



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

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

CONTENTS

Sl. No.	DESCRIPTION	Chapter	No. of Pages
Vol IA	Part-I: Contract specific details		
1	Project Information	Chapter-I	02
2	Scope of works	Chapter-II	04
3	Facilities & Consumables in the scope of Contractor / BHEL (Scope Matrix)	Chapter-III	10
4	T&Ps and MMEs to be deployed by Contractor	Chapter-IV	08
5	T&Ps and MMEs to be deployed by BHEL on sharing basis	Chapter-V	03
6	Time Schedule	Chapter-VI	02
7	Terms of Payment	Chapter-VII	03
8	Taxes & Duties	Chapter-VIII	02
9	Weight schedule/BOQ	Chapter-IX	05
10	General	Chapter-X	11
11	Foundations, Grouting and Civil Works	Chapter-XI	02
12	Material Handling, Transportation & storage	Chapter-XII	03
13	Scope of work-Detailed	Chapter-XIII	17
14	Progress of work	Chapter-XIV	02
15	Testing and Commissioning	Chapter-XV	06
16	Painting	Chapter-XVI	03
Vol IA	Part-II: Technical specifications		
1	Corrections / Revisions in Special Conditions of Contract, General Conditions of Contract and Forms & Procedures	Chapter-1	05
2	Data Sheet	Chapter-2	02
3	General Technical Requirements and Guidelines for Installation, Testing, Commissioning	Chapter-3	21
4	T&P Hiring Charges	Chapter-4	12
5	Health, Safety & Environment Plan for Site Operations	Chapter-5	131

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – I CHAPTER – I PROJECT INFORMATION

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

PROJECT INFORMATION

1.1.1.	Project Title	:	2x660 MW Udangudi Super Critical Thermal Power Project
1.1.2.	Plant capacity	:	2x660 MW
1.1.3.	Type of project	:	Green Field
1.1.4.	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.1.5.	Plant site location	:	Kallamoli - 628203, Tiruchendur Taluk, Tuticorin District., Tamil Nadu.
1.1.6.	Nearest Village	:	Udangudi
1.1.7.	Nearest Town & City	:	Tuticorin at 41 KM
1.1.8.	State Capital	:	Chennai (approx..655 Km)
1.1.9.	Nearest Railway Station	:	Thiruchendhur at 8 KM
1.1.10.	Nearest Airport	:	Domestic airport at Tuticorin (41 KM)
1.1.11.	Nearest Seaport	:	Tuticorin Port (45 KM)
1.1.12.	Meteorological Condition		
1.1.12.1.	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
1.1.12.2.	Site Elevation	:	(+)2.8 Meter above MSL
1.1.12.3.	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	41°C
b.	Annual Minimum Mean Temperature	:	22.3°C
c.	Dry bulb Temperature(DBT) for Design Purpose	:	Max 41°C & Min 17°C

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.1.12.4.	Relative Humidity for Design purpose	:	62-84 %
1.1.12.5.	Annual Rainfall		
	Average	:	384.4 mm to 718.2 mm
1.1.12.6.	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)
1.1.12.7.	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
1.1.12.8.	Seismic zone	:	Zone: II as defined in IS:1893-2002 (Part-IV)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME IA PART I CHAPTER II **SCOPE OF WORKS**

1.2.1. The scope of works covers C&I works of Units 1 and BOP areas of 2x660 MW Udangudi Super Critical Thermal Power Project as mentioned below, including supply of labour, tools and plants. The Scope of the works is indicative but not limited to the given below.

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

1.2.2. The scope of works consists of following works.

1.2.2.1. Package 1 broadly consists of C&I works pertaining to the following:

- ❖ Unit 1 (Main Plant)
- ❖ Aux. Boiler
- ❖ Fire water Pump house
- ❖ Sea water intake and out fall pump house
- ❖ RODM, Compressor House, CWPH, CHP & AHP and BOP areas like admin building, service building, ESP MCC. etc. for Master & slave clock system.
- ❖ C&I works in BOP areas.

1.2.3. **Note:** The above provided list is indicative only. Any other area not mentioned above, but required for completion of the scope of the works, shall be deemed to have been included in the bidder scope under this contract. Such work will be executed under this contract by bidder as per the direction of Engineer in charge.

