Yes	In consultation with BHEL

	on the decisions taken at site- example – routing of small-bore pipes			
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes	Yes	
1.3.2.1.5	Preparation of site construction schedules and other input requirements	Yes	Yes	In consultation with BHEL, as per requirement of BHEL targets
1.3.2.1.6	Review of performance (Form-14) and revision of site construction schedules in order to achieve the end dates and other commitments		Yes	
1.3.2.1.7	Weekly construction schedules based on Sl No 1.3.2.1.5		Yes	
1.3.2.1.8	Daily construction / work plan based on Sl No 1.3. 2.1.7		Yes	For daily monitoring meeting at site
1.3.2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months		Yes	At bidder's own cost
1.3.2.1.10	Preparation of preassembly bay, if any required		Yes	At bidder's own cost
1.3.2.1.11	Laying of racks for gantry crane if provided by BHEL or brought by the contractor / bidder himself			Not Applicable
1.3.3.0	**OPEN SPACE**			
	Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, fabrication yard and storage area at the job site, contractor's stores shed(s). BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements Contractor has to make his own arrangements for labour colony. The contractor shall provide adequate water arrangement for drinking/washing/bathing with required toilets, drainage system, and electrification etc. in labour colony at his own cost. Suitable paved area, as & if directed by customer based on hygiene requirement of labour, to be provided in the labour colony at the cost of contractor. The Contractor shall provide adequate arrangements for electricity requirements for labour colony. Location and area requirement for office/storage sheds/ fabrication yard shall be discussed and mutually agreed to. Any development of fabrication yard, storage area, etc. shall be done by the contractor within the quoted rates of the contract.			
1.3.4.0	**ELECTRICITY:**			

1.3.4.1	In general, Construction power will be provided to the contractor on prevailing rates of TANGEDCO on chargeable basis at one single point WITHIN THE PLANT AREA by BHEL. The contractor to Provide necessary energy meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc. However, based on request of Contractor and requirement of project, BHEL Site in charge, at his discretion, may provide construction power at multiple point (as close to work area as possible), for smooth execution of the work at site. If, BHEL provides electricity at more than one point (as close to work area as possible), it will be responsibility of the contractor to provide all the support necessary for enabling BHEL for extending such provision to contractor. However, the Construction power provided to the contractor shall be on chargeable basis at prevailing rates of TANGEDCO. The contractor has to Provide necessary meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/ LCB etc. Any dispute, BHEL engineer's decision shall be final and binding on contractor. Construction power prevailing charges are as below, The present LT tariff VI rate of TANGEDCO is a) Consumption charges at Rs.12.00 per unit. b) Maximum demand (MD) charges as applicable per month c) Low Power Factor (LPF) charges d) Electricity Tax on total amount e) Any other miscellaneous charges charged by M/s TANGEDCO pertaining to construction power supply. Note - The TANGEDCO tariff and tax may vary from time to time and the same is applicable for the bidder.
1.3.4.2	Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at their cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
1.3.4.3	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, shall 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 bidder / 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	As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, contractor should make his own arrangement for

	alternative source of power supply. No separate payment shall be made for this contingency.
1.3.4.7	Contractor has to make their own arrangements for their electricity requirement for their labour colony at their cost.
1.3.5.0	**WATER**
1.3.5.1	Water (Raw water) required for construction purposes will be provided at one single point WITHIN THE PLANT AREA on chargeable basis to contractor at the prevailing rates of TANGEDCO (tapping of water for construction is near Stage-I of North Chennai TPS as provided by M/s TANGEDCO). The contractor to Provide necessary meter for measuring the water consumption. The required pumps & accessories, pipes for drawing water from the given point and further distribution will be arranged by the contractor at their cost to go on without interruptions.
1.3.5.2	Successful Bidder to make his own arrangements for drinking water / water for sanitation for their labour & staff at bidders' cost.
1.3.5.3	The water charges may vary from time to time as per TANGEDCO/ Metro conditions. However, the prevailing water charge is Rs 145.00 per Kilo litres and may be liable to changes. Any dispute regarding consumption, the BHEL engineer decision will be final. The TANGEDCO tariff and tax may vary from time to time and the same is applicable for the successful bidder.
1.3.5.4	Incase non-availability of water or the TANGEDCO is not able to supply the water, the contractor shall make his own arrangements of water suitable for construction purpose to have uninterrupted work (from M/s TANGEDCO approved source of water). No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for their water requirement for their labour colony at their own cost.
1.3.6.0	**ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:**
1.3.6.1	One No of computer along with Multi-Function Printer (MFP) of latest configuration (preferably i5 processor, 8 GB Ram, 1 TB Hard disk, with internet provision on all the computers), along with one data entry operator per computer to be arranged by contractor for reporting of daily progress, billing and other similar activities, updating details in online SCMS package of BHEL, etc., within the quoted rate.
1.3.7.0	**CONSUMABLES:**
1.3.7.1	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.

1.3.7.2	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/Customer. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
1.3.7.3	All other electrodes including stainless steel electrodes required shall be arranged by the contractor at their cost. The bidder shall use the Customer approved quality welding electrodes only.
1.3.7.4	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.
1.3.7.5	All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.
1.3.7.6	In the event of failure of contractor to bring necessary and sufficient consumables, BHEL shall arrange for the same at the risk and cost of the contractor. The entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.
1.3.8.0	**MATERIAL SUPPLY:**
1.3.8.1	BHEL will supply the materials/equipment indicated in the BOQ/weight schedule from their respective manufacturing units which are to be erected/incorporated in the permanent system.
1.3.9.0	**POSSESSION OF GENERATORS:**
1.3.19.1	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 bidder / 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 diesel operated generator set to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by contractors. This may also be noted while quoting. No separate payment shall be made for this contingency.

1.3.10.0	**LIGHTING FACILITY (with ELCB):**
1.3.10.1	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.
1.3.11.0	**GASES:**
1.3.11.1	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.
1.3.11.2	BHEL reserves the right to reject the use of any gas in case required purity is not maintained.
1.3.11.3	The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
1.3.11.4	The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal working place with proper security etc.
1.3.12.0	**ELECTRODES SUPPLY AND STORAGE:**
1.3.12.1	The bidder shall use BHEL / Customer approved quality welding electrodes only.
1.3.12.2	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.
1.3.12.3	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.
1.3.12.4	Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at their own cost by the contractor.
1.3.12.5	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.
1.3.12.6	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.

1.3.12.7	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.
1.3.13.0	**MATERIALS /CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR AT THEIR COST FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENTS/ITEMS.**
1.3.13.1	All welding electrodes, filler wires, gases shall be arranged by the contractor at their cost.
1.3.13.2	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.
1.3.13.3	Other items
	1. Provision for Temporary scaffoldings
	2. Insulation tapes
	3. Paints required for primer coating & final coating and for protective coating. paint of approved colour, consumables like thinner brushes, emery paper etc.,
	4. Solder wire (Lead 60/40)
	5. Protocol / calibration report sheets as per BHEL format
	6. PVC wire marker sleeves and tag plates
	7. Panel / JB sealing compound material (for cable entry from bottom / top of panel)
	8. Materials required for cable dressing (GI / Aluminium Flats, PVC Cable ties, etc)
	9. Anchor fasteners for wall mounted cable trays & JBs wherever required.
	10.PVC wire marker sleeves and tag plates
	11. Lugs of size 2.5 sq.mm and below
	12. “U” clamps with nuts and washers for impulse pipes and GI pipe clamping.
	13. Tag Plats-Al/Fiberglass/Stainless Steel
	14. Insulation Tapes
	15. Teflon Tape for GI pipe coupling
	16. Protocol/Calibration report sheets as per BHEL format
	17. Fastener for mounting JB, Local PB boxes and earthing flats.
	18.PVC cable tie, Aluminium or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing, grommet sleeves for cables.
1.3.14.0	**TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS**
1.3.14.1	**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
1.3.14.2	**FERRULES:**	
	Colour of Ferrules	Yellow/White
	Colour of Engraving	Black
1.3.14.3	**TAGS:**	
	Material	Al/Fiberglass/Stainless Steel
	Markings	Engraving/Embossing/Printing
1.3.15.0	**POWER REQUIREMENT:**	
1.3.15.1	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.	
1.3.16.0	**CONTRACTOR'S OBLIGATION ON COMPLETION:**	
1.3.16.1	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

1.4.0.0	**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.
1.4.1.0	The following is the Tentative list of Major T&P to be deployed for execution, by the contractor within quoted Price: a. Oil Filtration Machine with all accessories 10 to 12 KL/hr capacity for oil filled Transformer: As required b. 20 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 14 T capacity (Parana) – 01 Nos. (min) As required The above list is tentative and not exhaustive.
1.4.2.0	Computerized ferrule printing machine (as required) shall be provided for making printed ferrules for all the cables.
1.4.3.0	**EQUIPMENT REQUIRED /RECOMMENDED INSTRUMENTS 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. • 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 • Insulation tester: a) Motorized Megger - 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohms (make: Any reputed brand) with PI option. b) Hand operated Megger - 0.5 KV/1.0 KV/2.5 KV, 0- 1000 M Ohms • Earth resistance tester 0 to 1, 10, 100 ohms • Transformer oil test kit • Torque wrench

	• Voltmeter AC 0 - 125 - 250 - 625 V AC • Ammeter AC 0 - 2A - 10A AC • Clamp on meter • Wattmeter - ac/dc - 0 - 125 - 250 V 0-5-10A. • Multimeter - analogue: AC V 2.5V - 2500V, AC A - 100 mA - 10 A DC V 25.V - 2500V, dc A - 50mA - 10A • Digital Multi meters (make: Fluke) AC 0V-600V, DC 0V-300V • Resistance - 0 - 200 M ohms • Digital: voltages AC & DC - 100mv - 1000 V Current 10-mA - 10A Resistance - 0-20 M ohms • Wheat stone bridge - 0.05 m ohm - 100 ohm. • HT cables Fault locator • HT cables jointer for straight through jointing and end termination on 24x7 basis • VARIAC - 1/ 3 phase - 5A, 15A 3 phase - 10A, 20A. • Primary injection kit - 0-10000 A. • Relays testing kit for Secondary injection test (Preferable Make: Omicron)- 0-5A. • HV Test kit - 50 KV AC 400kVA. • Wheat stone bridge - 0.05 m ohm - 100 ohm. • Oscilloscope • Air compressor. • Oil Tank for transformer oil filtration • Winding inductance/ capacitance test kit • 220V DC power pack for control supply required for testing of panels • Vacuum pump. • Phase sequence meter - 110V - 450V - 25 to 65Hz. • Frequency meter - 0 - 115 - 230 - 4500 - 45 - 601/s. • Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A. • Tachometer etc. • SF6 filling and evacuating equipment.

- mA Source
- Standard pressure gauges – If required
- Temperature oil bath– If required
- Capacitance and Tan Delta Test kit
- Oil specific gravity and PPM measuring Equipment-Only if HV Transformers are included in rate schedule
- Dew point measurement instrument
- 3 Phase relay testing kit (Of type omicron etc.) To be brought when required
- Contact resistance measurement kit
- Micro Ohm meter
- Equipment's for SFRA Test (400 KV on either side)
- Equipment for DGA test on Transformers (Guidelines attached in elsewhere in this specification)
- HT discharge rod (min 11 kV) – 3 Sets (min)
- Lockout Tagout (LOTO) system for implementing during testing, commissioning & initial operation of Electrical equipment
- Insulating Rubber mats & Hand gloves (as required)
- Test Lamp
- Buzzer
- Lux Meter
- Test setup for testing the lighting equipments such as 24 V DC, 220 V DC and 240 V 1 Ph AC.
- DCRM (OPERATIONAL ANALYZER)

TOOLS AND TACKLES REQUIRED FOR C&I WORKS:

Sl.No.	Description	Quantity
01	Dead Weight tester rated 600 kg/sq.cm with weights & test gauges facility.	As required.
02	Oil temperature bath suitable to calibrate upto 400˚ C	As required
03	Furnace range 600 Deg C	As required
04	Standard Pressure Gauges as below:	
	0 to 1 kg/Sq.cm	As required
	0 to 5/6 kg/Sq.cm	As required

	0 to 10 kg/Sq.cm	As required
	0 to 16 kg/Sq.cm	As required
	0 to 25 kg/Sq.cm	As required.
	0 to 60 kg/Sq.cm	As required
	0 to 100 kg/Sq.cm	As required
	0 to 250 kg/Sq.cm	As required
05	Standard Temperature Gauges as below:	
	0 to 100 Deg C	As required
	0 to 200 Deg C	As required
	0 to 600 Deg C	As required
06	Standard compound pressure gauge -1 to +3 kg/Sq.cm	As required
07	Standard Vacuum Gauge -760 mm Hg to 0 kg/Sq.cm	As required
08	Portable air compressor with drier and regulator rated for 10 kg/Sq.cm	As required
09	Manometer 0 to 1000 mm WC with hand bulb	As required
10	Vacuum pump with standard vacuum gauge	As required
11	Standard Milliamps Source (Digital)	As required
12	Standard Millivolts Source (Digital)	As required
13	Mercury Manometer different range	As required
14	DC Power Supply, 24 V; 5A	As required
15	Single Phase Variac 250V; 10A	As required.
16	Glass Thermometers of ranges in Deg C as below: 0-120; 0-200; 0-600	As required
17	Tong tester AC 5/10/25; KEW Snap Make	As required
18	Function Generator	As required
19	Hand Operated Megger 500V; 2.5 kV / 100 M Ohms	As required
20	Analog Multimeter Motwane Make	As required
21	Digital Multimeter 3 1/2 Digit	As required
22	Digital Multimeter 4 1/2 Digit	As required
23	Wire wrapping tool	As required
24	Oscilloscope	As required
25	Soldering irons, soldering pump, Vacuum cleaner, Air blower etc.	As required

OTHER GENERAL TOOLS AND TACKLES:

S.No.	DESCRIPTION	QUANTITY
01	Steel wire ropes	As required
02	Chain pulley block / turfer	As required
03	2 " size pipe bending machine	As required
04	Grinding machine	As required
05	Drilling machines: 1/4", ½", 3/4", 1 "	As required

	06	Ttube bender and cutter sizes 6 mm; 8 mm; 1/2",1/4"	As required
	07	Dye sets for threading upto 2 " pipe	As required
	08	Set of spanners	As required
	09	Allen key sets	As required
	10	Bench vice	As required
	11	Spirit level	As required
	12	Tap sets for both BSP & NPT threads upto 1 "	1 Set each
	13	Measuring instruments like micrometers, calipers etc.	As required
	14	Welding generator	As required
	15	Welding transformer	As required
	16	TIG Welding set	As required
	17	Mechanical tool kit for fitters	As required
	18	Electrician tool kit	As required
	19	Crimping tool	As required
	20	Flood light fittings	As required
	21	Fire extinguishers	As required
	22	Distribution boards with power cable complete as required with energy meter	As required
	23	Hydraulic test pump rating 750 kg/sq.cm	As required
	24	Painting brush	As required
	25	Fire proof tarpaulin	As required
	26	Safety belts & safety helmets	As required
	27	Telephone sets	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.*

1.4.4.0 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 200mV to 750 V	± 0.8% + 1 digit	
			Philips Current 20 mA to 20 A DC	± 0.5% + 1 digit	
			Hcl Current 200 mA to 010 A AC	± 1% + 1 digit	
	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 /1000 V	Upto 200 m Ohms	± 5% at Centre scale	10”
		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 tong Tester	0 to 1000A AC	± 3%	
	17	DC Tong 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	± 10%	
	20	DC Voltmeter	0 to 500 V	± 10%	
	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		
	28	MV/mV Source	0 to 200 mA / 200mV	0.2%	
	29	Standard Pressure Gauges	0 to 1 kg/cm^2	±0.25% LC–0.02 kg/ cm^2	10”
			0 to 6 kg/cm^2	±0.25% LC–0.1 kg/ cm^2	10”
			0 to 10 kg/ cm^2	±0.25% LC–0.02kg/ cm^2	10”
			0 to 25 kg/ cm^2	±0.25% LC–0.25kg/ cm^2	10”
			0 to 60 kg/ cm^2	±0.25% LC–0.1kg/ cm^2	10”
			0 to 250 kg/ cm^2	±0.25% LC–2.5kg/ cm^2	10”
			0 to 400 kg/ cm^2	±0.25% LC–2.5 kg/ cm^2	10”
			0 to 600 kg/ cm^2	±0.25% LC–2.5 kg/ cm^2	10”
			0 to 1000 kg/ cm^2	±0.25% LC–1.0 kg/ cm^2	10”
	30	Dead Weight Tester	0 to 400	LC – 5 kg/cm2	
			0 to 600	LC – 5 kg/cm2	
	31	Standard Hg in glass Thermometer	0 to 100^{0}C	LC - 1^{0}C	
			0 to 110^{0}C	LC - 1^{0}C	
			0 to 250^{0}C	LC - 1^{0}C	

			0 to 150^{0}C	LC - 1^{0}C	
			0 to 360^{0}C	LC - 1^{0}C	
			0 to 420^{0}C	LC - 1^{0}C	
	32	Tongue tester	0/300/600 A AC	± 5%	
			0 to 300 A DC	± 5%	
	33	Phase Sequence Meter		N/A	
	34	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	± 5% at Centre Scale range	

	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 and T&Ps:** 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.
1.4.5.0	T&Ps / equipment 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/ equipment 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 equipment. 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&Ps during the contract period will be mutually agreed in line with construction requirement.
1.4.6.0	**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.
1.4.6.6	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.

<table>
<tr><td></td><td>
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.
</td></tr>
<tr><td>1.4.6.7</td><td>
CALIBRATION RECORD OF SUB-CONTRACTOR’S INSTRUMENTS
Format No. CP:PEX:FOX
Name of Site:
Name of Sub-Contractor:
<table>
<tr><th>Sl.No.</th><th>Name of the Instrument</th><th>Instrument REGN.No.</th><th>Date of Entry / Exit</th><th>Periodicity of Calibration</th><th>Calibration Details</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Date of Cal:
Cal. Agency:
Next Due Date:</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Date of Cal:
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Next Due Date:</td></tr>
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VOLUME-IA PART – I CHAPTER – V

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

1.5.0.0	**T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS**
1.5.0.1	List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis. 1. Crawler Crane – 75 T or above Capacity – 01 No.
1.5.0.2	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.
1.5.0.3	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.
1.5.0.4	Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
1.5.0.5	BHEL's 75T (or above) Crane is only for erection purpose of FGD Transformer, Service Transformer, SP Bus Duct, HT/LT Switchgear panels, C&I panels and any other equipment only and shall not be available for material handling or transportation purpose. Providing the crane is at the discretion of the BHEL engineer. Contractor shall make their own arrangements for material transportation to erection site.
1.5.0.6	Contractor shall make good any loss or damage to the equipment's supplied to them and day to day maintenance and operations of equipment's shall be borne by the contractor including all consumables like petrol, oil and air filters etc.,
1.5.0.7	BHEL may provide either BHEL owned or hired 75T (or above capacity) cranes at the discretion of BHEL.
1.5.1	**In the event of providing BHEL owned cranes:**
1.5.1.1	BHEL shall provide crane operator at free of charges.
1.5.1.2	Fuel and lubricants are to be arranged by the contractor within the quoted rate.

1.5.1.3	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.
1.5.2	**In the event of providing hired cranes:**
1.5.2.1	Crane Operators for hired cranes will be provided by BHEL, free of charges.
1.5.2.2	Fuel and lubricants are to be arranged by the contractor within the quoted rate.
1.5.3	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.
1.5.4	Besides the T & P mentioned above, which is being made available to the contractor on free of hire charges, any additional crane and other T & P which may be required for successful and timely execution of the work covered within the scope of this tender shall be arranged and provided at site by the contractor at their cost. In case if the contractor fails to provide such equipment, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary even during contract period.
1.5.5	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.
1.5.6	All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections shall have to be arranged by the contractor at his cost.

1.5.7	Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be in the Contractor's scope.
1.5.8	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.
1.5.9	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.
1.5.10	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 his cost.
1.5.11	The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.
1.5.12	In case of non-availability of any of these equipments, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make arrangement at his 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

<table>
<tr><td>1.6.1</td><td>TIME SCHEDULE</td></tr>
<tr><td>1.6.1.1</td><td>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 at site.</td></tr>
<tr><td>1.6.1.2</td><td>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.</td></tr>
<tr><td>1.6.1.3</td><td>The work shall be commenced on the mutually agreed date between the bidder and BHEL Site Incharge and shall be deemed as completed in all respect only when the FGD System is in operation. The decision of BHEL in this regard shall be final and binding of the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.</td></tr>
<tr><td>1.6.1.4</td><td>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.</td></tr>
<tr><td>1.6.2.0</td><td>COMMENCEMENT OF CONTRACT PERIOD</td></tr>
<tr><td>1.6.2.1</td><td>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.</td></tr>
<tr><td>1.6.3.0</td><td>MOBILIZATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING ETC.,</td></tr>
<tr><td>1.6.3.1</td><td>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:
<table>
<tr><th colspan="2">A. Major Milestones</th></tr>
<tr><th>Milestone Activity</th><th>From Start of Work</th></tr>
<tr><td>1. Completion of E&C of FGD Transformer, SP Busducts, HT Switchgears, Service Transformers & LT Switchgears & Control room equipment</td><td>6th Month</td></tr>
<tr><td>2. Readiness for Commissioning of FGD system of NCTPS Stage III</td><td>8th Month</td></tr>
<tr><td>3. Readiness for Trial Operation of FGD system of NCTPS Stage III</td><td>10th Month</td></tr>
<tr><td>4. Balance work completion, punch points liquidation</td><td>13th Month</td></tr>
<tr><th colspan="2">B. Intermediate Milestones</th></tr>
</table>
</td></tr>
</table>

	Milestone Activity	**Total Package**
	1. Readiness for Commissioning of FGD system of NCTPS Stage III (M1)	8th Month
	2. Readiness for Trial Operation of NCTPS Stage III FGD system (M2)	10th 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.	
1.6.4.0	**PENALTY FOR INTERMEDIATE MILESTONES**	
1.6.4.1	M1 and M2 shall be intermediate Milestones for the work.	
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.	
1.6.4.5	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.	
	Note: * Executable contract value-value of work for which inputs/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.	
1.6.5.0	**CONTRACT PERIOD**	
1.6.5.1	The contract period for completion of entire work under scope shall be 13 (Thirteen) months from the “COMMENCEMENT OF CONTRACT PERIOD” as specified earlier.	

1.6.6.0	**GUARANTEE PERIOD**
1.6.6.1	The guarantee period of 12 months shall commence from the date of successful trial operation of the plant (Provided all erection, testing, commissioning and pending points works are completed in all respects).

VOLUME-IA PART – I CHAPTER-VII

TERMS OF PAYMENT

1.7.0	**Terms of Payment:** The progressive payment for erection, testing and commissioning on accepted rate / price of contract value will be released as mentioned below. Progressive Payment against monthly running bills will be made up to 85 % of the value of **the completed erection** on Pro rata as per Clause no 1.7.1.0 to 1.7.22.5 of the following table.	
Sl. No.	**Activity / Work Description**	**% of unit rate**
1.7.1	**PRO RATA PAYMENTS (85%)**	
1.7.1.0	**Oil Filled Transformers**	
1.7.1.1	Placement on foundation and alignment	25%
1.7.1.2	Erection of associated auxiliaries / assemblies, oil filling, earthing, including branch trays and piping work, etc.	25%
1.7.1.3	Dry out including oil filtration	15%
1.7.1.4	Pre-commissioning checks	10%
1.7.1.5	Testing, Charging	5%
1.7.1.6	Final Painting	5%
	Total =	**85%**
1.7.2	**HT/ LT Bus Ducts**	
1.7.2.1	Pre-assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc. complete with supporting structure and earthing.	50%
1.7.2.2	Pre-commissioning checks	20%
1.7.2.3	Testing, Charging	10%
1.7.2.4	Final Painting	5%
	Total =	**85%**
1.7.3	**DG Set/Switch Gears/ MCC/ ACDB/DCDB/ LDBs/ LPs/ Marshalling Box /kiosk/ Starter Units / Dry type Transformers / Electrical Hoists/ Panels / Cubicles / Desks / /Chargers / VFD / LA assy / NGT / NGR / SP/ Circuit breaker/ DAVR/ Miscellaneous Equipment/ etc.** **(Note: HT switchgear already erected at site, hence payment of 1.7.3.1 will be clubbed and release along with 1.7.3.2 for HT Switchgear)**	
1.7.3.1	Placement, Alignment, Grouting and coupling / interconnection where ever applicable, erection of associated accessories etc	50%
1.7.3.2	Pre-commissioning checks and tests	10%

1.7.3.3	Charging, Loop testing and commissioning	15%
1.7.3.4	System commissioning	10%
	Total =	**85%**
1.7.4	**For UPS/Battery sets/charger/Inverters**	
1.7.4.1	Checking, placement, assembly, grouting, mounting and wiring of loose components	50%
1.7.4.2	Adjustment, alignment, inter connections and pouring of Alkali	20%
1.7.4.3	Pre-commissioning test checks and making ready for energization	15%
	Total =	**85%**
1.7.5	**For DCS/MMI/PLC system and all types of control panels including MMIPIS(DCS) Related Instrumentation**	
1.7.5.1	Placement, assembly, fixing and clamping adjustment, alignment, grouting and electrical interconnections on prorata basis	65%
1.7.5.2	Pre-commissioning tests, checks and making ready for energization on prorata basis	10%
1.7.5.3	Completion of Commissioning	10%
	Total =	**85%**
1.7.6	**For Junction box/Push button station (Local/Remote)**	
1.7.6.1	Erection including fixing of terminal blocks where ever applicable	75%
1.7.6.2	Name plate fixing where ever applicable and labelling (inside and outside)	10%
	Total =	**85%**
1.7.7	**For all type of Instruments including Analyzers, Power Cylinders/Actuators, etc.**	
1.7.7.1	Assembly, checking, calibration, fixing and clamping Adjustment, Alignment, on prorata basis	60%
1.7.7.2	Pre-commissioning tests, checks and making ready for energization pro rata basis	15%
1.7.7.3	Completion of commissioning	10%
	Total =	**85%**
1.7.12	**LT & HT Power and Control Cables laying including Earth wires**	
1.7.12.1	Laying of cables / Wires	45%
1.7.12.2	Tagging, Glanding and termination (except HT terminations)	15%
1.7.12.3	Testing and charging	10%
1.7.12.4	Dressing and clamping	15%
	Total =	**85%**

1.7.13	**For all kind of Instrumentation Cables including CAT/ETHERNET/Digital/OFC/OLHS/SIGNAL laying with Earth wires**	
1.7.13.1	Laying/tagging/glanding/termination of cables / Wires	65%
1.7.13.2	Checking, Dressing and Clamping	10%
1.7.13.3	Loop Checking and Commissioning	10%
	Total =	**85%**
1.7.14	**Cable tray and accessories**	
1.7.14.1	Fabrication and fixing / welding / bolting in position	60%
1.7.14.2	Earthing of cable trays	15%
1.7.14.3	Tagging of cable trays (including covering, touch up painting & cable tray numbering on sides)	10%
	Total =	**85%**
1.7.15	**Earthing / Lightning protection strips, Earth pits (All kind of Earthing)**	
1.7.15.1	Fabrication, erection, alignment, welding / bolting of earthing / lightning protection strips; earth pits Completion	60%
1.7.15.2	Testing / commissioning	25%
	Total =	**85%**
1.7.16	**For Impulse Pipes**	
1.7.16.1	On laying and/or welding	50%
1.7.16.2	On clamping and/or painting	20%
1.7.16.3	System Charging	15%
	Total =	**85%**
1.7.17	**GI/PVC/HDPE Conduits, fittings & wires**	
1.7.17.1	Fixing of conduits with fittings	60%
1.7.17.2	Pulling of Wires/Cables/Earth wires	25%
	Total=	**85%**
1.7.18	**Misc. Structural steel works for Panel Supports, Cable tray supports, Local Instrument Rack, Local Instrument Enclosure, Local Gauge Board, Junction Boxes, Local Start/Stop Push Button Stations, Canopies, Conduits, pipes & tubes supports etc.**	
1.7.18.1	Fabrication / Pre-assembly and applying primer paint	45%
1.7.18.2	Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	40%
	Total =	**85%**
1.7.19	**Testing / Commissioning of Equipment (like LT/HT motors, actuators, skid, instruments, Misc equipment, etc) erected by other agencies.**	

1.7.19.1	Local testing including removal, calibration and refixing	40%
1.7.19.2	Remote testing, Loop testing, and commissioning	40%
1.7.19.3	Final completion of the system along with customer handing over protocols	5%
	Total =	**85%**
1.7.20	Other items (Misc Item) – Wireless communication, C&I lab, firefighting, water treatment packages, etc.	
1.7.20.1	Completion of work (erection, alignment & testing) of the respective item/equipment	75%
1.7.20.2	Completion of Commissioning of the respective item/equipment -on pro rata basis.	10%
	Total =	**85%**
1.7.21	**For Supply Items (If applicable)**	
1.7.21.1	On submission of running bill along with the Stores Receipt /Voucher/Stores endorsement issued by BHEL on prorata basis	85%
	Total =	**85%**
1.7.22	**Other items**	
1.7.22.1	Rubber mats / Display Boards / Miscellaneous items / etc : on installation	85%
1.7.22.2	Specialized Commissioning Services - on pro rata basis.	85%
1.7.22.3	Civil Works / structural works - On completion of actual work-on pro rata basis.	85%
1.7.22.4	Earthing of steel columns of FGD Structures and any other structure columns	85%
1.7.22.5	Termination, HT Termination, Straight through jointing etc : on pro rata basis	85%
	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 1.7.23 of the following table.	
1.7.23	**STAGE / MILESTONE PAYMENTS (15%)**	**% of unit rate**
1.7.23.1	On receipt of certificate from Electrical inspector for energising equipment (Full system)	1%
1.7.23.2	Completion of Trial run of Slurry pumps	1%
1.7.23.3	Trial run of Wet ball mills	1%
1.7.23.4	Trial run of Booster Fans	1%
1.7.23.5	Trial run of Oxidation Blower	1%
1.7.23.6	Trial run of FGD System	2%
1.7.23.7	Trial Operation of Unit	2%

1.7.23.8	Painting	1%
1.7.23.9	Area cleaning, temporary structures cutting/removal and return of scrap	1%
1.7.23.10	Punch List points/pending points liquidation	1%
1.7.23.11	Submission of 'As Built Drawings'	1%
1.7.23.12	Material Reconciliation	1%
1.7.23.13	Completion of Contractual Obligation	1%
	Total for Stage / Milestone Payments (15%)	**15%**

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

1.9.0.0 ELECTRICAL & C&I - BILL OF QUANTITY (BOQ)

Sl No.	Description	Qty	UOM
A	**SCOPE OF SUPPLY FROM BHEL BHOPAL**		
A.1.1	**11 KV SWITCHGEAR**		
A.1.1.1	11 KV, 19 Panel Unit Switchboard (0BC), 1250 A, Indoor, Metal Clad (VM-12) type, Vaccum Break Switch, incomer-outgoing feeders with Bus PT along with associated loose supplied items, insulating mats; SWBD consists of 19 panels of suitable 10 shipping sections. Overall panel sizes 15360 (L) x 2349 (D) x 2846 (H). Approximate weight of shipping sections for one panel shipping section - 1500 Kg. & two panel shipping section - 2500 Kg. (HT panels are already erected at site. Only testing and commissioning of HT panels are in the scope of the bidder)	**1**	**Set**
A.1.2	**6.6 KV SWITCHGEAR**		
A.1.2.1	6.6 KV, 16 Panel Unit FGD Switchboard (0CA),1000 A Indoor, Metal Clad (VM-12) type, Vaccum Break Switch, incomer-outgoing feeders with Bus PT along with associated loose supplied items , insulating mats; SWBD consists of 16 panels of suitable 9 shipping sections. Overall panel sizes 12900 (L) x 2927 (D) x 2846 (H). Approximate weight of shipping sections for one panel shipping section - 1250 Kg. & two panel shipping section - 2500 Kg. (HT panels are already erected at site. Only testing and commissioning of HT panels are in the scope of the bidder)	**1**	**Set**
A.2	**Earthing Breaker for 11 KV Switchgear**		
A.2.1	Feeder/ Busbar Earthing Breaker Truck suitable upto 1250A	**2**	**Set**
A.3	**Earthing Breaker for 6.6 KV Switchgear**		
A.3.1	Feeder/ Busbar Earthing Breaker Truck suitable upto 1000A	**2**	**Set**
A.4	**Set of Networking system, One set comprises of following Items:**		
A.4.1	Data Concentrator Panel along with loose items: Size 800mm(L) x800mm(D) x 2300mm(H) approx. weight 200kg. Loose items of data concentrator system - HMI OWS / EWS computer with monitor - 2 nos, DAU (Data Acquisition Unit Assembling of loose supply items: Laptop PC - 2 Nos for Prot. Relay parameterisation - 1 No, computer table, chairs, UPS,	**1**	**Set**

	Ethernet switches - 4 Nos, connecting cables, Printer, GPS antenna along with cables, GPS clock etc.		
A.4.2	Cat 5e/6 cable	**3000**	**Mtrs**
A.4.3	FO Cable includes fixing of fibre optic components and termination kits LIU, face plates, cabinets, SC coupler, grounding etc	**5000**	**Mtrs**
A.4.4	Splicing of OFC	**16**	**Nos.**
A.5	**Checking and commissioning of the following erected by Mechanical agency**		
A.5.1	11 KV HT Motors	**6**	**Nos.**
A.5.2	6.6 KV Motors	**6**	**Nos.**
C	**SCOPE OF SUPPLY FROM BHEL JHANSI**		
C.1	6.3 MVA, 11/6.9KV FGD Auxiliary Transformer 3 phase ONAN cooled, Dyn11, FGD Aux. Transformer, (0CAT01,0CAT02), Outdoor with OFF Load Tap Changers (OCTC) *HV/* LV/LVN post insulators, neutral bushings, bushing CTs, Turrets, Conservator tank, Buchholtz relay, breather & connected pipelines, Cooler control cabinet, common control kiosk, Piping, radiator bank, Marshalling box, valves, instruments and all accessories. Approximate Dimensions of each transformer (L x B x H): Overall Dimensions: 6400(L) x5210(B) x 5200(H). Shipping Dimension of Largest package: 3950(L) x 2200(B) x 2900(H) approx weight : 18500 Kg Weight of core and winding assembly- 9000 kg approx.; Weight of tank and fittings (including radiators), bushing, marshalling box, pipe work with supports, pump, conservator & coolers – 10000 kg approx.; Total weight of the package-25500 kg approx.; Insulating Oil Qty - 7700 Ltrs.approx. (6500 Kg) * Please refer TCC for scope and other details. Lump sum rate to be quoted for Erection, Testing, Commissioning including final painting.	**2**	**Set**
C.2	2500 KVA 11/0.433 KV 3 phase, AN cooled/ Dyn11, Cast Resin Dry Type FGD Service Transformer (0DGT01,0DGT02), (0DFT01,0DFT02)), Indoor with HV/LV/LVN Bushings, Off Circuit Bolted links type of Tap Changers, Marshalling box; Approximate Shipping Dimensions (+/- 100 mm tolerance): 3000(L) x 2115(B) x 3100(H) Weight of Shipment:8000 kg approx. each.	**4**	**Set**