1.2.4. **SCOPE OF C&I WORKS IN GENERAL (AS APPLICABLE):**

1.2.4.1. **Preassembly, Erection, Testing and Commissioning, Trial operation and reliability operation of the following (as applicable) :**

- (i) All types of Field Instruments (Gauges/Switches/Transmitters/Elements) like Temperature, Pressure, Flow (Paddle Wheel/DP/Ultrasonic, etc types of Local/Remote), Level, Density instruments (Local & remote) and special instruments like PD type Mass Flowmeters, etc.
- (ii) All Analyzers-Oxygen, HF, Flue Gas (SOX/NOX/CO), Mercury, NH₃, CO, SOX, NOX & Opacity.
- (iii) Vibration Monitoring System, Turbine Supervising Control and Monitoring System. Please refer the detailed scope of works in relevant chapters. and commissioning (assistance)
- (iv) SWAS system with analyzers i.e. (Conductivity, Sodium, Iron, Silica, Chloride, Turbidity, Dissolved Oxygen, pH)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- (v) Microprocessor based flame scanner system, H.E.A Exciter system, Acoustic Steam Leak Detector, Coal Bunker Level Monitor system
 - (vi) Large Video Screen System
 - (vii) UPS & Battery System of different kVA & AH ratings
 - (viii) Wireless communication, Station LAN, OPC Connectivity to all PLC (or) off site DCS wherever required
 - (ix) All type of Control Room instruments like Recorders, Indicators, Microprocessor based panels, DCS system and its accessories like system panels, Network Panels, Network Enclosures, PCs, Laptops, Printers, Computer, Furniture etc.
 - (x) All type of Pneumatic Power Cylinders, Controllers, Limit Switches, etc.
 - (xi) All type of Hardware like impulse pipes, Cable trays & tray supports, instrument airline, etc.
 - (xii) Master Clock system
 - (xiii) Control & Instrumentation works associated with Water Systems.
 - (xiv) UPS, ACDB, Battery Chargers, Battery Health Monitoring panels, DCDB, Power Distribution Boards etc.
 - (xv) All type of Local/Remote control panels and LGB, LIE, LIR, Network Enclosures, Junction Boxes, Pushbutton stations.
 - (xvi) Control & Instrumentation works associated with Fire Protection System (FPS) such as WBFPS/MVWSS/HVWSS/FBFPS/FDA/IGES systems like Remote IO, Fire Alarm Panels, Repeater Panels, FDA/FPS panels, Fire Detectors, Modules, Power, Control & Digital LHS cables, OFC & Splicing, Instruments, etc.
 - (xvii) Any other items that have not been specifically indicated, but required for completing installation of C&I Package.
 - (xviii) Laying, termination & testing of all types of power/control/instrumentation cables/Special Cables, etc.
 - (xix) Laying & Splicing of Optical Fiber Communication Cables
 - (xx) Calibration of instruments at site with the contractor's own calibration and testing equipment under the supervision of BHEL/Customer Engineers.
- 1.2.4.2. **Testing & Commissioning of the following - Erected by other contractors (includes cabling, tubing, removing, calibrating, testing, etc as required)**
- (i) All types of Pneumatic/ Motor Operated Valves/ Actuators/ Power Cylinders/ Controllers and Relief Valves.
 - (ii) Temperature Elements of all the HT Drives
 - (iii) Bidirectional Drives and Unidirectional Drives (HT/LT Drives) & Limit Switches

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- (iv) Removal, Calibration and re-fixing of the instruments in various systems as specified in the BOQ
- (v) Dosing Systems (Oxygen, NaOH, Ammonia & Hydrazine)
- (vi) Demonstration of the Mechanical and C&I Lab instruments. This includes transportation of the instruments from the stores to the place of erection, installing / setting up the instruments and commissioning / providing assistance to the OEM for demonstrating the instruments to the customer.
- (vii) Calibration of instruments at site with the contractor's own calibration and testing equipment under the supervision of BHEL/Customer Engineers.

1.2.4.3. **Others:**

- (i) Final Painting including supply of paints, as detailed in scope of respective item/equipment.
- (ii) Supply of all consumables required for installation as detailed elsewhere in the specification.
- (iii) Embossing Permanent nomenclature on equipment erected/ Trays/ panels/ wherever required as per site requirement.
- (iv) Necessary arrangements for Protecting and safe guarding the Erected equipment from any damages and pilferages.
- (v) Fabrication and installation of steel supports wherever required..

1.2.4.4. **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 within the quoted rate.
- (ii) Contractor shall have valid license to carry out the work indicated in the BOQ.
- (iii) BHEL will provide OEM's technical support for commissioning of various proprietary type special instruments/systems like Vibration Monitoring System, SWAS, Flue Gas Analyzers, Master Clock System, Coal Bunker Level Monitoring System, LVS System, Furnace Flame Viewing System, EPBAX, C&I Lab, Wireless Communication, Station LAN, OPC Connectivity to all PLC (as applicable), etc. The contractor shall carry out the works as per instructions of BHEL/ OEM's Engineer

1.2.5. **EXCLUSIONS:**

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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.