	Core coil assy - 7000 Kg approx. Enclosure - 1000 Kg Approx.		
C.3	2000 KVA 11/0.433 KV 3 phase, AN cooled/ Dyn11, Cast Resin Dry Type FGD Aux Service Transformer (0DET01,0DET02), Indoor with HV/LV/LVN Bushings, Off Circuit Bolted links type of Tap Changers, Marshalling box; Approximate Shipping Dimensions (+/- 100 mm tolerance) : 2800(L) x2165(B) x2750(H) Weight of Shipment:7000 kg approx. each.	**2**	**Set**
D	**SCOPE OF SUPPLY FROM BHEL RUDRAPUR**		
D.1	11 /6.6 KV-1000 A (FGD Auxiliary Trfr.) SPBD BUSDUCT, SIZE - 3.15tk x 400 mm (height) x 1200 mm (width) x 3720 mm (length) for standard size, approx. weight 100 kg/mtrs, Conductor size - Channel (1 x 101.6 x 41.8 x 6.68 tk) mm and includes seal off bushing, Neoprene rubber gaskets, support steel structure, space heaters, grounding. (BD-01 INCOMER FROM FGD AUX. TRFR. -11/6.6 kV FGD AUX. to SWBD-OCAT01(PANEL No. - 01) & BD-02 INCOMER FROM FGD AUX. TRFR. -11/ 6.6 kV FGD AUX. SWBD-OCAT02 to (PANEL No. - 11) Total weight of support Structure for SPBD: 10 MT(Approx.) including grounding flat	**25**	**Mtrs**
E	**SCOPE OF SUPPLY FROM BHEL PEM**		
E.1	11 KV Neutral Ground Resistor (NGR) with NGR Cubicle of size 1.42(L) X 1.11(W) X 2.095(H) of weight approx. 600 kg and with Supporting Structures 250 kg	**1**	**Set**
E.2	6.6 KV Neutral Ground Resistor (NGR) with NGR Cubicle of size 0.83(L) X 1.05(W) X 1.99(H) of weight approx. 450 kg and with Supporting Structures approx. 220 kg	**2**	**Set**
E.3	220V-200 AH Battery (High Discharge Lead Acid Plante Battery) comprising a bank of 108 cells, Dimensions of each cell 0.362(L) X 0.203(W) X 0.426(H) , Overall dimensions 1.677(L) X 0.610(W) X 0.915(H) in Mtrs., weight of each cell with acid - 58.4 Kg	**2**	**Set**
E.4	Float cum Boost Charger 220V /150A SMPS, of dimensions 0.8(L) X 0.80(D) X 2.1(H) in Mtrs for each charger - Weight-700 Kg / charger along with a. Discharge Resistor Panel 0.60 (L) X 1.50(W) X 1.1(H) in Mtrs - Weight - 100 Kg (1 No) b. Cell Booster Panel of 0.60(L) X 0.60(W) X 0.80(H) in Mtrs - Weight - 70 Kg (1 No)	**3**	**Nos.**

E.5	**LAYING OF 11KV, 1100V, MULTI STRD. AL/CU COND. XLPE INSULATION, HRPVC (ST-2) INNER SHEATH, GALVANISED SINGLE ROUND STEEL / STRIP H4 Grade Aluminium WIRE ARMOR FOR TWIN AND MULTICORE CABLES (ALUMINIUM ROUND WIRE FOR SINGLE CORE CABLES) & HRPVC(ST-2) FRLS OUTER SHEATH. Unearthed grade POWER CABLE**		
E.5.1	11 KV 1C x 630 Sq.mm (AL)	**8000**	**Mtrs**
E.5.2	11 KV 1C x 240 Sq.mm (AL)	**2000**	**Mtrs**
E.5.3	11 KV 3C x 240 Sq.mm (AL)	**500**	**Mtrs**
E.6	**LAYING OF 6.6KV, 1100V, MULTI STRD. AL/CU COND. XLPE INSULATION, HRPVC (ST-2) INNER SHEATH, GALVANISED SINGLE ROUND STEEL / STRIP H4 Grade Aluminium WIRE ARMOR FOR TWIN AND MULTICORE CABLES (ALUMINIUM ROUND WIRE FOR SINGLE CORE CABLES) & HRPVC(ST-2) FRLS OUTER SHEATH. Unearthed grade POWER CABLE**		
E.6.1	6.6 KV 1CX240 Sq.mm (AL)	**3000**	**Mtrs**
E.6.2	6.6 KV 3CX185 Sq.mm (AL)	**2000**	**Mtrs**
E.7	**Cable termination kits for 11/11 KV (UE) GRADE, XLPE Insulated aluminium conductor armoured cables for the following sizes.**		
E.7.1	Termination Kit (XLPE) 11 KV 1C-630 Sq.mm Al Arm Al lug	**35**	**Nos.**
E.7.2	Termination Kit (XLPE) 11 KV 1C-240 Sq.mm Al Arm Al lug	**18**	**Nos.**
E.7.3	Termination Kit (XLPE) 11 KV 3C-240 Sq.mm Al Arm Al lug	**15**	**Nos.**
E.8	**Cable termination kits for 6.6 KV (UE) GRADE, XLPE Insulated aluminium conductor armoured cables for the following sizes.**		
E.8.1	Termination Kit (XLPE) 6.6 KV 3C-185 Sq.mm Al Arm Al lug	**16**	**Nos.**
E.8.2	Termination Kit (XLPE) 6.6 KV 1C-240 Sq.mm Al Arm Al lug	**38**	**Nos.**
E.9	**Cable straight through joint kits for 11/11 KV (UE) GRADE, XLPE Insulated aluminium conductor armoured cables for the following sizes.**		
E.9.1	Jointing Kit (XLPE) 11 KV 1C-630 Sq.mm Al Arm	**10**	**Nos.**
E.10	**Lightning Protection Materials**		
E.10.1	GS FLAT 25 mm X 6 mm	**850**	**Mtrs**
E.10.2	GS FLAT 50 mm X 6 mm	**425**	**Mtrs**
E.10.3	GS FLAT 75 mm X 10 mm	**170**	**Mtrs**
E.10.4	GI WIRE 16 SWG	**35000**	**Mtrs**

E.10.5	GS Rod 20 mm dia LONG 1000 mm vertical air termination, Test links (150 x 75 x 10)	**40**	**Set**
E.11	**Below Grounding Earthing**		
E.11.1	40 MM Dia MS rod	**40**	**Mtrs**
E.12	**Gypsum dewatering Sytem**		
E.12.1	Level Transmitter-Ultrasonic / Radar	**6**	**Nos.**
E.12.2	Magnetic Flow Transmitter	**3**	**Nos.**
E.12.3	Pressure Gauge (Bourdon Tube)	**10**	**Nos.**
E.12.4	Pressure Gauge (Diaphragm seal)	**2**	**Nos.**
E.12.5	Pressure Transmitter (SMART) - Diaphragm Seal	**7**	**Nos.**
E.12.6	RTDs for Vacuum Pumps	**3**	**Nos.**
E.12.7	Pull cord Switches	**4**	**Nos.**
E.12.8	Limit Switches	**12**	**Nos.**
E.12.9	**Weather Proof Junction Boxes**	**25**	**Nos.**
E.13	**ERECTION AND TESTING OF IMPULSE PIPES CS / AS / SS, INSTRUMENT VALVES AND FITTINGS**		
E.13.1	PIPE, SMLS, XS, PE, ASTM A 106 GR. B – 15-25NB	**40**	**Mtrs**
E.13.2	Valve manifold	**16**	**Nos.**
E.14	**MISCELLENEOUS ITEMS**		
E.14.1	Treated Earth pit (Electronic) of 40 NB Gal.MS pipe 3000 M long with accessories including all civil works excavation, filling of earth pit with alternate layer of charcoal & 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. If desired resistivity is not achieved then Bentonite mix to be used by the contractor. Supply of Bentonite mix is in the scope of bidder.	**2**	**Nos.**
E.14.2	Treated Earth pit (Electrical) of 40 NB Gal.MS pipe 3000 M with accessories including all civil works excavation, filling of earth pit with alternate layer of charcoal & 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. If desired resistivity is not achieved then Bentonite mix to be used by the contractor. Supply of Bentonite mix is in the scope of bidder.	**8**	**Nos.**

F	SCOPE OF SUPPLY FROM BHEL RANIPET		
F.1.0	**LAYING OF 1100V, MULTI STRD. AL/CU COND. XLPE INSULATION, HRPVC (ST-2) INNER SHEATH, GALVANISED SINGLE ROUND STEEL / STRIP WIRE ARMOR FOR TWIN AND MULTICORE CABLES (ALUMINIUM ROUND WIRE FOR SINGLE CORE CABLES) & HRPVC(ST-2) FRLS OUTER SHEATH. POWER CABLE**		
F.1.1	1C X 35 Sqmm (Cu)	**3500**	**Mtrs**
F.1.2	1C X 120 Sqmm (Al)	**1000**	**Mtrs**
F.1.3	1C X 400 Sqmm (Al)	**1000**	**Mtrs**
F.1.4	1C X 630 Sqmm (Al)	**1500**	**Mtrs**
F.1.5	2C X 6 Sqmm (Cu)	**6000**	**Mtrs**
F.1.6	2C X 10 Sqmm (Al)	**500**	**Mtrs**
F.1.7	2C X 16 Sqmm (Al)	**3500**	**Mtrs**
F.1.8	2C X 25 Sqmm (Al)	**1000**	**Mtrs**
F.1.9	2C X 95 Sqmm (Al)	**1500**	**Mtrs**
F.1.10	3C X 10 Sqmm (Al)	**12500**	**Mtrs**
F.1.11	3C X 25 Sqmm (Al)	**21500**	**Mtrs**
F.1.12	3C X 35 Sqmm (Al)	**2000**	**Mtrs**
F.1.13	3C X 50 Sqmm (Al)	**11000**	**Mtrs**
F.1.14	3C X 95 Sqmm (Al)	**9000**	**Mtrs**
F.1.15	3C X 185 Sqmm (Al)	**1500**	**Mtrs**
F.1.16	3C X 240 Sqmm (Al)	**2500**	**Mtrs**
F.1.17	3.5C X 25 Sqmm (Al)	**1000**	**Mtrs**
F.1.18	3.5C X 50 Sqmm (Al)	**5500**	**Mtrs**
F.1.19	3.5C X 95 Sqmm (Al)	**500**	**Mtrs**
F.1.20	4C X 10 Sqmm (Al)	**1500**	**Mtrs**
F.2.0	**TERMINATION OF POWER CABLES**		
F.2.1	1C X 35 Sqmm (Cu)	**24**	**Nos.**
F.2.2	1C X 120 Sqmm (Al)	**8**	**Nos.**
F.2.3	1C X 400 Sqmm (Al)	**8**	**Nos.**
F.2.4	1C X 630 Sqmm (Al)	**10**	**Nos.**
F.2.5	2C X 6 Sqmm (Cu)	**40**	**Nos.**
F.2.6	2C X 10 Sqmm (Al)	**4**	**Nos.**
F.2.7	2C X 16 Sqmm (Al)	**24**	**Nos.**
F.2.8	2C X 25 Sqmm (Al)	**8**	**Nos.**
F.2.9	2C X 95 Sqmm (Al)	**10**	**Nos.**
F.2.10	3C X 10 Sqmm (Al)	**84**	**Nos.**

F.2.11	3C X 25 Sqmm (Al)	**144**	**Nos.**
F.2.12	3C X 35 Sqmm (Al)	**14**	**Nos.**
F.2.13	3C X 50 Sqmm (Al)	**74**	**Nos.**
F.2.14	3C X 95 Sqmm (Al)	**60**	**Nos.**
F.2.15	3C X 185 Sqmm (Al)	**10**	**Nos.**
F.2.16	3C X 240 Sqmm (Al)	**18**	**Nos.**
F.2.17	3.5C X 25 Sqmm (Al)	**8**	**Nos.**
F.2.18	3.5C X 50 Sqmm (Al)	**38**	**Nos.**
F.2.19	3.5C X 95 Sqmm (Al)	**4**	**Nos.**
F.2.20	4C X 10 Sqmm (Al)	**10**	**Nos.**
F.3.0	**LAYING AND TERMINATION OF 1100V, MULTI STRD. AL/CU COND. XLPE INSULATION, HRPVC (ST-2) INNER SHEATH, GALVANISED SINGLE ROUND STEEL / STRIP WIRE ARMOR FOR TWIN AND MULTICORE CABLES (ALUMINIUM ROUND WIRE FOR SINGLE CORE CABLES) & HRPVC(ST-2) FRLS OUTER SHEATH. POWER CABLE**		
F.3.1	2C X 2.5 Sqmm (Cu)	**49000**	**Mtrs**
F.3.2	3C X 2.5 Sqmm (Cu)	**98000**	**Mtrs**
F.4.0	**LAYING AND TERMINATION OF1100V, MUL STR ANN.PLAIN CU COND. HRPVC INSULATION, FRLS HRPVC(ST-2) INNERSHEATH, GAL. SINGLE ROUND STEEL WIRE / STRIP ARMORED, EXT FRLS HRPVC OUTERSHEATH CONTROL CABLE**		
F.4.1	3C X 2.5 Sqmm (Cu)	**24000**	**Mtrs**
F.4.2	5C X 2.5 Sqmm (Cu)	**4000**	**Mtrs**
F.4.3	7C X 2.5 Sqmm (Cu)	**42000**	**Mtrs**
F.4.4	10C X 2.5 Sqmm (Cu)	**5000**	**Mtrs**
F.4.5	12C X 2.5 Sqmm (Cu)	**7000**	**Mtrs**
F.4.6	16C X 2.5 Sqmm (Cu)	**6000**	**Mtrs**
F.4.7	19C X 2.5 Sqmm (Cu)	**7000**	**Mtrs**
F.5.0	**LAYING OF 1100V, MUL STR ANN.PLAIN CU COND. HRPVC INSUL., FRLS HRPVC(ST-2) INNERSHEATH, GI. SINGLE ROUND STEEL WIRE / STRIP ARM., EXT FRLS HRPVC(ST-2) FRLSH OUTERSHEATH CONTROL CABLE**		
F.5.1	5C X 4.0 Sqmm (Cu)	**3000**	**Mtrs**
F.6.0	**TERMINATION OF 1100V, MUL STR ANN.PLAIN CU COND. HRPVC INSUL., FRLS HRPVC(ST-2) INNERSHEATH, GI. SINGLE ROUND STEEL WIRE / STRIP ARM., EXT FRLS HRPVC(ST-2) FRLSH OUTERSHEATH CONTROL CABLE**		
F.6.1	5C X 4.0 Sqmm (Cu)	**20**	**Nos.**

F.7.0	**LAYING AND TERMINATION OF STRANDED ANNEALED TINNED COPPER CONDUCTOR, HRPVC TYPE C INSULATION, EXTRUDED FRLS HRPVC TYPE ST2 INNERSHEATH, GI WIRE / STRIP ARMOURED AND EXTRUDED FRLS HRPVC TYPE ST2 INSTRUMENTATION CABLE**		
F.7.1	2P X 0.5 Sq.mm (G-Type)	**2500**	**Mtrs**
F.7.2	4P X 0.5 Sq.mm (G-Type)	**58500**	**Mtrs**
F.7.3	8P X 0.5 Sq.mm (G-Type)	**64000**	**Mtrs**
F.7.4	12P X 0.5 Sq.mm (G-Type)	**1500**	**Mtrs**
F.7.5	2P X 0.5 Sq.mm (F-Type)	**15500**	**Mtrs**
F.7.6	4P X 0.5 Sq.mm (F-Type)	**37500**	**Mtrs**
F.7.7	8P X 0.5 Sq.mm (F-Type)	**15000**	**Mtrs**
F.7.8	12P X 0.5 Sq.mm (F-Type)	**6500**	**Mtrs**
F.8.0	**CABLE TRAY AND ACCESSORIES (Trays- Ladder/ Perforated type including accessories Tee, Reducer, Bend, Horizontal, Vertical, Cover, Trough etc.**		
F.8.1	50 mm wide, 25 mm height, 2 mm thick perforated type trays with accessories	**125**	**Mtrs**
F.8.2	100 mm wide, 25 mm height perforated type trays with accessories	**313**	**Mtrs**
F.8.3	150 mm wide, 2 mm thick ladder type trays with accessories	**2750**	**Mtrs**
F.8.4	150 mm wide, 2 mm thick perforated type trays with accessories	**2200**	**Mtrs**
F.8.5	300 mm wide, 2 mm thick ladder type trays with accessories	**1250**	**Mtrs**
F.8.6	300 mm wide, 2 mm thick perforated type trays with accessories	**650**	**Mtrs**
F.8.7	600 mm wide, 2 mm thick ladder type trays with accessories	**8300**	**Mtrs**
F.8.8	600 mm wide, 2 mm thick perforated type trays with accessories	**4550**	**Mtrs**
F.9.0	**Structural Steel : Cable tray supports**		
F.9.1	CHANNELS, ANGLES, CLAMPS etc	**30**	**MT**
F.10.0	**Earthing Systems**		
F.10.1	GS FLAT 65 mm X 8mm	**5100**	**Mtrs**
F.10.2	GS FLAT 50 mm X 6mm	**2300**	**Mtrs**
F.10.3	GS FLAT 30 mm X 5mm	**2100**	**Mtrs**
F.10.4	GS FLAT 25 mm X 3mm	**3500**	**Mtrs**
F.10.5	FLEXIBLE COPPER BRAID FOR GATE EARTHING	**3**	**Nos.**
F.10.6	G.S. WIRE 8 SWG	**58253**	**Mtrs**