- 1.2.6. The scope of work covers identification of items at stores / yards, checking, reporting the damages if any, loading, transportation, unloading at Contractor's stores / working yard, keeping in safe custody in contractor's stores, pre- assembly, calibration, checking, erection, testing and commissioning, supply of consumables like electrodes, gas, cable dressing materials, tag plates, PVC sleeves for wire marking, lugs (specific sizes), specific type of fasteners, paints and its consumables, T & P, Material handling equipment's, Testing instruments, deployment of skilled / unskilled manpower, engineers / supervisors, returning of un-used materials / items to BHEL stores.
- 1.2.7. The scope of specification covers the material receipt from BHEL stores, transportation to erection site, installation, testing and commissioning of the equipment, hardware, software communication along with accessories as detailed in Bill of Materials.
- 1.2.8. 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 BOM.
- 1.2.9. **Note:** FOR BOQ & FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT CHAPTERS IN THIS BOOK

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

SI.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.1.	ESTABLISHMENT			
(i)	FOR CONSTRUCTION PURPOSE:			
A	Open space for office	Yes		Free
B	Open space for storage	Yes		Free
C	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
D	Bidder's all office equipment's, office / store / canteen consumables		Yes	
E	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
F	Firefighting equipment's like buckets, extinguishers etc.		Yes	
G	Fencing of storage area, office, canteen etc. of the bidder		Yes	
(ii)	FOR LIVING PURPOSES OF THE BIDDER			
A	Open space		Yes	
B	Living accommodation		Yes	
1.3.1.2.	ELECTRICITY			
(i)	Electricity For construction purposes			Chargeable as per prevailing TANGEDCO tariff

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
	PART I			
A	Single point source	Yes		Refer clause 1.3.4
B	Further distribution for the work to be done which include supply of materials and execution		Yes	
(ii)	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	
A	Distribution from single point including supply of materials and service		Yes	
B	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
(iii)	Duties and deposits including statutory clearances for the above		Yes	
(iv)	Demobilization of the facilities after completion of works		Yes	
(v)	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc on the above lines		Yes	
1.3.1.3.	WATER SUPPLY			Refer Cl. 1.3.5
(i)	For construction purposes:		Yes	
A	Making the water available at single point		Yes	
B	Further distribution as per the requirement of work including supply of materials and execution		Yes	
(ii)	Water supply for bidder's office, stores, canteen etc.		Yes	
A	Making the water available at single point		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
	PART I			
B	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4.	LIGHTING			
A	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site / area		Yes	
B	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.5.	COMMUNICATION FACILITIES for site operations of the bidder	-		
A	Telephone, Fax, internet, intranet, email etc (min 2 Nos of PC & Printer) – 2 Data entry operator with computer knowledge		Yes	
1.3.1.6.	COMPRESSED AIR SUPPLY	-		
A	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc		Yes	
B	Installation of above system and operation & maintenance of the same		Yes	
C	Supply of the all the consumables for the above system		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.2.	PART II			
	ERECTION FACILITIES			
1.3.2.1.	Engineering works for construction	Yes		
1.3.2.2.	Providing the erection drawings for all the equipment covered under this scope	Yes		
1.3.2.3.	Drawing for construction methods		Yes	In consultation with BHEL
1.3.2.4.	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	In consultation with BHEL
1.3.2.5.	Shipping lists etc for reference and planning the activities	Yes		
1.3.2.6.	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL.
1.3.2.7.	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	As per requirement of BHEL targets
1.3.2.8.	Weekly erection schedule based on SI No 1.3.2.1.6		Yes	
1.3.2.9.	Daily erection / work plan based on SI No 1.3. 2.1.7		Yes	For daily monitoring meeting at site
1.3.2.10.	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	In consultation with BHEL
1.3.2.11.	Preparation of preassembly bay		Yes	
1.3.2.12.	Laying of racks for gantry crane if provided by BHEL or brought by the contractor / bidder himself			Not applicable

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.3.3. **OPEN SPACE**

- 1.3.3.1. Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, contractor's stores shed(s), fabrication yard and storage area at the job site.
- 1.3.3.2. BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements. Contractor has to make his own arrangements for labour colony.

1.3.4. **ELECTRICITY:**

- 1.3.4.1. In general, construction power will be provided to the contractor on prevailing rates of TANGEDCO on chargeable basis at one single point by BHEL. The contractor 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 required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the contractor. Any dispute, BHEL engineer's decision shall be final and binding on contractor.

Construction power prevailing charges are as below,

The present LT tariff VI rate of TANGEDCO is:

- a) Consumption charges at Rs.12.25 per unit
- b) Maximum demand (MD) charges as applicable per month
- c) Low Power Factor (LPF) charges
- d) Electricity Tax on total amount
- e) Any other miscellaneous charges charged by M/s TANGEDCO pertaining to construction power supply.

Note - The TANGEDCO tariff and tax may vary from time to time and the same is applicable for the bidder.

- 1.3.4.2. Any other charges, duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.
- 1.3.4.3. Provision of distribution of electrical power from the given points to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State/ BHEL / their customer with

TECHNICAL CONDITIONS OF CONTRACT (TCC)

appropriate statutory requirements shall be the responsibility of the tenderer / contractor.

- 1.3.4.4. Necessary “Capacitor Banks” to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor’s bills.
- 1.3.4.5. Contractor has to make their own arrangements for electricity requirement for labour colony at their cost. Any duty, deposit involved in getting the Electricity for contractors use i.e. Office shed, labour colony etc shall be borne by the bidder
- 1.3.4.6. 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.
- 1.3.4.7. As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites / non availability of power source near work area, contractor should make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown / failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.
- 1.3.5. **CONSTRUCTION WATER:**
 - 1.3.5.1. The contractor shall make his own arrangements of water suitable for construction purpose to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.
- 1.3.6. **DRINKING WATER:**

Bidder shall provide drinking water at the work spot at their cost.
- 1.3.7. **ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]**

Contractor has to provide at BHEL office, minimum two (02) computers and printers along with refilling of cartridges whenever required (along with one operator per PC) for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate. BHEL reserves the right to make alternative arrangement at the risk and cost of the contractor, if the required nos of PCs are not deployed by the contractor.
- 1.3.8. **CONSUMABLE**
 - 1.3.8.1. Such of those consumables as indicated as consumables provided by BHEL, alone will be provided to the contractor by BHEL free of charge for erection activities. Other required consumables like electrodes, all gases, solvent cement for CPVC Pipes and other materials for this scope of work are to be arranged by the contractor at their cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.3.8.2. All the required electrodes (in contractor's scope) as approved by BHEL shall be arranged by contractor at their cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
- 1.3.8.3. All electrodes including stainless steel electrodes required for shall be arranged by the contractor at their cost. The bidder shall use the BHEL/Customer approved quality welding electrodes only.
- 1.3.8.4. The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless steel), all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding and pre-assembly materials, hardware items etc. required for temporary works such as supports, scaffoldings, bed are to be arranged by them. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by them.
- 1.3.8.5. All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.
- 1.3.8.6. In the event of failure of contractor to bring necessary and sufficient consumables, BHEL shall arrange for the same at the risk and cost of the contractor. The entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.
- 1.3.9. **LIGHTING FACILITY (with ELCB):**
- 1.3.9.1. Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, and contractor's material storage area etc. at his cost.
- 1.3.10. **MATERIAL SUPPLY:**
- 1.3.10.1. 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.
- 1.3.11. **POSSESSION OF GENERATORS:**
- 1.3.11.1. 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 shall only be given and contractor is not entitled for any compensation. It shall be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

the responsibility of the contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have at least 2 Nos. of diesel operated generator sets to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by the contractor. This may also be noted while quoting. No separate payment shall be made for this contingency.

1.3.12. **GASES**

- 1.3.12.1. All the required gases like Oxygen / Acetylene / argon /Nitrogen required for work shall be supplied by the Contractor at their cost. It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of these gases. Non-availability of gases cannot be considered as reason for not attaining the required progress.
- 1.3.12.2. BHEL reserves the right to reject the use of any gas in case required purity is not maintained.
- 1.3.12.3. The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.3.12.4. The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.

1.3.13. **ELECTRODES SUPPLY AND STORAGE**

- 1.3.13.1. The bidder shall use the BHEL / Customer approved quality welding electrodes only.
- 1.3.13.2. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
- 1.3.13.3. Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate. Contractor shall submit weekly/ fortnightly/ monthly statement/ report regarding consumption and available stock of all types of electrodes for avoiding stoppage of work on consumable scarcity.
- 1.3.13.4. Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at their own cost by the contractor.
- 1.3.13.5. All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at their cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.3.13.6. In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's first subsequent bills at market value plus departmental charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.
- 1.3.13.7. BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at their cost without loss of time.
- 1.3.14. **OTHER FACILITIES**
- 1.3.14.1. Adequate waterless urinals [at least 2 nos per level] shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, with proper disposal arrangement.
- 1.3.15. **MATERIALS /CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR AT THEIR COST FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENTS/ITEMS.**
- 1.3.15.1. All welding electrodes, filler wires, gases shall be arranged by the contractor at their cost.
- 1.3.15.2. Supply of paints, Ferrules, lugs for sizes up to 2.5 sq mm shall be in the scope of the contractor within the quoted rate.
- 1.3.15.3. **Other items:**
- (i) Provision for Temporary scaffoldings
 - (ii) Insulation tapes
 - (iii) Paints required for primer coating & final coating and for protective coating. Paint of approved colour, consumables like thinner brushes, emery paper etc.,
 - (iv) Solder wire (Lead 60/40)
 - (v) Protocol / calibration report sheets as per BHEL format
 - (vi) Panel / JB sealing compound material (for cable entry from bottom / top of panel)
 - (vii) Materials required for cable dressing (GI / Aluminium Flats, PVC Cable ties, etc)
 - (viii) Anchor fasteners for wall mounted cable trays & JBs wherever required.
 - (ix) PVC wire marker sleeves and tag plates
 - (x) Lugs of size 2.5 sq.mm and below

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- (xi) Ferrules
- (xii) "U" clamps with nuts and washers for impulse pipes and GI pipe clamping.
- (xiii) Tag Plats-Al/Fiberglass/Stainless Steel
- (xiv) Insulation Tapes
- (xv) Teflon Tap for GI pipe coupling
- (xvi) Fastener for mounting JB, Local PB boxes and earthing flats.
- (xvii) 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.