F.11.0	**Checking and commissioning of the following erected by Mechanical agency**		
F.11.1	Electrical actuator for FGD outlet	**4**	**Nos.**
F.11.2	Blade Pitch Actuator	**2**	**Nos.**
F.12.0	**BOOSTER FAN items - Actuator/APT**		
F.12.1	Electrical Actuator - BUF Inlet / Outlet	**8**	**Nos.**
F.13.0	**GGH**		
F.13.1	Instrument control panel (1000 mmx300 mmx1300 mm)- (LXBXH)	**1**	**Nos.**
F.13.2	GGH Inverter panel (800 mm X 600 mm X1900 mm)- (LX BXH)	**1**	**Nos.**
F.14.0	**Junction box**		
F.14.1	FRP CONTROL JUNCTION BOX	**48**	**Nos.**
G	**SCOPE OF SUPPLY FROM BHEL ISG**		
G.1	**DG Set**		
G.1.1	750 KVA (e) 1500 RPM 415V 0.80 pf (lag) DG Set with Radiator on a common Base frame along with acoustic enclosure. Size of DG approx. 10 mtr x 3.5 mtr x 3 mtr (height); Over all weight of DG Set is 15 tons. Initial filling of lube oil 150 ltrs approx. and coolant oil 300 ltrs approx. DG Set shall be supplied complete with acoustic enclosure a. Fuel day tank of 990 Ltr capacity installed ground level along with fuel piping MS Fuel Pipes- 1" - 20 m length (supply + return)- over all weight 500 kg approx. 2000 Litres fuel filling from Barrels with handpumps to be done at site. b. Lead Acid type automotive Battery with connecting leads, accessories and stand etc. (4 no's battery each of 12 V ,180 AH , weight of each battery : 55 Kg ; Dimension of each battery : 521mm*278mm*270 mm c. Float cum Boost Battery charger of rating 24 V 50 A for recharging engine battery for one DG set. Weight of one charger is approx. 200 kg. MS stand for the charger to be fabricated at site. The overall dimension is approx.: L=1000 X W=500 X H=500 mm. ISMC channel to be fabricated at site for installation above trench. d. Complete Exhaust piping (MS Class 200 NB pipes, CLASS-B) including silencers, pipe supports, with bellows, flanges	**1**	**Set**

	welding, making bends and accessories, including insulation and aluminium cladding upto entire length of the pipe as per the enclosed drawing (250 mm exhaust pipe , 50 mm insulation , Al cladding) and final Painting of the same. Weight 2000 kg each approx. e. 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 2000kg approx.(Refer Layout drawing) f. Engine B-check kit (Filters) with lube oil (150 Litres) and coolant (300 Litres) to be filled at site before commissioning of DG Set. g. Installation of Phase and neutral extension terminal box for one alternator , mounting of three no's PS class Current Transformer on alternator neutral side busbars. Weight 500 kg approx. h. AMF Panel size 1500mm x 1000mm X 2300mm weight approx. 2000 kg i. Power and Control cable laying and termination between engine, alternator, DG AMF panel, battery charger, and distribution board and battery. (8px0.5 SCR Cu-20m, 12 x 2.5sq.mm Cu cable -100m,2 x 2.5Sq.mm Cu cable -50m, 7X 2.5 Sqmm Cu calbe - 50 ml. ALL PANELS ARE LOCATED INSIDE THE DG Building . REFER TO THE LAYOUT DRAWING.) j. Installation of NSPBD of length 4 meters, weight 2000 Kg with adaptor box, bellows and bottom structural support between DG set and DG AMP Panel. (Refer attached layout)		
H	**SCOPE OF SUPPLY FROM BHEL SBD**		
H.1	**415V LT SWITCHGEAR**		
H.1.1	415V LHP PMCC rating 3200A, (ODE) Approximate Overall Weight (in kg) 15300, Approximate Dimension in mm (LxDxH): 1900X1700X2450 No. of Panels: 19 & No. of Shipping Sections: 10	**1**	**Set**
H.1.2	415V FGD PMCC rating 4000A, (ODF) Approximate Overall Weight (in kg) 22800, Approximate Dimension in mm (LxDxH): 2900X1700X2450 No. of Panels: 29 & No. of Shipping Sections: 15	**1**	**Set**

H.1.3	415V FGD Emergency MCC rating 1250A, (0DG) Approximate Overall Weight (in kg) 9700, Approximate Dimension in mm (LxDxH): 11800X1700X2450 No. of Panels: 12 & No. of Shipping Sections: 6	**1**	**Set**
H.1.4	415V FGD Common PMCC rating 4000A, (ODH) Approximate Overall Weight (in kg) 21750 Approximate Dimension in mm (LxDxH): 26700X1700X2450 No. of Panels: 27 & No. of Shipping Sections: 14	**1**	**Set**
H.1.5	415V AC /Ventilation MCC rating 630A, (OSA) Approximate Overall Weight (in kg) 14250, Approximate Dimension in mm (LxDxH): 17700X1700X2450 No. of Panels: 18 & No. of Shipping Sections: 9	**1**	**Set**
H.1.6	415V Compressed Air, water system MCC rating 250A, (0SB) Approximate Overall Weight (in kg) 6000, Approximate Dimension in mm (LxDxH): 8000X1700X2450 No. of Panels: 8 & No. of Shipping Sections: 4	**1**	**Set**
H.1.7	220V, Common DCDB, rating 200A (0FA), Approximate Overall Weight (in kg) 2250, Approximate Dimension in mm (LxDxH): 3000X1700X2450, No. of Panels: 3 & No. of Shipping Sections: 2	**1**	**Set**
H.1.8	Main Light Distribution Board MLDB	**1**	**Nos.**
H.1.9	Welding Distribution Board	**1**	**Nos.**
H.1.10	AC Distribution Board (ACDB)	**1**	**Nos.**
H.1.11	DC Distribution Board (DCDB)	**1**	**Nos.**
H.1.12	DC FUSE DB	**2**	**Nos.**
H.1.13	AC FUSE DB	**1**	**Nos.**
H.1.14	DC lighting board (DCLDB)	**1**	**Nos.**
H.2	**LT BUS DUCTS**		
H.2.1	NSPBD TYPE BUSDUCT 3200A, 415 V, for 415V FGD PMCC # 0DE	**24**	**Mtrs**
H.2.2	NSPBD TYPE BUSDUCT 4000A, 415 V, for 415V FGD PMCC # 0DF	**9**	**Mtrs**
H.2.3	NSPBD TYPE BUSDUCT 4000A, 415 V, for 415V FGD PMCC # 0DH	**10**	**Mtrs**
H.3	**LPBS**		
H.3.1	STOP PUSH BUTTON	**180**	**Nos.**
H.4	**LOCAL MOTOR STARTERS**		

H.4.1	LOCAL MOTOR STARTERS (0.37KW,0.55KW,0.75KW,1.1KW,1.5KW,2.2KW, 5.5KW)	**100**	**Nos.**
J	**SCOPE OF SUPPLY FROM BHEL EDN**		
J.1	**Placement, Alignment, Erection, Electrical Interconnection, Testing and Commissioning of Valmet DNA DDCMIS AND CONTROL BOARDS**		
J.1.1	Suite of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg- CBA21-23, CBA24-26, CBA27-29, CBA30-32, CBA41-43, CBA44-46, CBA47-49, CBA51-53, CRA54-56, CBA57-59, CJU01-03	**11**	**Set**
J.1.2	Suite of four Cubicles Size: 3000 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1600 kg- CBA01-04, CBA05-08, CBA09-12	**3**	**Set**
J.2	**Erection, Testing & Commissioning of Supporting Panels**		
J.2.1	NETWORK PANEL COMMON (SUITE: CNP21) Size: 750 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 400 kg	**1**	**Nos.**
J.2.2	RELAY PANEL- 750 mm(W) X 800 mm(D) x 2117 mm(H) approx. CTE01, CTE02, CTE03, CTE04, CTE05 Approx. weight 400 kg	**5**	**Nos.**
J.3	**Erection of UPS with ACDB**		
J.3.1	2 X55 KVA UPS parallel redundant comprising of the following: UPS-1, UPS 2, SCVS Panels comprising of Rectifier, Inverter, Input and output Iso. Transformer. Approx. Overall size 3000 mm (L) x 1000 mm(W) x 2120 mm(H) and other accessories like Battery tie breaker, Battery Breaker Box, etc.	**1**	**Set**
J.3.2	ACDB: over all approx. size 1300mm(L) x 700 mm(D) x 1950 mm(H) mm;	**4**	**Nos.**
J.3.3	BHMS approx. size 600mm(W) x 400mm(D) x 1500 (H)mm	**1**	**Nos.**
J.3.4	**IP BASED EPABX SYSTEM (PLANT TELEPHONE SYSTEM) Erection by PSSR. Commissioning by OEM**		
J.3.4.1	Network Panel	**1**	**Nos.**
J.3.4.2	FCBC with 48v Ni-Cd battery bank of min 100 ah rating	**1**	**Nos.**
J.3.4.3	MDF, Connector Blocks and accessories for 150 extensions	**1**	**SET**
J.3.4.4	Analog Desktop Telephone Set	**50**	**Nos.**
J.3.4.5	SIP IP telephones	**2**	**Nos.**
J.3.4.6	Chief/Secretary phone	**2**	**Nos.**
J.3.4.7	PVC conduits and casing	**3200**	**Mtrs**
J.3.4.8	PVC telephone cable	**4000**	**Mtrs**
J.3.4.9	Jelly filled cable	**3500**	**Mtrs**

J.3.4.10	Fibre optic cable and accessories	**1500**	**Mtrs**
J.3.4.11	CAT 6 UTP cable	**1000**	**Mtrs**
J.3.4.12	3 core, 2.5 sq mm Power cable	**250**	**Mtrs**
J.3.4.13	2" GI conduit	**300**	**Mtrs**
J.3.4.14	Flexible tubes 1½"	**200**	**Mtrs**
J.3.5	UPS to Battery Size NYVIN Copper, 1C, Size0000/109Sq.mm Cable	**440**	**Mtrs**
J.3.6	UPS to ACDB Cable NYVIN Copper, 1C, Size000/84.2Sq.mm Cable	**80**	**Mtrs**
J.3.7	Modbus Cable (Cat5/Cat6 Cable)	**100**	**Mtrs**
J.3.8	UPS BATTERY: Lead Acid Plante Battery 220V/535AmpHr made up of around 110 cells, housed in racks in multi row configuration with applicable inter cell connectors, inter block connectors, inter row connectors, cell mounting insulators, with safety apparatus accessories of batteries and test measuring instruments, etc. filling of electrolyte 27.1l/cell, Corrosion Prevention Grease and SS fasteners, Each Cell dimension: 230(L) x 368(W) x 682(H). Weight / cell: 60.1 Kg. Approx. without electrolyte	**1**	**Set**
J.3.9	Termination of Cables 1C, Size 0000/109Sq.mm Cable	**4**	**Nos.**
J.3.10	Termination of Cables 1C, Size 000/84.2Sq.mm Cable	**2**	**Nos.**
J.4.0	**Erection, Testing, Calibration and Commissioning of Field Instruments**		
J.4.1	Pressure/ DP Gauges	**90**	**Nos.**
J.4.2	Pressure/ DP Switch	**8**	**Nos.**
J.4.3	Level Gauge	**1**	**Nos.**
J.4.4	Electromagnetic Flowmeters	**7**	**Nos.**
J.4.5	Temperature Elements	**46**	**Nos.**
J.4.6	Temperature Gauges	**28**	**Nos.**
J.4.7	Ultrasonic type Level Transmitter	**20**	**Nos.**
J.4.8	Radar type level transmitter	**4**	**Nos.**
J.4.9	Electronic Transmitters (Pressure, differential pressure)	**85**	**Nos.**

J.5.0	**Erection of Analysers (Erection supervision, commissioning in vendor scope)- All these analysers (except pH Analysers) are to be fixed at the probes provided at various elevation of the Chimney. Please refer TCC for elevation details and payment.**	-	-
J.5.1	Mercury Analyser	**1**	**Nos.**
J.5.2	Opacity Analyser	**1**	**Nos.**
J.5.3	pH Analyser	**3**	**Nos.**
J.5.4	Low Temperature Oxygen Analyzer	**3**	**Set**
J.5.5	Flue Gas SOx/NOx/CO/CO2 Analyzer at Chimney	**1**	**Set**
J.5.6	Flue Gas Sox/Nox Analyzer at FGD absorber/GGH Inlet	**4**	**Set**
J.5.7	Flue Gas Sox/Nox Analyzer at FGD absorber/GGH Outlet	**2**	**Set**
J.5.8	SO2 analyser- system	**1**	**Nos.**
J.5.9	**Vibration Monitoring System (VMS)**		
J.5.9.1	Installation of 3 Nos. Panel, 2 Nos of server, 1 no of printer, Installation of 74 no's of vibration sensors - sensors are brittle, to be handled with proper precautions., driver, extension cable with mounting block- Qty- 74 no's, Phase marker sensor (probe), driver, extension cable, mounting bracket- Qty-12 set. Loop checking of VMS system through Portable shaker table for (Qty) each vibration sensors. Portable shaker table will be provided by BHEL.	**1**	**Set**
J.5.10	Junction Boxes	**45**	**Nos.**
J.6	**Installation and Commissioning of HMI System**		
J.6.1	Operator Station with Monitor, Keyboard & mouse along with UPS, original software and Accessories	**3**	**Nos.**
J.6.2	Engineering Activity Station (EAS), Programmer cum documentation station, Info/ Historian / (Storage & retrieval Information / OPC Server with Monitor, Keyboard & mouse along with UPS, original software and Accessories	**3**	**Nos.**
J.6.3	A4 LaserJet (B/W) Printer	**2**	**Nos.**
J.6.4	A3 LaserJet (B/W) Printer	**2**	**Nos.**
J.6.5	A3 LaserJet (Colour) Printer	**1**	**Nos.**

J.6.6	Operator Desk (2 Section) Overall dimension 2450mm (W) x 600mm (D) x 750mm (H) including fixing of power Sockets, MCBs, ethernet switches hardware etc (along with chairs)	**1**	**Set**
J.6.7	Printer Table	**1**	**Nos.**
J.6.8	Laying of FO Cable	**4000**	**Mtrs**
J.7	**Installation of Large Video Screen**		
J.7.1	Large Video Screen (80" - 84") - 1 controller with resolution 1400 x 1050 and other loose supplied items like Video display controller, Border binder, interconnecting power & Networking /communication cables, Mounting stand 1200 mm height approx.	**1**	**Set**
J.7.2	VFD panel - 5000 KG (Length -3900 mm ; Height-2500 mm, Depth-1100 mm)	**1**	**Nos.**
J.8	**PROCESS CONNECTION AND PIPING AND ERECTION MATERIAL**		
J.8.1	Valve Manifolds	**1**	**Nos.**
J.8.2	LIE- Type -A	**2**	**Nos.**
J.8.3	LIE- Type -B (Dimensions: 1100 mm (W) X 1000mm (D) X 2200mm (H))	**5**	**Nos.**
J.8.4	LIE- Type -C (Dimensions: 800 mm (W) X 1000mm (D) X 2200mm (H))	**5**	**Nos.**
J.8.5	Stand Alone Racks (To be Fabricated at site) 1600 mm (W) X 650mm (D) X 2200mm (H))	**40**	**Nos.**
J.8.6	LIR- Type -B	**2**	**Nos.**
J.8.7	LIR- Type -C	**3**	**Nos.**
J.9	**E&C of IMPULSE PIPES, FITTINGS, MANIFOLDS AND ACCESSORIES**		
J.9.1	Impulse Pipe ASTM A106 Gr.C Size:1/2"NB Sch 80	**1600**	**Mtrs**
J.9.2	Impulse Pipe ASTM A106 Gr.C Size:3/4"NB Sch 80	**1400**	**Mtrs**
J.10	**Laying of GI conduits at a depth of 300mm including cutting, threading, fixing of sockets/ bends where required etc. complete. Both ends of GI conduits shall be closed by plastering. Payment will be made for the as erected pipe length. (excavation, backfilling, making and repairing of walls in trenches is by Civil contractor).**		
J.10.1	GI Pipe	**3000**	**Mtrs**
J.10.2	FABRICATION & ERECTION OF STRUCTURAL STEEL (Channels plates, angles etc.)	**12**	**MT**

K	SCOPE OF SUPPLY FROM BHEL HPEP		
K.1	**Erection, Testing, Calibration and Commissioning of Field Instruments**		
K.1.1	Pressure Gauge	**10**	**Nos.**
K.1.2	Diff Pressure Gauge	**2**	**Nos.**
K.1.3	Pressure Transmitter	**29**	**Nos.**
K.1.4	Diff Pressure Transmitter	**6**	**Nos.**
K.1.5	Pressure Switch	**4**	**Nos.**
K.1.6	Diff. Pressure Switch	**3**	**Nos.**
K.1.7	Density meter	**4**	**Nos.**
K.1.8	Flow Switch	**4**	**Nos.**
K.1.9	Flow Transmitter (DP / VORTEX)	**16**	**Nos.**
K.1.10	Level Transmitter - Ultrasonic	**16**	**Nos.**
K.1.11	RTD, temperature elements	**104**	**Nos.**
K.1.12	Temp. Gauge	**3**	**Nos.**
K.1.13	Temp. Transmitter	**16**	**Nos.**
K.1.14	Thermometer	**2**	**Nos.**
K.1.15	Speed switch	**2**	**Nos.**
K.1.16	Temp Switch	**4**	**Nos.**
K.1.17	Position Switch	**6**	**Nos.**
K.1.18	Limit / Proximity Switch	**9**	**Nos.**
K.1.19	Vibration Transmitter	**6**	**Nos.**
K.1.20	Vibration Switch	**16**	**Nos.**
K.1.21	Weight Transmitter	**2**	**Nos.**
K.1.22	Instrument Valve	**6**	**Nos.**
K.1.23	Exhaust Fan	**4**	**Nos.**
K.2	**Erection, Testing & Commissioning of VFD Panels**		
K.2.1	VFD of Mill Circuit Pumps-800 mm (W)x 2115 mm (H) x 600 mm (D)	**4**	**Nos.**
K.2.2	VFD of Weight Feeders600 mm (W)x 1900 mm (H) x 600 mm (D)	**2**	**Nos.**
K.3	**Commissioning of the following erected by Mechanical Contractor**		
K.3.1	6.6 KV, Motor for Oxidation blower - 300 KW	**2**	**Nos.**
K.3.2	T Unidirectional & Bidirectional drives (0.2 kW to 110 kW)	**44**	**Nos.**
K.3.3	Solenoid Valve	**34**	**Nos.**
K.3.4	Control valve	**4**	**Nos.**
K.3.5	Blow-Off valve (BOV) electrical actuator	**4**	**Nos.**

K.3.6	Motorised butterfly valve (Isolation Valve)	**2**	**Nos.**
K.3.7	Loop Checking of RTDs	**104**	**Nos.**
L	**SCOPE OF SUPPLY FROM BHEL PESD**		
L.6	**Fire Fighting and Fire Protection Systems (WBFPS, FDA, OLHS)**		
L.1.1	Fire Alarm Panel with optical fibre card (with batteries & cabinet, each panel shall have 32 Max loops) Approx. Size: 1000 X 600 X 300 (H X W X D) , Approx. weight 100 Kg	**1**	**Nos.**
L.1.2	Repeater Panels Approx. Size: 300 X 500 X 100 (H X W X D), Approx. weight 20 Kg	**1**	**Nos.**
L.1.3	Multisensor Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	**160**	**Nos.**
L.1.4	Heat Detectors with detector base and mounting back box (Analogue addressable) along with PVC cable glands	**16**	**Nos.**
L.1.5	Beam Detectors (Addressable) along with PVC cable glands	**3**	**Nos.**
L.1.6	Optical LHS Cable with erection hardwares	**6000**	**Mtrs**
L.1.7	Optical LHS Controller 6Km Range	**1**	**Nos.**
L.1.8	UPS for OLHS Controller with 48 hrs backup (2KVA) along with Batteries (Battery-100AH with Stand)	**1**	**Nos.**
L.1.9	Indoor Manual Call Points with mounting back box (Addressable type) along with PVC cable glands	**20**	**Nos.**
L.1.10	Outdoor Manual call points with mounting back box (IP-65 min.) (Addressable type) along with PVC cable glands	**40**	**Nos.**
L.1.11	Interface Modules (Input / Output)	**46**	**Nos.**
L.1.12	Indoor Hooter cum Strobe with Back Box (addressable & loop powered) with PVC cable glands	**30**	**Nos.**
L.1.13	Response Indicators	**25**	**Nos.**
L.1.14	230V AC Back-Lit Exit Sign Board with Battery Back Up	**35**	**Nos.**
L.1.15	Operator Workstation along with Commissioning software with Licence / Dongle + Graphic software with License /Dongle & 2 KVA UPS, Printer	**1**	**Set**
L.1.16	UPS with battery / 24V DC Power Supply Module	**4**	**Nos.**
L.1.17	Furniture for Operator Workstation (1no. Table + 1no. Chair)	**2**	**Set**
L.1.18	Power Cable (2C x 1.5 Sqmm)	**14000**	**Mtrs**
L.1.19	Power Cable (3C x 2.5 Sqmm) Armoured LSZH Sheathed cable Insulation Extruded XLPE	**500**	**Mtrs**
L.1.20	Fibre Optic / LAN Cable for Conveyors	**4000**	**Mtrs**
L.1.21	Splicing of OFC	**40**	**Nos.**

L.1.22	Pressure switch with hook-up matrl.	**6**	**Nos.**
L.1.23	Deluge Valve Control Panel, Solenoid Valve	**2**	**Nos.**
L.1.24	Structural Steel Angles, Channels, M Plates	**15**	**MT**

VOLUME-IA PART –I CHAPTER –X/ 01

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)

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

i) Security Deposit
ii) Unqualified Acceptance for LOI, LOA, Detailed LOI / Work Order.
iii) Rs.100/- Stamp Paper for preparation of Contract Agreement.

1.10.1.1 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.

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

1.10.1.3 PROVIDENT FUND

1.10.1.3.1 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.

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

1.10.1.4 OTHER STATUTORY REQUIREMENTS

1.10.1.4.1 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.

1.10.1.4.2 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.

1.10.1.4.3 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.

1.10.1.4.4 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.

1.10.1.4.5 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.

1.10.1.4.6 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.

1.10.1.5 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 andbinding.

1.10.1.6 Site Visit by the Bidder

1.10.1.6.1 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.

1.10.1.6.2 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.

1.10.1.6.3 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.

1.10.1.6.4 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.

1.10.1.6.5 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.

1.10.1.6.6 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.

1.10.1.6.7 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.

1.10.1.6.8 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.

1.10.1.6.9 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.

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

1.10.1.6.11 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.

1.10.1.6.12 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.

1.10.1.6.13 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.

1.10.1.6.14 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.

1.10.1.6.15 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.

1.10.1.6.16 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.

1.10.1.6.17 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.

1.10.1.6.18 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.

1.10.1.6.19 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.

1.10.1.6.20 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.

1.10.1.6.21 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. 1.10.1.6.22 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.

1.10.1.6.23 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.

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

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

1.10.1.6.26 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. 1.10.1.6.27 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.

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

1.10.1.6.29 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.

1.10.1.6.29 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.

1.10.1.6.30 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.

1.10.1.6.31 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.

1.10.1.6.32 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.

1.10.1.6.33 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.

1.10.1.6.34 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.

1.10.1.7 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.

1.10.2 SITE INSPECTION

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

1.10.2.2 BHEL / Owner 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 Owner / BHEL.

1.10.2.3 The contractor shall maintain at site a joint protocol for recording actual measurement of work carried out at site, inspection and witnessing of various tests conducted by the contractor.

1.10.2.4 Field Quality Assurance (FQA) Formats: -

It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and Owner as token of their acceptance. Payment to the contractor will be inked with the submission of these FQA log sheets.

1.10.2.5 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.

1.10.2.6 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.

1.10.2.7 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.

1.10.2.8 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 and get the work executed through other agency and debit the cost including overheads 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.

1.10.3 Comprehensive General Liability Insurance

1.10.3.1 This insurance shall protect the Bidder against all claims arising from injuries,

disabilities, disease or death of members of public or damage to property of others, due to any act or omission on the part of the Bidder, his agents, his employees, his representative and sub-contractors or from riots, strikes and civil commotion. This insurance shall cover all the liabilities of the Bidder arising out of the relevant clauses of enquiry documents.

1.10.3.2 1.10.36.2 The hazards to be covered will pertain to all the works which and areas where, the Bidder, his Sub-contractors, his agents and his employees have to perform work pursuant to the contract.

1.10.3.3 1.10.36.3 The above are only illustrative list of insurance covers normally required and it will be the responsibility of the Bidder to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the contract.

1.10.3.4 1.10.37 Liability for Accident and damage: The Contractor shall Indemnify the Purchaser against any claims which may be made under the workman's Compensation Act, 1923, or any statutory modification thereof or otherwise for or in respect of any damages under the workman's Compensation Act, 1923, or any statutory modification thereof or otherwise for or in respect of any damages or compensation payable in consequence of any accident or injury sustained by any workman or other person whether in the employment of the Contractor or not.

VOLUME-IA PART –I CHAPTER –X/ 02

GENERAL

1.10.0.0	**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).
1.10.1.0	**a. The successful bidder shall 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.100/- Stamp Paper for preparation of Contract Agreement.
1.10.1.1	**b. The successful bidder shall furnish the proof of documents for the following at PSSR- Site.** I. PF Regn No. II. Labour License No. III. Workmen Insurance Policy No.
1.10.1.2	In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II), the contractor shall comply with the following:
1.10.1.3	The Contractor shall conform to the provisions of Indian Boiler Regulation, State Government Factory Laws, Indian Electricity Act and rules made there under, and any other acts of legislature relating to the work and to the regulations and bye-laws of any national or local authority and of any water, lighting and other companies and/or authorities with whose systems the plant/structure is proposed to be connected and shall before making any variations from the drawings or specifications that may be necessitated by so conforming, giving to the Purchaser/Consultant written notice, specifying the variations proposed to be made and the reason for making if any apply for instructions thereof.
1.10.1.4	For any work involving repair & maintenance underground, the Contractor shall follow the safety procedural orders/instruction issued by BHEL Site Engineer/End User. The Contractor shall ensure supervision of such jobs by competent persons within the meaning of Factories Act & Rules or any other statutory provisions as applicable. All persons engage on such jobs shall have to have proper training instructions as required under Factories Act & Rules or any other statutory provisions as applicable.
1.10.1.5	The Contractor shall abide by the provisions of Factories Act (as applicable), State Factory Rules (as applicable), Employee Compensation Act, Payment of Wages Act, Contract Labour (Regulation) Act etc. and keep BHEL/End User indemnified of provision the above Acts and Rules.

	SCT TO INCLUDE OTHER GENERAL REQUIREMENTS
1.10.6.0	**OTHER GENERAL REQUIREMENTS:** 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.
1.10.6.1	The scope of specification covers the installation, testing and commissioning of the erected equipment / instrument along with accessories as detailed in Bill of Quantity.
1.10.6.2	Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting the equipment, aligning, fastening, supporting, cleaning, checking and carrying out statutory tests as required, trial operation, pre-commissioning, commissioning and post-commissioning activities up to the time of completion of commissioning activities and commercial / trial operation of the unit and handing over to customer or till completion of contract period (including extended period) whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.
1.10.6.3	Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc., in their possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.
1.10.6.4	It is not the intent to specify herein all details of material. Any item related to this work not covered by this document but necessary to complete the system will be deemed to have been included in the scope of the work.
1.10.6.5	The contractor shall have valid ELECTRICAL LICENCE as required to carry out the scope of work indicated in the BOQ.
1.10.6.6	All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
1.10.6.7	Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc will decide the sequence of erection/commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection/commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.

1.10.6.8	Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations and Field quality plans of BHEL.
1.10.6.9	The contractor shall co-ordinate and provide assistance for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation. Testing shall also include any additional tests, which the Engineer feels necessary because of site conditions and also to meet system specification.
1.10.6.10	During the course of erection, testing and commissioning certain rework / modification/ rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and/ or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously. Payments for such works shall be governed by Cl. No. 2.15.1 of GCC.
1.10.6.11	The work shall be executed under the usual conditions without affecting power plant construction and in conjunction with other operations and contracting agencies at site. The contractor and their personnel shall co-operate with the personnel of other agencies, co-ordinate their work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
1.10.6.12	If any item or equipment not covered but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ.
1.10.6.13	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 usage 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.
1.10.6.14	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.
1.10.6.15	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.
1.10.6.16	Contractor shall remove all scrap materials periodically generated from their working area in and around power station/work 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. All the package materials, including special transporting frames, etc., shall be returned to the BHEL stores / customer's stores by the contractor.
1.10.6.17	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. Details of the same to be produced along with the running bill.
1.10.6.18	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.
1.10.6.19	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.
1.10.6.20	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.
1.10.6.21	All the surplus, damaged, unused materials, package materials, containers, special transporting frames, gunny bags etc. shall be returned to the BHEL stores / customer's stores by the contractor.
1.10.6.22	If required by BHEL, the contractor shall change the sequence of their operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.
1.10.6.23	Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
1.10.6.24	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.

1.10.6.25	The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.
1.10.6.26	The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe/tubes, and handrails etc for any temporary supporting or scaffolding works. Contractor shall arrange themselves all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.
1.10.6.27	The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawals at the rate prescribed by manufacturing units.
1.10.6.28	No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
1.10.6.29	Contractors shall ensure that all their Staff/Employees are exposed to periodical training program conducted by qualified agencies/ personnel on ISO 9001 /2015 Standards.
1.10.6.30	For other agencies, such as piping, insulation etc., 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. 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.
1.10.6.31	The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.
1.10.6.32	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.
1.10.6.33	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 own cost. In the event of the Contractor's failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.
1.10.6.34	Prior to erection of any component's inspection is to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.

1.10.6.35	All the equipment /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erecting the same.
1.10.6.36	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 BHEL Engineer & the Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
1.10.6.37	No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the existing columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
1.10.6.38	In electrical MCC's the fixed and moving contacts in contactors & Copper strips shall be removed and kept in safe custody. The same shall be re-erected during commissioning of the system.
1.10.6.39	Whenever cable glands are supplied along with MCC'/JB's/ PB's/etc. they shall be removed and kept in safe custody. The same shall be re-erected during cable termination.
1.10.6.40	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, HT Panel & individual feeders, SP Bus duct heater JB, Transformers are to be done by the contractor as per the requirement of BHEL Engineer. The above work should be done within the quoted rate and no extra payment shall be made for the same.
1.10.6.41	All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor. There is no extra cost in this regard. Also refer the clause - ELECTRICAL INSPECTORATE'S APPROVAL below.
1.10.7.0	**ELECTRICAL INSPECTORATE'S APPROVAL**
1.10.7.1	Contractor is responsible for getting Electrical Inspectorate/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.
1.10.7.2	All electrical installation covered in contractor's scope which also includes equipment covered in commissioning assistance are to be inspected/approved by the electrical inspectorate/statutory authority. For getting electrical inspectorate approval, contractor shall arrange the following: a. Work Completion certificate for all the equipment covered in the contract

	b. Details of Equipment (specification). c. Results of tests conducted at site for all the equipment including electrical equipment erected by Mechanical contractor. d. Any other documents as required by statutory authority. Any expenditure related to documentation shall be borne by contractor.
1.10.7.3	Contractor shall carry out the modifications/rectifications, if any, as suggested by the authority at their cost. However, it is not applicable for equipment erected by Mechanical contractor.
1.10.7.4	Contractor shall also have valid electrical installation license of their company as well as for individuals, acceptable to respective state electrical inspectorate requirement.
1.10.7.5	The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at their cost. Any Expenditure related to documentation shall be borne by the contractor. Contractor shall pay all fees related to electrical inspectorate approval. However, BHEL shall reimburse all statutory fees as applicable on production of receipts.
1.10.7.6	**Any modification work required by inspector shall be attended by the contractor. Modifications which are required due to execution deficiencies, are at the cost of contractor whereas modifications which are due to design change shall be treated as extra work.**
1.10.8.0	**SITE INSPECTION**
1.10.8.1	Various Inspection / quality control / quality assurance procedures/methods at various stages of erection and commissioning will be as per BHEL / Customer quality control procedure / codes and other statutory provisions and as per BHEL Engineer's instructions.
1.10.8.2	The owner / employer or their authorized agents may inspect various stages of work during the currency of the contract awarded to them. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the BHEL. No cost whatsoever such duplication of inspection of work be entertained.
1.10.8.3	BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.

1.10.8.4	Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same.
1.10.9.0	**MANPOWER REQUIREMENT**
1.10.9.1	Manpower requirement for Erection and Commissioning shall be as follows: a. There shall be a Resident manager as Site In Charge at site, under whom there shall be sufficient area engineers who shall take care of the erection activities. b. Resident Engineer should have a minimum qualification of Electrical Engineering Degree with minimum 5 years' experience or Diploma in Electrical /Electronic engineering with minimum 10 years of experience in Thermal Power Station. c. Supervisor should have a minimum qualification of Diploma in electrical engineering or any graduate with minimum 5 years of experience in Thermal Power Station. d. Lab Technicians should have experience in Thermal Power Stations. e. Contractor should have one Store Keeper, one Transport Supervisor for the safe transportation of materials. f. Planning / safety Engineers should be available and they should have experience in construction field especially in power plant. g. Licensed supervisor-01 No. with valid HT electrical license h. HT cable jointer-01 No. should be available on 24x7 basis. i. Dedicated commissioning engineer should be deployed for commissioning of the equipment.
1.10.9.2	There shall be separate Erection In-charge each for electrical, C&I. He shall work with required manpower, T&P etc., including storage facilities.
1.10.9.3	Site In-charge shall have minimum 2 erection engineers who shall be in charge of HT/LT ELECTRICAL, C&I AND OTHER areas exclusively.
1.10.9.4	Each area engineer shall be provided with minimum One supervisor 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 Unit and the minimum requirement shall be as indicated in

	previous Clause. Besides, there shall be separate engineers for Planning, Safety and Quality.
1.10.9.5	The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor.
1.10.9.6	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.
1.10.9.6	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.
1.10.9.7	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.
1.10.9.8	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 to suffer delay on this account.
1.10.9.9	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.
1.10.9.10	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.
1.10.9.11	The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer or delay on that account.
1.10.10.0	**DOCUMENTATION**
1.10.10.1	The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval.

	a. Bar chart covering planned activities at site b. Detailed organization chart c. Details of T&P available with contractors with documents proofs.
1.10.10.2	The following information shall be furnished by the bidder after testing and inspection: Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan. **As built drawings:** After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.
1.10.10.3	VOLUME-IA PART- II CHAPTER -4 of this booklet contains general guidelines for Erection and Commissioning of this package.

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

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

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

1.11.1.0	FOUNDATIONS, GROUTING AND CIVIL WORKS
1.11.1.1	Foundation for the equipment to be erected shall be provided by BHEL/ clients of BHEL except for the items/equipment specifically mentioned elsewhere in the tender. 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. Minor adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipment and 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. If required, special cement like conbextra, GP1, GP2, PAGAL, shrinkomp etc., or its equivalent as approved by BHEL, shall be arranged by the contractor at their cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.
1.11.1.4	It shall be contractor's responsibility to check the foundations of various equipment for the 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 other minor modifications 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. including the fine aggregates are to be arranged by the contractor.
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	Removal of gravel, if gravelling is done, for connection of Equipment earthing strip to the existing mat (wherever earthing mat is already laid), and after completion of earthing, placing the gravel to bring it to original shape, is in contractor's scope.
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.)