1.3.16. TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS

1.3.16.1. CABLE LUGS:

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

1.3.16.2. FERRULES

Colour of Ferrules	Yellow/White
Colour of Engraving	Black

1.3.16.3. TAGS:

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

1.3.17. CONTRACTOR'S OBLIGATION ON COMPLETION:

- 1.3.17.1. On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instructions 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

1.4.1. 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.

1.4.2. The following minimum Instruments / T&P shall be arranged by contractor in sufficient number as required to carry out the job simultaneously in more than one area. The list is tentative and not exhaustive.

A. List of Recommended Instruments for Erection, Testing & Commissioning.

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 :	As required
	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
05	Standard Temperature Gauges as below :	As required
	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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No.	Description	Quantity
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	Torque wrench	As required
21	AC Voltmeter 0-125 ; 250 ; 625V	As required
22	AC Ammeter 0-2A ; 10A	As required
23	Analog Multimeter Motwane Make	As required
24	Digital Multimeter 3 1/2 Digit	As required
25	Digital Multimeter 4 1/2 Digit	As required
26	Wire wrapping tool	As required
27	Oscilloscope	As required
28	Soldering irons, soldering pump, Vacuum cleaner, Air blower etc.	As required

B. List of Recommended Tools & Plants

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" , 1/2" , 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	Allenkey sets	As required
10	Bench vice	As required.
11	Spirit level	As required
12	Tap sets for both BSP & NPT threads upto 1 "	As required
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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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:

- a) T & Ps mentioned in above list are the suggestive requirement considering parallel working. However, mobilization schedule, quantity/numbers, capacity and period of T&Ps deployment will be mutually agreed at site as per actual requirement and contractor has to adhere to the same.
- b) List of T&Ps required for the completion of entire scope of works shall be listed by the contractor and approval shall be obtained from BHEL Site. Numbers / time of requirement will be reviewed from time to time at 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.
- c) Vendor will give advance intimation prior to dispatch. Also on completion of the respective activity, demobilization of T&Ps 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.

1.4.3. ACCURACY REQUIREMENT OF TESTING INSTRUMENTS

SI.No.	Instrument / Tool	Range	Accuracy	Dial Size
01	Digital Multimeter	Voltage 200 mV to 1000 V DC	$\pm 1\% + 1$ digit	
		Philips Voltage 200 mV to 1000 V AC	$\pm 1\% + 1$ digit	
		Philips Current 20 mA to 20 A AC	$\pm 0.8\% + 1$ digit	
		Resistance (HCl) 2120 200* to 20 M*	$\pm 0.5\% + 1$ digit	
		Resistance (Hcl) 2105 200* to 200M*	$\pm 0.25\% + 3$ digits	
		Hcl Voltage 200 mV to 750 V	$\pm 0.8\% + 1$ digit	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No.	Instrument / Tool	Range	Accuracy	Dial Size
		Philips Current 20 mA to 20 A DC	$\pm 0.5\%$ + digit	
		Hcl Current 200 mA to 010 A AC	$\pm 1\%$ + digit	
02	Analog Multimeter	Voltage 2.5 to 2500V AC	$\pm 1.0\%$	
		Current 100 mA to 10A AC	$\pm 2.0\%$	
		Current 250 micro A to 1A DC	$\pm 1.5\%$	
		Resistance upto 100 ohms	$\pm 3.0\%$	
		Voltage 2.5 V to 2500 V	$\pm 1\%$	
03	MV/mV Source	0 to 200 mA / 200mV	0.2%	
04	Hand operated Megger 500V /1000 V	Upto 200 m Ohms	$\pm 5\%$ at Centre scale	10"
05	Standard Pressure Gauges	0 to 1 kg/cm ²	$\pm 0.25\%$ LC- 0.02 kg/ cm ²	10"
		0 to 6 kg/cm ²	$\pm 0.25\%$ LC- 0.1 kg/ cm ²	10"
		0 to 10 kg/ cm ²	$\pm 0.25\%$ LC- 0.02kg/ cm ²	10"
		0 to 25 kg/ cm ²	$\pm 0.25\%$ LC- 0.25kg/ cm ²	10"
		0 to 60 kg/ cm ²	$\pm 0.25\%$ LC- 0.1kg/ cm ²	10"
		0 to 250 kg/ cm ²	$\pm 0.25\%$ LC- 2.5kg/ cm ²	10"
		0 to 400 kg/ cm ²	$\pm 0.25\%$ LC- 2.5 kg/ cm ²	10"
		0 to 600 kg/ cm ²	$\pm 0.25\%$ LC- 2.5 kg/ cm ²	10"
		0 to 1000 kg/ cm ²	$\pm 0.25\%$ LC- 1.0 kg/ cm ²	10"
06	Dead Weight Tester	0 to 400	LC - 5 kg/cm ²	
		0 to 600	LC - 5	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No.	Instrument / Tool	Range	Accuracy	Dial Size
			kg/cm ²	
07	Standard Hg in glass Thermometer	0 to 100°C	LC - 1°C	
		0 to 110°C	LC - 1°C	
		0 to 250°C	LC - 1°C	
		0 to 150°C	LC - 1°C	
		0 to 360°C	LC - 1°C	
		0 to 100°C	LC - 1°C	
08	Single Phase Variac	15 A Capacity	N/A	
09	Power Pack	0 to 50 V DC, 3A	± 2%	
10	Vibration Measuring Equipments	Velocity up to 50 mm/sec	± 0.5% mm/sec	
		Displacement upto 300 microns	± 2 microns	
11	Tong tester	0/300/600 A AC	± 5%	
		0 to 300 A DC	± 5%	
12	Tacho Meter (Hand held)	0 to 4000 rpm	± 5%	
13	Phase Sequence Meter		N/A	
14	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	± 5% at Centre Scale range	
15	DC Ammeter	0 to 300 A	± 10%	
16	DC Voltmeter	0 to 500 V	± 10%	