1.12.1.0	**COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS**
1.12.1.1	BHEL shall issue materials covered in BHEL scope from their stores at site. The contractor shall collect such materials from BHEL stores and transport to site of work at their cost.
1.12.1.2	The contractor shall inspect such materials as soon as received by the contractor and shall bring to the attention of the Engineer-in-Charge any shortage / damage or other defects noticed before taking over the materials. Materials once taken over will be deemed to have been received in good condition and in correct quantities except for intrinsic defects which cannot be observed by visual and dimensional inspection and weighing.
1.12.1.3	Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.
1.12.1.4	All materials issued by BHEL shall be properly stored and systematic records of receipts, issue and disposal will be maintained. Periodic inventory shall be made available to BHEL Engineer-in-Charge.
1.12.1.5	All materials issued by BHEL shall be utilized as directed by Engineer-in-Charge or most economically in the absence of such direction. The contractor shall be responsible for the return of all surplus material to BHEL Stores, 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.
1.12.2.0	**STORAGE**
1.12.2.1	Materials shall be stacked neatly, preserved and stored in the contractor's shed/ work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area/ site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
1.12.2.2	The equipment should be preferably in its original package and should not be unpacked until it absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.
1.12.2.3	The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinking 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 or regenerated when de-colorization takes place. 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 risk and 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 is to be repacked after inspection
1.12.2.11	**Sub-Assemblies:** a. All sub-assemblies should be kept in a separate place where it is easily accessible. b. Sub-assemblies should have a protective cover in case it is stored without wooden packing / case to prevent accumulation of dust. Silica gel packets should also be kept along with it. c. Sub-assemblies should not be stacked one above the other.
1.12.2.12	**Loose items (wherever applicable):** The loose items supplied for the main equipment fall 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. and are to be categorized accordingly and stored separately with proper identification.
1.12.2.13	Sometimes it may become necessary for the contractor to handle certain unrequired components at Customer's / BHEL's stores in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
1.12.2.14	The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components at site.
1.12.2.15	Contractor at their own cost has to arrange required fire resistant tarpaulins to protect the machined components / assembled parts drawn from BHEL, before and after erection.
1.12.2.16	The contractor shall take delivery of item, materials and consumables from the storage yard / stores / sheds of BHEL / customer which are within a radius of 5 km, after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer. He shall also make arrangements for safe custody, watch and ward of equipment after it has been handed over to them till they are fully erected, tested and commissioned.

1.12.2.17	Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment, placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment from customer stores / storage yard also. Contractor's Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators, Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.
1.12.2.18	The equipment / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer, so as to avoid damage / loss of such equipment at site.

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

1.13.0	**SCOPE OF WORKS- DETAILED**
1.13.1	**TRANSFORMERS:** Different types of transformers like oil immersed or dry type shall be supplied: Refer BOQ and reference drawings for more details.
1.13.1.1	**FGD TRANSFORMER:** 50/40 MVA, 400/11.5 kV 3 phase ONAN/ONAF cooled, YNyn0, Outdoor with On Load Tap Changers (OLTC)HV/LV post insulators, neutral bushings, bushing CTs, Turrets, Conservator tank, Buchholtz relay, breather & connected pipelines, Cooler control cabinet, common control kiosk, Piping, radiator bank, Marshalling box, valves, fan motors, oil pump motors, instruments and all accessories. Please refer BOQ and reference drawings for more details.
1.13.1.2	**FGD Auxiliary Transformer** (0CAT01, 0CAT02)**:** 6.3MVA, 11/6.9KV, 3 phase, ONAN, Dyn11, OCTC 6Please refer BOQ and reference drawings for more details.
1.13.1.3	**Cast Resin Dry Type FGD Aux Service Transformer (0DGT01, 0DGT02)** 2500 KVA 11/0.433 KV 3 phase, AN cooled/ Dyn11, Cast Resin Dry Type, Indoor with HV/LV/LVN Bushings, Off Circuit Bolted links type of Tap Changers, Marshalling box. Please refer BOQ and reference drawings for more details.
1.13.1.4	**Cast Resin Dry Type FGD Aux Service Transformer (0DET01,0DET02),** 2000 KVA 11/0.433 KV 3 phase, AN cooled/ Dyn11, Cast Resin Dry Type, Indoor with HV/LV/LVN Bushings, Off Circuit Bolted links type of Tap Changers, Marshalling box. Please refer BOQ and reference drawings for more details.
1.13.1.5	**NGR (11 kV & 6.6 kV)** The scope of erection includes minor civil works such as chipping/grouting of support structure, final painting etc. Refer BOQ for more details.
	NOTE: • Responsibility of contractors to obtain customer protocols with respect to Field Quality Plan. • SFRA (Sweep Frequency Response Analysis) test shall be conducted for FGD Transformer. • Before charging the oil filled transformers, Particle Count Test shall be carried out as per latest standards wherever required by BHEL site engineer. • Necessary equipment's T&P to conduct the test shall be arranged by the contractor within the quoted rates. • DGA Analysis for power transformers oil

	• Frequency of DGA test to be carried out as under. ➢ Before commissioning as benchmark value and to ensure that ➢ the oil has been properly degassed. ➢ Within 24 hrs of charging/operation. ➢ Within one week of 1st charging or operation. ➢ Within 1 month of 1st charging or operation. ➢ Every 3 months Log book to be maintained all records of DGA test report. ➢ Record of online DGA trends to be recorded. ➢ Precautionary measure to be taken before taking oil sample. • 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. • 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 litres 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 colour. 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 N_2, 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-4 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 on receipt at contractor's end).

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	FGD transformer 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 FGD Transformer 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	FGD Transformer 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 and 5-6 KL / hr capacity 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 including those items mentioned in elsewhere in the tender specification 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	FGD Auxiliary and FGD 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 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 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.
1.13.3	**HT SWITCHGEARS -11kV /6.6 kV & TRANSFORMER CONTROL / RELAY PANELS AND OTHER CONTROL PANELS ETC:**

1.13.3.1	**General construction and operation features of HT Switchgear:** HT Switchgear shall be installed in FGD control room building. 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	**DETAILS OF HT Switchgear** **A. 11 kV** System Nominal : 11 kV, 3 PHASE, 50 Hz System Voltage Highest: 12 kV **B. 6.6 kV** System Nominal : 6.6 kV, 3 PHASE, 50 Hz System Voltage Highest: 6.6 kV The details of Switchboards are given in BOQ.
1.13.3.3	**Scope of work for HT Switchgear board & Transformer Control/ Relay Panels and other control panels etc., (Note: The following outlines a brief general scope of works. As the HT switchgear has already been erected at site, all works as applicable will be carried out at site.)** 1. 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. 2. 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.

	3. 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. 4. 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. 5. 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. 6. 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. 7. 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 BOQ). Contractor has to co-ordinate with C&I contractors to make the interconnecting cables through. 8. The contractor shall do touch up painting of switchgear panels wherever necessary. This includes supply of paint also. 9. 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. 10. The contractor shall calibrate and commission all switchgear/ panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc.,

	11. One-time calibration shall be carried out for Energy meters in NABL accredited lab if required within the quoted price. 12. 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. 13. The contractor shall carry out testing and commissioning works with their own testing equipment and testing teams under the supervision of BHEL/Customer Engineers. 14. 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. 15. 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. 16. 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. 17. 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. 18. The charged and commissioned equipment shall be maintained by the contractor till the same is taken over by Customer. 19. 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. 20. 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. 21. 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. 22. 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. 23. Scope of work shall also cover drilling of bottom gland plates for cable entry as required. 24. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments, transducers mounted on the panels. 25. 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. 26. 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. **Note: -** 1. Dimensions & weights indicated in the BOQ 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.
1.13.4	**BUS DUCTS:** BHEL will supply two types of bus ducts as detailed below. HT segregated phase bus ducts (11 kV) between FGD Transformer to FGD Switchboard. HT segregated phase bus ducts (6.6 kV) between i. FGD Aux transformers to FGD Aux switch board LT Non-Segregated Phase bus ducts (1.1 KV) REFER BOQ FOR MORE DETAILS
1.13.5.1	**SEGREGATED PHASE HT BUS DUCTS (SPBD)**

	BHEL will supply 11KV & 6.6 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 FGD Transformers, FGD Aux transformers and HT Switchboards along with associated interconnection etc., The tentative details of bus ducts are as under: Insulation level: 28 kV for 11KV SP 17 kV for 6.6 kV SP
1.13.5.2	**SCOPE OF WORKS FOR ERECTION & COMMISSIONING OF BUS DUCTS** The general scope of works for Segregated Phase Bus duct is Receipt from BHEL stores/ storage yard, unloading all the bus duct materials and accessories and equipment as indicated in the BOQ 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/ BOQ 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 weight and dimensions of Bus ducts within +10% shall not be considered for payment. However, for variations beyond +10%, payment shall be considered on extra work basis. 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. Detailed scope of work shall as below: 1. 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. 2. Placement of embedment and erection and alignment of steel support structures. 3. Assembly and checking of bus duct at ground level if necessary.

	4. Fixing of wall bushings/wall frame assembly 5. Providing earthing connections as per site conditions. 6. 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. 7. 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. 8. Grouting of bus duct and support structures and connecting to earth grid /earth pits as detailed in the relevant bus duct drawings. 9. 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) 10. Extension of embedment if required and erection of required supports structures as detailed in the drawing. 11. 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) 12. Conducting air-tightness test after erection to meet the requirement of BHEL/Customer Standards. 13. 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. 14. Conducting high voltage test for SP 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. 15. 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.

	16. Fixing of Current transformers and wiring from CT terminal to junction box/Marshalling box, taking through rigid/flexible conduit pipe. 17. Carrying out minor repair, rectification of enclosure and conductors if it has happened during transit without any extra cost. 18. Arranging all T&P material handling equipment required for erection, except those arranged by BHEL. 19. Calibration of all inspection, measuring and test equipment (IMTEs) before using. 20. 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. 21. Furnishing copy of the calibration certificate to the concerned BHEL Engineer for verification and approval. 22. 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. 23. Maintaining the equipment after commissioning till taken over by customer. 24. 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.
1.13.5.3	**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.
1.13.6.	**SCOPE OF WORKS FOR LT BUSDUCTS**
1.13.6.1.	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.
1.13.6.2.	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.
1.13.6.3.	The scope of work includes Receipt from BHEL stores/yards, unloading all the busduct materials and accessories and equipment as indicated in the BOQ 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.
1.13.6.4.	The unit rate quoted for E&C of bus ducts shall include transport, shifting, installation and painting of busduct. For fabrication of supports payment shall be made as per the rate quoted in BOQ.
1.13.6.5.	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.
1.13.6.6.	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 will not be considered for payment.
1.13.6.7.	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.
1.13.6.8.	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)
1.13.6.9.	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.
1.13.6.10.	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.
1.13.6.11.	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.
1.13.6.12.	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.
1.13.6.13.	Fixing of Current transformers and wiring from CT terminal to junction box/Marshalling box, taking through rigid/flexible conduit pipe.
1.13.6.14.	Fixing of Space Heaters and wiring from Space Heaters terminal to junction box, taking through rigid/flexible conduit pipe.
1.13.6.15.	Carrying out minor repair, rectification of enclosure and conductors if it has happened during transit without any extra cost.
1.13.6.16.	Arranging all T&P material handling equipment required for erection, except those arranged by BHEL.
1.13.6.17.	Calibration of all inspection, measuring and test equipment (IMTEs) before using it.
1.13.6.18.	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.
1.13.6.19.	Maintaining the equipment after commissioning till taken over by Customer.
1.13.6.20.	Milli volt drop test is to be carried out for all bolted joints.
1.13.6.21.	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).
1.13.7.	**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:**

1.13.7.1.	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.
1.13.7.2.	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.
1.13.7.3.	The base frames shall normally be supplied along with the boards. These shall be aligned, levelled 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.
1.13.7.4.	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.
1.13.7.5.	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. The required structural steel for fabrication of base frame shall be provided by BHEL on free of cost.
1.13.7.6.	The MCCs will be located in MCC room at any elevation in the Power house, as per plant layout. 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.
1.13.7.7.	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.
1.13.7.8.	Any of the LT or Control Panel items which are supplied in loose condition, 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.
1.13.7.9.	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.
1.13.7.10.	The contractor shall do touch up painting of switchgear panels wherever necessary including supply of paints within the quoted rate.
1.13.7.11.	The contractor shall calibrate and commission all switchgear/panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc., with well experienced Engineers/ Technicians.
1.13.7.12.	MCC/PCC incomer bus shall be connected to main source/PCC of customer. The contractor shall co-ordinate for proper connection at both ends.
1.13.7.13.	Erection of Resistance box of DC drives shall be part of erection of DC starter panels.
1.13.7.14.	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.
1.13.7.15.	Contractor shall co-ordinate with other cable-laying agency for proper cable termination.
1.13.7.16.	The contractor shall close unused opening at the panel bottom plate with suitable material in consultation with Site Engineer as part of panel erection.
1.13.7.17.	Rubber mats for Switchgear shall be supplied by BHEL, and these shall be laid, wherever required, by the contractor.
1.13.7.18.	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.
1.13.7.19.	The scope of work shall include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels.
1.13.7.20.	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 minor modification is required in the bus conductor for matching busduct, busbar, the same shall be carried out without extra cost.
1.13.7.21.	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 equipment once commissioned by him in case a need arises. BHEL Engineer decision in this regard is final. 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.

1.13.7.22.	All T&P, Material handling equipment including cranes and Relay Testing/ HV Testing Calibration equipment/ Instruments shall be arranged by contractor.
1.13.7.23.	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.
1.13.7.24.	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.
1.13.7.25.	The contractor shall maintain the charged and commissioned equipment till the same is taken over by customer.
1.13.7.26.	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.
1.13.7.27.	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.
1.13.7.28.	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.
1.13.7.29.	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.
1.13.7.30.	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.
1.13.7.31.	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.
1.13.7.32.	Subject to availability, BHEL shall provide higher capacity crane for the purpose of shifting the panels with in the building on sharing basis at free of cost as specified elsewhere in the tender conditions. However, the contractor shall arrange T&P.
1.13.8.	**SCOPE OF WORKS FOR BATTERY AND BATTERY CHARGER:**
1.13.8.1.	**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 BOQ. 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.
1.13.8.2.	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.
1.13.8.3.	Filling the individual cells with Acid/alkali – if applicable.
1.13.8.4.	Arranging suitable resistive load banks for charging and discharging during charging and discharging cycles.
1.13.8.5.	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.
1.13.8.6.	Modifications or changes if any for the loose supplied items or any minor changes in wiring.
1.13.8.7.	Arranging necessary tools, T&P, Testing equipments required for erection and commissioning of the battery.
1.13.8.8.	For laying and termination of cables of battery/ battery charger system, separate rate shall be applicable as per rates in Rate Schedule.
1.13.9.	**SCOPE OF WORK FOR INVERTER, BATTERY CHARGER PANELS:**
1.13.9.1.	The scope of work will be in line with scope of work for electrical control panels, as detailed elsewhere in this specification.
1.13.10.	**SCOPE OF WORK FOR DIESEL GENERATOR SET**
1.13.10.1.	The DG sets of rating 750 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.,
1.13.10.2.	Cooling system comprising of radiators, engine mounted water pump, self-contained pipe, thermostat etc.
1.13.10.3.	**Fuel system** consisting of PT fuel pump, injectors, fuel filters, self-contained piping.
1.13.10.4.	**Lubricating system** consisting of oil pumps, strainers, lube oil cooler, bypass filter, self-contained piping.

1.13.10.5.	Air Intake System consisting of dry type filter, air intake manifold with necessary connectors, turbo charger with after cooler.
1.13.10.6.	Exhaust system consisting of exhaust manifold, flexible piping, residential silencer etc.
1.13.10.7.	The scope of works covers erection of Diesel Generator and erection of all loose supplied items, Acoustic treatment/insulation as detailed in BOQ and as per BHEL drawing.
1.13.10.8.	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.
1.13.10.9.	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.
1.13.10.10.	All T&P, material handling equipments, including crane shall be arranged by the contractor.
1.13.10.11.	All calibration and testing instruments required for relay testing, high voltage testing and load testing shall be arranged by the contractor.
1.13.10.12.	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.
1.13.10.13.	Obtaining explosive license (if applicable) shall be under the scope of the contractor.
1.13.10.14.	Fuel filling in DG till handing over is included in the scope of the vendor. Fuel shall be supplied by BHEL.
1.13.10.15.	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.
1.13.10.16.	**The DG set shall be maintained by the contractor after commissioning until full load testing is completed.**
1.13.11.	**SCOPE OF WORK FOR HT CABLES** a. BHEL will supply HT cables (armoured / unarmoured, Aluminium/ Copper) and Instrumentation cables of different sizes and also Termination Kits/ Joint Kits for HT cables. b. 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. c. 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.

d. Cable Termination

- Termination of HT cable shall be treated as part of installation of HT termination kits and separate rate shall be applicable for the same.
- For all other cables, a composite rate covering laying and termination shall be applicable.
- Qualified HT cable jointer to be deployed for carrying out HT termination kits.

e. 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.

f. 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.

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

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

i. 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.

j. 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.

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

l. 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. m. 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. n. The approximate number of terminations for the purpose of estimation to be assumed as follows: The average run length shall be considered as 150 metres.
1.13.12.	**SCOPE OF WORK FOR LT CABLES**
1.13.12.1.	BHEL will supply LT cables (1.1 kV, Armoured / Unarmoured, Aluminium / Copper XLPE/PVC insulated) of different sizes. (Power, control and instrumentation cable). The special cables supplied shall be Compensating cable, Ethernet cables and Fibre-optic cable of different sizes and type.
1.13.12.2.	The cables covered in the BOQ may be appearing either in BHEL's C&I cable schedule or in BHEL's Electrical cable schedule. The contractor shall lay and terminate all the cables covered in the BOQ, as per directive of BHEL Engineers.
1.13.12.3.	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. A composite rate covering laying and termination shall be applicable for cables, except for higher size cables. Separate rate will be applicable for termination of higher size cables and the same will be indicated specifically in the Rate Schedule / price bid / BOQ. 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.
1.13.12.4.	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.
1.13.12.5.	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 risk and

	cost. Supply of above material shall conform to the specification detailed elsewhere in tender specifications.
1.13.12.6.	Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.,
1.13.12.7.	For single core Power cable, fixing of Trefoil clamps shall be treated as part of laying work.
1.13.12.8.	If the cables are to be routed on steel angles as per site condition, steel angles will be supplied by BHEL.
1.13.12.9.	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.
1.13.12.10.	Single core cable used for three phase AC power shall be clamped in trefoil cable at the time of laying itself.
1.13.12.11.	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.
1.13.12.12.	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.
1.13.12.13.	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.
1.13.12.14.	Minor chipping of concrete floor cut out below panels in order to align the panel's gland plate with the floor cut out shall be done without any extra cost by the contractor.
1.13.12.15.	If any of the cables are required to be laid for commissioning of the system and the same is not covered in the BOQ, the contractor may carry out the work. Payment shall be made in the above case as per the equivalent BOQ rate nearest to the cable size. BHEL engineer decision in this regard is final.
1.13.13.	**SCOPE OF CABLE TERMINATION**
1.13.13.1.	The scope of termination shall include termination of cables on various panels/ JBs/ Push buttons/ equipment etc. including those installed by other agencies.
1.13.13.2.	Re-termination if required during testing/ commissioning shall be carried out without additional cost.
1.13.13.3.	Scope of termination shall include supply of insulating sleeves. The sleeves shall be fire resistant and long enough to over pass conductor insulation.