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

their cost.

- d. Necessary accessories for the above shall also be provided by the contractor.
 - e. Contractor shall send all the instruments, equipment, measuring tools etc. for testing and calibration periodically from time to time, as required by BHEL, and necessary calibration certificates are to be submitted to BHEL before use.
 - 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.
- 1.4.4. 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&P's during the contract period will be mutually agreed in line with construction requirement
- 1.4.5. Computerized ferrules printing machine (min – 01 No.) shall be provided for making printed ferrules for all the cables.
- 1.4.6. **PROTECTION / HANDLING OF TOOLS AND PLANT ARRANGED BY THE CONTRACTOR**
- 1.4.6.1. Equipment, vehicles, tools and plants and materials brought to site by the contractor from their resources shall have distinctive identification marks and the contractor shall intimate the description and quantity to BHEL in writing.
- 1.4.6.2. All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without extra cost necessary enclosures containers and protective materials for proper storage of materials inside, whenever so instructed by the purchaser without any extra cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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 Part II of Volume IA, Technical Conditions of Contract) as per following cases:
- In case the T&P is specifically listed in “T&Ps to be deployed by Contractor”, ‘Rates of hire charges applicable to outside agencies other than contractors working for BHEL’ will apply.
 - In case the T&P is not specifically listed in “T&Ps to be deployed by Contractor”, ‘Rates of hire charges applicable to contractors working for BHEL’ will apply.
- The hire charges of Capital Tools & Plants are exclusive of operating expenses e.g., Operator, fuel & Consumables and the same shall be arranged by the contractor at their 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.4.6.7.

CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS					
Format No. CP:PEX:FOX					
Name of Site:					
Name of Sub-Contractor:					
Sl.No.	Name of the Instrument	Instrument REGN.No.	Date of Entry / Exit	Periodicity of Calibration	Calibration Details
					Date of Cal: Cal. Agency: Next Due Date:
					Date of Cal: Cal. Agency: Next Due Date:
					Date of Cal: Cal. Agency: Next Due Date:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

- 1.5.1. List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis is as below.
 - 1.5.1.1. EOT Crane at TG Hall without operator based on requirement.
- 1.5.2. EOT crane without operating personnel shall be made available in the TG Hall free of charge. The contractor has to arrange operator for EOT Crane. EOT crane will be allocated for execution of C&I work including shifting the panels within power house building on sharing basis at free of hire charges. The decision of BHEL Engineers will be final with regard to allotment of crane.
- 1.5.3. Experienced Crane operator for EOT crane to be arranged by the bidder at their cost.
- 1.5.4. Providing manpower assistance required for free movement of Trailing cable of EOT Crane is also scope of the bidder at their cost.
- 1.5.5. The availability of crane is likely to be hampered from time to time due to routine preventive maintenance or breakdown maintenance. Contractor has to make alternative arrangement or plan / modify / alter their activities to suit the above conditions and the contractor will not be liable for any compensation or extension of time due to this non-availability, for maintaining the erection schedule.
- 1.5.6. In the event of the crane not available for longer duration due to major breakdown or any other reasons, BHEL will reschedule the work in consultation with bidder and direct the bidder to concentrate on other areas till such time the cranes are made available.
- 1.5.7. Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.5.8. All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at their cost.
- 1.5.9. 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.
- 1.5.10. BHEL may provide either BHEL owned or hired 75T (or above capacity) cranes as per site requirement for erection at the discretion of BHEL.
- 1.5.11. In the event of providing BHEL owned cranes:
 - 1.5.11.1. BHEL shall provide crane operator at free of charges.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.5.11.2. Fuel and lubricants are to be arranged by the contractor within the quoted rate.
- 1.5.11.3. Maintenance for the BHEL own cranes shall be carried out by BHEL. However, all the consumables for the maintenance of BHEL own cranes shall be provided by the contractor within the quoted rates. The Tentative List of consumables required to be provided by contractor from the BHEL/OEM recommended supplier is as below:
- a. Engine Oil
 - b. Fuel Filters
 - c. Air Filters
 - d. Hydraulic Oil
 - e. Hydraulic Filters
 - f. Gear Oil
 - g. Engine Oil Filter
 - h. Oil Separator Filter
 - i. Rope
 - j. Grease
 - k. Maintenance for the BHEL cranes shall be carried out by BHEL. The bidder shall extend support if required for routine maintenance works without any additional cost.
- 1.5.12.** In the event of providing hired cranes:
- 1.5.12.1. Crane Operators for hired cranes will be provided by BHEL, free of charges.
- 1.5.12.2. Fuel and lubricants are to be arranged by the contractor within the quoted rate.
- 1.5.13.** 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.
- 1.5.14.** Besides the T & P mentioned above, which is being made available to the contractor on free of hire charges, any additional T & Ps 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.
- 1.5.15.** 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.
- 1.5.16.** All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections shall have to be arranged by the contractor at their cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.5.17.** Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be in the Contractor's scope.
- 1.5.18.** 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.
- 1.5.19.** For the cranes, the required consolidation and preparation for placing crane for operation is under bidder scope and also necessary plates / sleepers required for marching operation shall be provided by the contractor within quoted rates.
- 1.5.20.** 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 sleepers. The sleepers shall be arranged by the contractor at their cost.
- 1.5.21.** The contractor at their cost shall arrange for grouting of anchor points of T&Ps issued to them. Necessary grout materials are to be arranged by the contractor at their cost.
- 1.5.22.** In case of non-availability of any of these equipment, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make arrangement at their cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – I CHAPTER-VI **TIME SCHEDULE**

TIME SCHEDULE

- 1.1.1.1. The entire work of erection testing and commissioning of each package as detailed in the Tender Specification shall be completed within **3 (Three)** months from the date of commencement of work at site.
- 1.1.1.2. During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.
- 1.1.1.3. The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer at site. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

1.1.2. COMMENCEMENT OF CONTRACT PERIOD

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

1.1.3. MOBILIZATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING ETC.,

- 1.1.3.1. The activities for erection, testing etc. shall be started as per directions of Construction manager of BHEL.
- 1.1.3.2. In order to meet project 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.
- 1.1.3.3. 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.

1.1.4. CONTRACT PERIOD

- 1.1.4.1. The contract period for completion of entire work for each package under scope shall be **3 (Three) months** from the “COMMENCEMENT OF CONTRACT PERIOD” as specified earlier.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.1.5. GUARANTEE PERIOD

The guarantee period of 12 months shall commence from the date of handing over of the Unit to Customer (or) Six months from the date of trial operation & COD of the Unit, whichever is earlier.

(Provided all erection, testing, commissioning and pending points works are completed in all respects).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

1.2.1. Terms of Payment:

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

- 1.2.2. Progressive Payment against monthly running bills will be made up to 95 % of the value of **the completed erection** on Pro rata basis as per Clause no 1.7.2.1. to 1.7.2.10. of the following table.

Sl. No.	Activity / Work Description	% of unit rate
PRO RATA PAYMENTS (95%)		
1.6.1.1.	For fabrication and installation of steel materials including LIR/LIE/JB/TTE	
1.6.1.1.1.	Fabrication / Pre assembly and applying primer paint	55%
1.6.1.1.2.	Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	40%
	Total =	95%
1.6.1.2.	For cable trays, tray supports, earthing	
1.6.1.2.1.	On satisfactory completion of work on prorata basis	80%
1.6.1.2.2.	On completion of drawing or area wise on prorata basis	15%
	Total =	95%
1.6.1.3.	For Impulse Pipes	
1.6.1.3.1.	On laying and welding on prorata basis and protocol signed	60%
1.6.1.3.2.	On clamping and painting on prorata basis and protocol signed	20%
1.6.1.3.3.	System Charging	15%
	Total =	95%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No.	Activity / Work Description	% of unit rate
PRO RATA PAYMENTS (95%)		
1.6.1.4.	For Special instruments (like Furnace CCTV, analysers, etc)	
1.6.1.4.1.	On laying and welding on prorata basis and protocol signed	60%
1.6.1.4.2.	On clamping and painting on prorata basis and protocol signed	20%
1.6.1.4.3.	System Charging	15%
	Total =	95%
1.6.1.5.	Other items (Items not covered under above heads) etc.	
1.6.1.5.1.	Completion of work(erection, alignment & testing) of the respective item/equipment	80%
1.6.1.5.2.	Completion of Commissioning of the respective item/equipment on pro rata basis.	15%
	Total=	95%
1.6.1.6	Cable laying & Earthing wires	
1.6.1.6.1	Laying/tagging/termination of cables/wires	75%
1.6.1.6.2	Checking, Dressing and clamping	10%
1.6.1.6.3	Loop checking and commissioning	10%
	Total=	95%
1.6.1.7	For UPS/Battery sets/charger	
1.6.1.7.1	Receipt, transport to erection site, checking, placement, assembly, grouting, mounting and wiring of loose components	50%
1.6.1.7.2	Adjustment, alignment, inter connections and pouring of Alkali	20%
1.6.1.7.3	Pre-commissioning test checks and making ready for energization	25%
	Total=	95%
1.6.1.8	For SADC	
1.6.1.8.1	Receipt, transport to erection site, assembly, checking, calibration, fixing and clamping Adjustment, Alignment, on prorata basis and protocol signed	60%
1.6.1.8.2	Pre-commissioning tests, checks and making ready for energization pro rata basis and protocol signed	15%
1.6.1.8.3	Completion of commissioning	20%
	Total=	95%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.6.1.9	STAGE / MILESTONE PAYMENTS (5%)	% of unit rate
1.6.1.9.1	Area cleaning, temp structure cutting/ removal and return of scrap	1%
1.6.1.9.2	Punch List points / pending points liquidation	1%
1.6.1.9.3	Submission of 'As Built Drawings'	1%
1.6.1.9.4	Monthly Material Reconciliation	1%
1.6.1.9.5	Completion of Contractual Obligation	1%
	Total for Stage / Milestone Payments (5%)	5%