1.13.13.4.	Contractor shall arrange all type of termination and crimping Tools/equipment required for the connections/terminations.
1.13.13.5.	Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.
1.13.13.6.	After cable terminations, the debris shall be removed then & there.
1.13.14.	**SCOPE OF WORK FOR CABLE TRAYS & SUPPORTS**
1.13.14.1.	Scope of cable tray works covers erection of various sizes of ladder & perforated trays with tray accessories such as bends(vertical and Horizontal), tees, cross, reducers, coupler plates, fasteners etc.
1.13.14.2.	**The scope of erection shall also cover erection of all type of trays and its accessories such as coupler plates/fixing plates, anchor bolts, fasteners, Tees, Reducers, Bends (vertical and Horizontal), cross etc.,**
1.13.14.3.	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.
1.13.14.4.	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.
1.13.14.5.	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.**
1.13.14.6.	No separate rate shall be paid for any fabrication of tray accessories or any modification on straight trays.
1.13.14.7.	If trays covers are supplied same shall be erected after completion of cable laying. GI strip clamps are to be used for fixing the tray covers.
1.13.14.8.	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.
1.13.14.9.	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.
1.13.15.	**RIGID & FLEXIBLE CONDUITS** 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 supplied by BHEL shall be used. Unit rate shall be paid on running meter basis. 2. Unit rate quoted on meter basis 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. No separate payment will be made for fixing of end connectors.

	3. Unit rate quoted on meter basis for GI rigid conduit includes supply of suitable clamps / fasteners / tag plates etc. The scope of work includes drilling of holes on the plates, fixing of end connectors, providing suitable supports and fixing tag plates as required by BHEL. Supply of suitable clamps, fasteners and tag plates are covered in the unit rate.
1.13.16.	**SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY OTHER CONTRACTOR.**
1.13.16.1.	**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.
1.13.16.2.	**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.
1.13.16.3.	**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 during the commissioning activities including shift operation.
1.13.17.	**SCOPE OF WORK OF JUNCTION BOXES/ MARSHALLING BOX/ STARTER BOXES AND PUSH BUTTON BOXES:**

	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: 1. 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. 2. Fabrication and fixing of supports shall be on tonnage basis. 3. The contractor shall close all unused holes on the gland plates using GROMMET or other suitable material issued by BHEL, within the quoted rate. 4. All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor. 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. Equivalent Unit rate shall be paid for installation of such JBs. Decision of site engineer will be final regarding the equivalent rate.
1.13.18.	**SCOPE OF ABOVE GROUND EARTHING & LIGHTNING PROTECTION** 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. 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. 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. 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. 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.

	6. Installation of treated earth pit as per IS:3043 including providing concrete chamber with GI/CI cover (hinge type) and nomenclature/ identification of the pit. (Only GI/CI pipe shall be supplied by BHEL)
1.13.19.	**LIGHTNING PROTECTION SYSTEM INSTALLATION**
1.13.19.1.	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.
1.13.19.2.	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.
1.13.19.3.	The scope of work for horizontal and vertical conductor shall include supply of supports, clamps, saddles, spacers, Anchor fasteners etc.
1.13.19.4.	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.
1.13.19.5.	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.
1.13.19.6.	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.
1.13.19.7.	The scope of work for vertical electrode shall cover driving into the earth with suitable tools, and welding to the riser rod, consolidation etc.
1.13.19.8.	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.
1.13.19.9.	Supply of base plates, and related civil works, grouting and supply of grouting materials are part of the scope for vertical air terminations.
1.13.20.	**FIRE DETECTION & ALARM SYSTEM**

1.13.20.1	Fire Analogue addressable type Fire Alarm System consisting of Multi sensor type detectors, Linear Heat Sensing Cable (LHSC) detector, cabling, junction boxes, instrumentation, Fire Alarm cum control panels, repeater panels, etc.
1.13.20.2	a) All MCC / switch gear room / Control room shall be provided with Multisensor type detectors. b) All Conveyors and Cable Galleries shall be provided with Linear Heat Sensing Cable detectors. c) All cable galleries shall be provided with Multisensor type detector.
1.13.21.	**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.
1.13.22.	**SCOPE OF WORK FOR C&I PANELS / CONTROL DESK:**
1.13.22.1.	The different types of Microprocessor based panels like DCS / PLC Panels, Instrument Panels, unit control desk, EPABX System, Public Address

	System, MIS/LAN etc. are covered in the scope of work for erection and commissioning.
1.13.22.2.	The unit rate quoted for Installation of control panels shall include fixing of anti-vibration pads, levelling and alignment, welding, grouting, drilling of bottom gland plates for cable entry as required, closing control panels bottoms with suitable flame proof compounds wherever required and checking of internal wiring, instruments, components etc. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels except the Instruments identified in the BOQ.
1.13.22.3.	Panels are normally supplied in suite of one / two / three/ four/five cubicles with bottom base frame and these panels are to be mounted on separate site fabricated base frames as per site condition. The base frames to be properly grouted to the concrete floor or to be TIG welded to the embedded insert plates. The structural steel material for the above will be supplied by BHEL. For fabrication and erection of frame, unit rate shall be paid be as quoted in rate schedule, on tonnage basis.
1.13.22.4.	For panels to be mounted on trenches, if any channel supports are required, the same shall be provided across the cable trenches over which the base frames of the panels shall be mounted. Similarly, for the panels to be mounted on false flooring, if mounting frames are not provided, same shall be fabricated at site. The contractor shall carry out fabrication and erection of these support structures on tonnage rate basis. For fabrication and erection of frame, unit rate as quoted in rate schedule shall be paid, on tonnage basis.
1.13.22.5.	The panels which are supplied for various control systems have to be erected at different places like unit control room/ near the equipment/ various operating floors as per site layout. 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.
1.13.22.6.	If any minor grinding is to be carried out on the cut-outs provided in the panels for mounting instruments like recorders, indicators, console etc., the same shall be carried out by the contractor at no extra cost.
1.13.22.7.	All the panels and JBs shall be electrically earthed to the nearest earth grid by means of GI wire/Flats as per the instructions of BHEL engineer.

1.13.22.8.	Painting of fabricated parts and earthing conductors of panels shall be part of the work. Touch up painting for panels, including supply of paints shall be carried out by the contractor within the quoted rate.
1.13.22.9.	Closing the Panel openings and unused drilled holes with non-flammable sealant materials, including supply of above material, shall be part of erection work.
1.13.22.10.	For panels/ equipment erected by other agencies, commissioning work and troubleshooting are to be carried out by the contractor as per the rate quoted in the schedule.
1.13.22.11.	Normally the panels shall be supplied with instruments / modules mounted and wired. No separate payment shall be made for commissioning of any instrument/ cards/ components. If dismantling of the above such instruments and rewiring is needed at site, the same shall be carried out at no extra cost. If any instruments/ cards/ components supplied as loose items for safe transit, the same shall be mounted and wired at no extra cost unless specified otherwise in the BOQ. Similarly, if any loose supplied instruments /modules are to be mounted and wired on customer panels or any other panels not erected by contractor, the same shall be carried out at no extra cost unless otherwise specified in the BOQ. However, if any major installation/ modification/ wiring is involved, the same may be carried out as extra work. The decision of BHEL Engineer shall be final in respect of above extra works.
1.13.22.12.	Dimensions & weights indicated in the BOQ 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.
1.13.23.	**INVERTER, UPS, AC & DC DB AND OTHER ELECTRICAL CONTROL PANELS:** The erection & commissioning scope of above panels will be in line with clauses above in 1.13.22
1.13.24.	**SCOPE OF WORK OF DCS PACKAGE / HMI/ STATION LAN/ PADO SYSTEM / SCADA etc WITH RELATED INSTRUMENTATION:**
1.13.24.1.	BHEL will supply sophisticated DCS system. The tentative details are furnished in the BOQ.

1.13.24.2.	The scope of DCS system includes erection of sophisticated microprocessor-based systems, DNA control panels, I/O panels, Ethernet switching panels, Network Enclosure cabinets, CPU, Engineers workstations, operator workstations, CRTs, server, desk, EPABX System, Public Address System, MIS/LAN printers, portable UPS power supply, furniture and interconnecting cables like Ethernet/ Fiberoptic etc.
1.13.24.3.	The scope of work for DCS Panels will generally be in line with that for C&I Panels as detailed in Clause 1.13.22
1.13.24.4.	Unit rate quoted for DCS equipment shall cover installation & integration of all the above said equipment and providing necessary commissioning assistance. No separate unit rate applicable for installation of loose items/ modules/ components or accessories including furniture etc, which is not explicitly mentioned in the BOQ, but comes as part of the system.
1.13.24.5.	Laying and termination of all cables including Ethernet and fibre optic cables as detailed in the scope of work for cabling. Splicing/Termination of fibre optic cables is included in the scope of this contract.
1.13.24.6.	If any underground C&I works for firefighting systems the earth excavation and earth filling is in the scope of civil.
1.13.25.	**SCOPE OF WORK FOR INSTRUMENTS:**
1.13.25.1.	The type of instruments to be erected and commissioned shall be detailed below: a) Panel/ Control desk mounted Instruments like indicators, recorder, electronic modules etc. b) All types of transmitters like temperature, pressure, flow, level and position feedback transmitters etc. c) Local mounted pressure gauges, DP gauges, thermocouples, RTDs, temperature gauges, temperature switches, pressure switches, DP switches, flow switches and limit switches and flow indicator level switches etc. d) Air filter regulator sets, Air lock off valve, Power cylinders etc. e) I/P converters and local controllers. f) Special instruments like vibration sensors, proximity sensors, electronic water level indicator, Steam and water analysis system (SWAS), Gas analyser, Coal Flow Monitor, PC based instruments etc. g) Pneumatic operated control valves, trip valves, solenoid valves, and electrically operated valves. (commissioning only).

1.13.25.2.	Prior to installation, all the Instruments (local & remote), I/P converters, etc. shall be calibrated. Similarly, the healthiness of RTDs and thermocouples, limit switches, flow switches, level switches, solenoid valves, air filter regulator, purge meters, etc. shall be checked for proper operation.
1.13.25.3.	Unit rate quoted for each instrument shall include calibration, installation, loop checking, commissioning and troubleshooting until satisfactory performance as per operational and system requirement and maintenance till the end of contract period or trial operation whichever is earlier. In case any instrument requires recalibration to achieve the expected performance, the same shall be carried out at no extra cost. If any re-calibration or replacement of instruments and rechecking of cable termination is found necessary during commissioning, the same shall be done at no extra cost. The unit rate shall also cover marking Tag numbers of instruments or Racks, either by paint or a separate tag plate as per BHEL Engineer's directive.
1.13.25.4.	Unit rates have been asked item-wise for instruments, gauges, switches, indicators, recorders etc. as indicated in BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items of work of the rate schedule.
1.13.25.5.	Unit rate quoted for erection of pressure/ differential pressure transmitters, gauges, switches, shall include fixing the instruments on the racks / supports along with manifolds, and associated fittings and clamps.
1.13.25.6.	Unit rate quoted for Temperature transmitters, I/P converters, Air filter/ Air lock off valves, Purge meters, Rotameters, position transmitter, probes etc shall include fixing the instruments on the racks / supports along with associated fittings and clamps.
1.13.25.7.	Unit rate quoted for control room mounted instruments shall cover mounting of instruments on panels / desk wiring, minor grinding on the cut out of panels for proper fixing.
1.13.25.8.	Unit rate quoted for erection and checking of thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells.
1.13.25.9.	Unit rate quoted for erection and checking of temperature switches, gauges, thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells.
1.13.25.10.	If any instrument is to be relocated for reasons not attributable to the contractor, but required for satisfactory performance, the same shall be carried out on BOQ rate basis.

1.13.25.11.	Level switches supplied shall be of different types- float type or fixed contact type (Electronic type). The scope of work for float type Level switches shall include fixing of switches on float chambers and fixing of float chambers on stand pipe, providing supports wherever required etc. The scope of work for Electronic type Level switches includes fixing of Electrode standpipe, Electrodes, Electronic unit, integration of all loose supplied items etc Any minor modification require to match Float chamber / Electrode standpipe with tapping point same shall be carried out at no extra cost. Uniform unit rate shall be quoted for Erection and commissioning of various types of level switches, irrespective of their type.
1.13.25.12.	The unit rate quoted for erection and commissioning of Electronic type Level switches includes fixing of Electrode standpipe, Electrodes, Electronic unit, any minor modification required to match Float chamber/ Electrode standpipe with tapping point, integration of all loose supplied items etc.
1.13.25.13.	Unit rate quoted for erection / commissioning of special instruments like, Vibration monitoring System, Large video screen, Flue Gas analyzers, Station LAN / HMI plant management system, PC based instruments, Wireless communication, UPS with battery and charger, Graphical interphase system, as per configuration, operator training simulator, computer furniture, etc. 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. Lump sum rate shall be quoted as mentioned in the BOQ. No separate rate shall be payable for loose items including furniture. The quantity of loose supplied items is approximate only. No proportional rate will be applicable for any variation in quantity or for any additional items supplied as part of equipment.
1.13.25.14.	If any surface finishing / tapping is required to fix the sensors for Vibration Monitoring System, the same shall be arranged by the contractor at no extra cost.
1.13.25.15.	Some of the Flue Gas Analyzers may have to be installed at Chimney 82/77/46 Mtrs app. as indicated in BOQ. For the erection of associated hardware for these analyzers, like cables, trays, GI pipe etc. that are to be routed from the analyzer at 82/77/46 Mtrs of Chimney to zero-meter level, payment will be made at twice the unit rate quoted against each item as applicable
1.13.25.16.	Canopy shall be provided for field-mounted instruments as per site requirements. Necessary materials like MS Plate shall be provided by BHEL. Rate for fabrication and installation of canopy shall be on tonnage basis.

1.13.25.17.	Temporary protection by thermocol, polythene sheet, GI sheets shall be provided by the contractor for safe guarding the instruments against damages. The protective materials shall be supplied by the contractor at no extra cost.
1.13.25.18.	In case the Instruments are mounted and supplied along with main equipment and the BOQ calls for Erection & Commissioning, the contractor shall carry out removal, calibration, re-fixing and commissioning of same. Payment shall be made only for removal, calibration, re-fixing and commissioning, in line with rate quoted for removal, calibration and re-fixing of Instrument of similar type.
1.13.25.19.	In case the Instruments are supplied as loose items, and the BOQ calls for removal, calibration, re-fixing and commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made only for Erection and commissioning in line with rate quoted for Erection and Commissioning of Instruments of similar type.
1.13.26.	**SCOPE OF WORK FOR IMPULSE PIPES:**
1.13.26.1.	Different types of impulse pipes, like alloy steel, carbon steel, stainless steel of different sizes and thickness shall be supplied with suitable fittings like coupling, sockets, root valves, drain valves, manifold, condensing pots, syphons, tees, bends, nut and tail piece.
1.13.26.2.	Unit rate quoted for impulse piping shall include site routing using reducers (at root valve) unions, connector Nuts and tail pieces, sockets, nipples, equal tees, couplings, condensing pots, siphons, root valves, isolation valves cold bending, tig / arc welding. etc., fixing of manifolds and supporting with suitable fixtures and 'U' clamps and painting as per BHEL specification and site engineer's instructions. No separate rate shall be paid for the Impulse pipe fittings. The unit rate also includes supply of U clamps, fasteners, paints, etc. For impulse pipe support materials viz. Angles/ Channels, the rate shall be paid on tonnage basis. The above support materials shall be supplied by BHEL. For scope of painting, please refer Scope of Painting clause. Welding of impulse pipe for High Pressure Lines shall be carried out by High Pressure welder. Suitable root valves will be provided by BHEL on the tapping point wherever required
1.13.26.3.	TIG-welding sets, welding transformer/generator rectifier, Hydraulic bending machines, DPT kits, Hydraulic testing pumps required for pressure testing of impulse pipes shall be arranged by the contractor. Similarly, consumables such as welding electrodes, gas, Tungsten rods, filler wire etc., shall be arranged by the contractor within the quoted rate.
1.13.26.4.	For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer.

1.13.26.5.	Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work.
1.13.26.6.	The contractor shall obtain necessary approval for welding electrodes, filler wire from BHEL welding engineer at site.
1.13.26.7.	Impulse pipes welder shall undergo test and get approval from BHEL welding engineer according to the nature of welding.
1.13.27.	**SCOPE OF WORK FOR PRE-FABRICATED/ SEMI-FABRICATED LIR/ LIE/ GAUGE BOARDS CABLES TERMINATION**
1.13.27.1.	If the frame or rack is supplied as a pre-fabricated item like LIR, same shall be erected, grouted and painted as per site requirement.
1.13.27.2.	If any frame or support or rack supplied as semi-fabricated item, same shall be assembled at site either by welding or bolting and erected, grouted and painted as per site requirement.
1.13.27.3.	Unit rate quoted for such pre-fabricated /semi-fabricated items like LIE/LIR and enclosure shall be on Number basis. Unit rate shall cover installation, grouting, painting and supply of nuts, bolts, anchor fasteners, grouting materials such as cement, sand etc. as required. Unit rate shall also include full painting of impulse line fitted and supplied along with LIR/LIE/LGB.
1.13.27.4.	Wherever LIR/LGB/LIE are supplied with instruments mounted on them, the rate quoted for LIR/LGB/LIE shall include calibration of all the instruments mounted on them as detailed in the BOQ. However, if the instruments supplied as loose items, the instruments shall be calibrated and mounted on the LIR/LGB/LIE and separate calibration/erection /commissioning charges shall be applicable in line with other instruments erection.
1.13.28.	**SCOPE OF WORK FOR COPPER/ STAINLESS STEEL TUBES:**
1.13.28.1.	Different sizes of copper tubes of different thickness with or without PVC coating shall be supplied in standard lengths of 15 meter Coils and Stainless Steel tube shall be supplied in standard length of 6meter. The connectors and tees will be of brass / Stainless Steel of different sizes as per site requirement.
1.13.28.2.	The unit rate quoted on meter basis shall cover site routing, bending, providing supports, fixing of connectors, unions, valves, tees, etc. and connecting to the instrument - air line instruments. The unit rate shall also include providing tag plates on instruments / power cylinders.
1.13.28.3.	If copper / Stainless Steel tube length is more than half meter, suitable support shall be provided either by angle or trays. Protective angles to be used for copper tube routing. The support materials shall be supplied by BHEL. For fabrication and installation of steel supports and frames, the rate shall be as quoted in BOQ for fabrication and installation of steel Tonnage basis.

1.13.28.4.	Copper / Stainless Steel tubes shall be clamped with suitable clamping materials. Supply of suitable Aluminium clamps and tag plates are under contractor's scope. The unit rate quoted for laying of copper tube shall cover the supply of clamping materials also. For SADC system copper tube, tag plates shall be provided near instruments, Tees and Power cylinders. Leak test shall be carried out after completion of tubing works as per guidelines.
1.13.29.	**SCOPE OF WORK FOR INSTRUMENT AIR LINES (GI PIPES):**
1.13.29.1.	Different type of GI pipes of different thickness class shall be supplied along with GI fitting accessories like union, coupling, tee, reducers, elbow, valves, etc.
1.13.29.2.	Unit rates on length basis for erection of instrument air lines includes site routing, providing supports, fixing "U" clamps, fixing of loose supplied GI accessories mentioned as above as per the drawings, providing fresh threading as required for jointing with unions, valves and all type of other fittings as required in the system. Unit rate also shall include supply of U clamps, Teflon tapes and bolts, etc.
1.13.29.3.	Teflon tapes shall be used for tightening all the joints. No bending, welding etc. is allowed. No separate rate shall be paid for erection of GI fittings / accessories and U clamps.
1.13.29.4.	After installation of instrument air lines, the line shall be blown and leak test shall be conducted for all the joints as per the guidelines given elsewhere in this tender.
1.13.30.	**SCOPE OF WORK OF ELECTRIC & PNEUMATIC ACTUATORS:**
1.13.30.1.	Different types of pneumatic actuators like regulating type, on-off type, of different stroke length shall be supplied. Some of them may be fitted and supplied with main equipment.
1.13.30.2.	The unit rate quoted for erection & commissioning scope of electrical and pneumatic actuators includes fabrication and installation of base frame, modification of linkage mechanism wherever required and connecting the same with driven equipment, fixing of all accessories like air sets, Solenoid valves, air lock off valves, limit switches, if supplied loose item as part of power cylinders, replacing the damaged copper tubes or any other accessories like gauges, solenoid valves, limit switches, etc. connecting to air line, and adjusting the stroke length. No separate rate shall be paid for the above works. For all pneumatic and electrical actuators, the necessary Linkage Mechanism shall be supplied by BHEL as part of actuators. No separate rate shall be paid for erection of linkage mechanism. For fabrication

	and erection of steel supports and frames, the rate shall be paid on Tonnage basis.
1.13.30.3.	The link rods have to be adjusted to suit the opening and closing position. This adjustment has to be repeated number of times till proper operation is obtained. If BHEL site engineer desires to remove the accessories like position transmitters, air locks, positioners, limit switches, solenoids etc. prior to erection either at BHEL stores or at site to avoid damages/pilferage, keep in safe custody and remount the same prior to commissioning, this shall be part of scope of work for power cylinders.
1.13.30.4.	For calibration of any pneumatic actuator at field, temporary air supply if required shall be arranged by the contractor.
1.13.30.5.	In case the power cylinder is supplied in assembled condition along with main equipment and the BOQ calls for Erection & Commissioning of the same, payment shall be made only for commissioning, in line with rate quoted for commissioning of pneumatic power cylinder of similar type.
1.13.30.6.	In case the power cylinder is supplied as loose item, and the BOQ calls only for commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made in line with rate quoted for Erection and Commissioning of power cylinder of similar type.
1.13.30.7.	The contractor shall provide necessary support for checking the remote operation of Electric actuators and loop checking of command and feedback signals from DCS to the actuator. The Contractor shall co-ordinate with the other agencies to ensure that all feedback and command signals and settings are made available for bi-directional.
1.13.31.	**SCOPE OF WORK FOR JUNCTION BOXES/ CJCBs / PUSH BUTTON BOXES:**
1.13.31.1.	Different Junction Boxes/ Push Button boxes with gland plates shall be supplied by BHEL.

1.13.31.2.	The unit rate quoted for erection of junction boxes/push button boxes shall cover the following also. a. Providing necessary supports b. Drilling of bottom gland plates for cable glands as required c. Painting the tag Nos. or fixing a separate tag plate on junction boxes/push button boxes d. Minor chipping, grouting as required for mounting the JBs/PB e. Supply of all bolts and nuts (Fasteners) including grouting bolts as required for mounting the junction box/push button. f. Closing all unused holes on the gland plates using grommet or any other suitable materials. g. Any modification like replacement of terminals, enlarging gland holes etc. that may be required to accommodate power cables.
1.13.31.3.	All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.
1.13.31.4.	For CJCBs/ RJCBs, the rate for Junction Boxes of similar size, as per Rate Schedule, will be applicable.
1.13.31.5.	For fabrication and fixing of supports/Frame, rate shall be paid on tonnage basis.
1.13.32.	**SCOPE OF WORK FOR FABRICATION & ERECION OF STEEL MATERIALS:**
1.13.32.1.	Scope of steel fabrication and installation covers, fabrication and installation of various type of supports for cable tray, instruments, impulse pipes, GI pipes, support angles for copper tubing, mounting frames for JB, Control Box/Panel, local PB Stations, canopy for local instruments and local instrument rack etc. wherever required.
1.13.32.2.	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.
1.13.32.3.	Immediately after fabrication, primer shall be applied to prevent corrosion. The installation shall be carried out only after applying the primer as detailed in painting clause.
1.13.32.4.	All fabricated steel materials shall be painted as detailed in the scope of painting.
1.13.32.5.	A composite rate shall be quoted for fabrication and installation of steel, on tonnage basis. The above rate shall include supply of paints and painting, grouting and grouting material as required.

1.13.32.6.	Any minor chipping as required as detailed elsewhere in the tender specifications, 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.
1.13.33.	**SCOPE OF EARTHING:**
1.13.33.1.	The scope of earthing covered in this contract is above ground earthing, i.e. equipment earthing. Scope of earthing covers earthing of field Instruments, JBs, Branch trays, LIR/LIE, JB, Push Button boxes etc. All DCS and its accessories, PLC/Instrumentation panels/systems etc, shall be earthed to a separate Electronic earth grid.
1.13.33.2.	Different type of earthing materials shall be supplied and same shall be erected as per site requirement.
1.13.33.3.	The scope of work shall include supply of fasteners, lugs, minor civil works etc.
1.13.33.4.	All connections from the equipment to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the contractor at site.
1.13.33.5.	The unit rate shall be quoted for earthing on metre basis. The rate shall cover supply of fasteners, lugs, minor civil works, painting the welded joint etc.
1.13.34.	**MEASUREMENTS, WASTAGE & CUTTING ALLOWANCES:**
1.13.34.1.	For all payment purposes, measurement shall be made on the basis of the execution of drawings/physical measurements. Physical measurements shall be made by the contractor in the presence of the Engineer.
1.13.34.2.	The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays, earth flat etc. shall be made on the basis of length actually laid.
1.13.34.3.	All the surplus, scrap and serviceable materials, out of the quantity issued to the contractor shall be returned to BHEL in good condition and as directed by the engineer.
1.13.34.4.	All materials returned to stores should carry an aluminium tag indicating the size and type. More than 5 metres length termed as serviceable material and shall be returned size wise and category wise to the owner's stores/yard. Cable of serviceable length being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum(s) shall be noted and certified by the Engineer-in-charge. This shall be applicable only for the purpose of accounting the cables issued for installation.

1.13.34.5.	While carrying out material reconciliation with contractor, all the above points will be taken into account. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity(ies) will be taken as the net quantity(ies) issued to the contractor. Material appropriation shall be done and allowable scrap quantity calculated as per wastage allowance specified below. Any scrap / wastage generated by the contractor in excess of the allowable percentage shall be charged at the rates decided by the Engineer whose decision shall be final and binding on the contractor.
1.13.34.6.	For all site-fabricated steel items such as supports, racks, frames, Canopy etc. physical measurement shall be made and then converted to tonnage.
1.13.34.7.	For steel material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.
1.13.34.8.	Every month the contractor shall submit an account for all the materials issued to them by BHEL in the standard proforma prescribed for this purpose by the site in charge.
1.13.34.9.	The cable take off from drums shall be planned strategically such that jointing in the run of cables and wastage are avoided. For this purpose, the exact route length between various equipment/panels as per the cable schedule shall be measured and the route length recorded before laying of the cables. Depending upon the route length the type of cable required for various destinations, the cable drums shall be suitably selected for cable laying. Jointing of cable, if any shall be approved by the BHEL engineer. All the cut pieces / bits of cables which are not used / unused shall be returned to the BHEL stores for accounting towards wastage. The cables damaged by the contractor shall have to be replaced by the contractor at their own cost.

1.13.34.10. The erection contractor shall make every effort to minimize wastage during erection work. The wastage allowances as permissible for various items are indicated in the following table. Cutting and wastage allowance shall be computed on the lengths and weight of materials actually used, measured and accepted. In any case, the wastage shall not exceed the following limits.

Sl.No.	Item	% wastage on issued quantity
01	Fabrication Steel	2
02	Each size of power cables	1
03	Each size of control / instrumentation cables	2
04	Impulse pipe / tubes / GI Pipes / Copper Tubes	1

NOTE:

1. Salvageable scrap shall mean lengths of pipes, multicables, other cables etc., that can be used one time or other at a later date and normally they are recovered from the cut-pieces of tubes, pipes, multicore cables, cables etc.
2. Non - Salvageable scrap means the lengths of tubes, pipes, multicore cables, cables etc., and they are from cut-pieces of tubes, pipes, multicore cables, cables etc., that cannot be used at all one time or other.

1.13.35. 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.

1.13.36. SCOPE OF CIVIL WORKS

1. In addition to the scope of works as detailed elsewhere in the tender specifications, 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. No separate payment will be applicable for above civil works.

VOLUME-IA PART-I CHAPTER-XIV

PROGRESS OF WORK

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

	any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required.
1.14.8.0	The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes / ferrules / lugs) report, cranes availability report and other reports as per Performa considered necessary by the Engineer as per the BHEL formats.
1.14.9.0	The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purpose.
1.14.10.0	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
1.14.11.0	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.)
1.14.12.0	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.
1.14.13.0	The contractor to reflect actual progress achieved during the month and will be submitted to BHEL, so that slippages can be observed and necessary action taken in order to ensure that the situation does not get out of control will update the construction schedule forming part of this contract each month.

VOLUME-IA PART - I CHAPTER- XV

TESTING AND COMMISSIONING

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

1.15.1.0	**SCOPE OF PRE-COMMISSIONING / COMMISSIONING AND POST COMMISSIONING WORKS:**
1.15.1.1	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. The 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.
1.15.1.2	The contractor shall co-ordinate with BHEL and other contractors during commissioning to ensure successful commissioning of total plant/system.
1.15.1.3	After erection of each item of equipment and duly inspected by both BHEL and TANGEDCO for correctness and completeness, the necessary standard, pre-commissioning tests including those required by the consultants will be carried and FGD System will be taken for trial operation
1.15.1.4	Trial operation shall be defined as continuous operation of the FGD System for 14 days, at any unit load, up to maximum capacity of 800 MW. Trial operation will also include 72 hours of continuous operation on full load for the FGD system with guaranteed value of SOx emissions at FGD outlet during complete period of trail operation.
1.15.1.5	It shall be the responsibility of the contractor to provide various category 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. Contractor will provide necessary consumables, Certified T&P's, IMTE's 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.
1.15.1.6	It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.
1.15.1.7	The pre-commissioning activities of the main FGD plant will start with energizing of startup power supply systems followed by trial run of various drives.

<table>
<tr><td></td><td>Commissioning operations shall continue till trial operation 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.</td></tr>
<tr><td>1.15.1.8</td><td>The mobilization of testing team shall be planned in time and shall be undertaken round the clock. Contractor shall discuss on day to day / weekly / monthly basis and the requirement of testing manpower, consumables, tools and tackles shall be discussed with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and the cost will be recovered from contractor.</td></tr>
<tr><td>1.15.1.9</td><td>Prior to commissioning and after commissioning, protocols have to be made with BHEL / Customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL commissioning engineers which may involve over time payment which forms part of Contractors Scope.</td></tr>
<tr><td>1.15.1.10</td><td>Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at their cost. During commissioning, any improvement rework / rectification / modification due to design improvement / requirement is involved and which is not attributed to contractor’s workmanship, the same shall be carried out promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.</td></tr>
<tr><td>1.15.1.11</td><td>Minimum requirement of Man Power for testing/checking works shall be as follows: (Requirement given below is per unit):

<table>
<tr><th></th><th>HT/LT Electrical</th><th>C&I</th></tr>
<tr><td>Engineer</td><td>1</td><td>1</td></tr>
<tr><td>Supervisor</td><td>1</td><td>1</td></tr>
<tr><td>Technician</td><td>2</td><td>2</td></tr>
</table>
The above testing / checking group shall be identified at the Pre-commissioning time. The above commissioning group shall have the knowledge of various 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 /</td></tr>
</table>

	Technician at appropriate time of commissioning, no payment shall be made against commissioning activities as per terms of payment.
1.15.1.12	All T&P / instruments required for testing are to be arranged by the contractor.
1.15.1.13	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.
1.15.1.14	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.
1.15.1.15	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.
1.15.1.16	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.
1.15.1.17	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.
1.15.1.18	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.
1.15.1.19	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.
1.15.1.20	Recommissioning of any item listed in BOQ as per site requirement is to be done by the contractor without any extra claim.

1.15.1.21	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.
1.15.1.22	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.
1.15.1.23	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.
1.15.1.24	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.
1.15.1.25	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.
1.15.1.26	It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, even if commissioning of equipment is delayed due to reasons not attributable to the contractor.
1.15.2.0	**SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY OTHER/ 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 elsewhere in the tender specifications.
1.15.2.1	**All types of Drives and Generator:** 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
1.15.2.2	**<u>PNEUMATIC (ALL TYPES OF VALVES AND POWER CYLINDERS)</u>** a) Calibration and checking of instruments mounted on the

	actuators and setting stroke length of the actuator. b) Servicing of positioners, position transmitters, limit switches, solenoid valves, air lock-off valves, removing/replacement of defective components, copper tubes etc., if necessary. c) If the actuator is to be removed for attending to any mechanical problems, removing of copper tubes, cables etc. reconnecting and re-commissioning of the actuators is to be done. d) Testing and checking the remote / local operation in Auto as well as Manual mode. e) Fixing of instruments if supplied as loose items. f) Attending to any defects till the contract period.
1.15.2.3	**FLOW METERS / SWITCHES** a) Checking the calibration and servicing if required. b) Setting the alarm value c) Replacement of defective components if any
1.15.2.4	**LIMIT SWITCHES & LEVEL SWITCHES** a) Checking the operation b) Replacing defective components if required
1.15.2.5	**SOLENOID VALVES** a) Checking the healthiness of coil b) Checking the operation c) Replacement of defective components if required.
1.15.2.6	**TEMPERATURE ELEMENTS (MOTORS AND GENERATORS WINDING AND BEARING)** a) Checking the healthiness b) Replacement of defective element (only for bearing)
1.15.2.7	**DIRECT WATER LEVEL GAUGES (REMOTE & LOCAL)** a) Checking the calibration b) Fixing of bulbs and extending Power supply c) Replacing defective components
1.15.2.8	**INSTRUMENTS MOUNTED ON THE EQUIPMENTS / SKIDS / PANELS** Scope of work covers removal, re-calibration, re-fixing, and re-termination of cables, checking the continuity, replacing any defective parts or replacing the

	total instrument, if required.
1.15.3	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.
1.15.4	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. Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However, contractor has to take proper care of the equipment issued to him.
1.15.5	All the tests at various stages shall be repeated till all the equipment satisfy the requirement of BHEL / Customer. Any rectifications required shall have to be done / redone by the contractor at his cost.
1.15.6	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.
1.15.7	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.
1.15.8	In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
1.15.9	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 programmes made to achieve the schedule agreed with customer.

1.15.10	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 the system to customer.
1.15.11	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.
1.15.12	The contractor shall carryout any other test not listed in the tender as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
1.15.2.13	It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, even if commissioning of equipment is delayed due to reasons not attributable to the contractor

VOLUME-IA PART- I CHAPTER-XVI
PAINTING

1.16.0.0	**PAINTING**
1.16.1.0	FINAL PAINTING **The scope of the work will comprise of but not limited to the following:**
1.16.1.1	The scope of work shall also include 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/as specified by the Engineer.
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. Spray painting gun and compressed air arrangement has to be made by the contractor.
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.
1.16.2.0	**PRESERVATION / TOUCH UP PAINTING**
1.16.2.1	Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other consumables like wire brushes, emery paper, cotton waste, cloth etc., at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.
1.16.2.2	Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling,

	the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint are to be applied on all the bare / unpainted surfaces. Touch up painting is generally required for trays, control panels.
1.16.2.3	All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
1.16.2.4	Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipment under this tender specification right from pre- assembly stage to till the equipment is cleared for final painting.
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.
1.16.2.7	**Paint Shade of transformers/Busducts: (**Will be furnished during execution of the works at site