- 1.2.3. **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.**
- 1.2.4. PVC & ORC : Not applicable for this contract
- 1.2.5. Security Deposit : Applicable for this contract

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

Goods and service Tax (GST) & Cess

- 1.8.1.1 The successful bidder shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work.
- 1.8.1.2 Contractor's price/rates shall be exclusive of GST & Cess (if applicable) (herein after termed as GST). Contractor shall submit to BHEL the GST compliant tax invoice/debit note/revised tax invoice on the basis of which BHEL will claim the input tax credit in its return. Since this is a works contract, the applicable rate shall be @ 18% GST, as applicable presently.
- 1.8.1.3 Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules wherein the 'Bill To' details will as below:
- BHEL GSTN - 33AAACB4146P2ZL
NAME - BHARAT HEAVY ELECTRICALS LIMITED
ADDRESS - BHEL-PSSR SITE OFFICE, 2X660 MW Udangudi Supercritical Thermal Power Station, Kallamoli Village, Thiruchendur Taluk, Thoothukudi District, Tamil Nadu - 628203
- 1.8.1.4 GST charged in the tax invoice/debit note/revised tax invoice by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return.
- 1.8.1.5 In case BHEL has to incur any liability (like interest / penalty etc.) due to denial/reversal / delay of input tax credit in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.
- 1.8.1.6 Further, in case BHEL is deprived of the Input tax credit due to any reason attributable to contractor, the same shall not be paid or Recovered if already paid to the contractor.
- 1.8.1.7 Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.
- 1.8.1.8 TDS under GST (if/ as & when applicable) shall be deducted at prevailing rates on gross invoice value from the running bills.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

1.8.2 All taxes and duty other than GST & Cess

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

1.8.3 Statutory Variations

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

1.8.4 New Taxes/Levies

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

1.8.5 Direct Tax

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – I CHAPTER IX

WEIGHT SCHEDULE/BOQ

1.9.1 BOQ

Sl. No.	BOQ Ref. No.	Description	UOM	% BRK UP	Qty
1	A.20.14,B.1.11,D.3.9,D.3.10,D.3.13,E.1.3,E.2.4,E.2.5,G.5.2,G.6.2,G.7.5,K.2.1,K.2.5,K.5.13	Pressure Transmitters / DP Transmitters / DP Type flow transmitters/Conductivity Transmitters/DP type LT	Nos	100%	34
2	A.20.1,A.20.2,A.20.10,E.1.8,E.2.10,G.5.6,K.2.3,K.5.8	Level Transmitter (Guided Wave/Ultrasonic/Capacitance Type) along with accessories	Nos	100%	6
3	A.20.4,B.1.2,B.6.1,C.1.1,D.3.7,D.3.8,E.1.1,E.1.2,E.2.3,E.2.6,E.3.1,F.1.4,G.5.1,G.6.1,G.7.6,K.2.2,K.5.7,K.6.14,K.7.4,K.7.5,K.7.7	Pressure / DP Gauge/Reverse Rotation Indicators	Nos	100%	120
4	A.20.6,B.1.3,B.6.3,C.1.2,D.3.3,E.1.12,E.2.2,F.1.5,G.5.4,G.6.4,G.7.4,G.11.1,G.11.2	Temperature Gauge	Nos	100%	94
5	A.20.5,B.1.4,B.6.2,D.3.1,D.3.12,D.5.12,E.1.4,K.3.1,K.4.1,K.5.6,K.7.11	Pressure / Differential Pressure Switch / Temperature Switch	Nos	100%	73
6	A.20.7,A.20.8,B.6.15,E.4.2,G.5.5	Level Switches (RF/Float/Capacitance/Conductivity type) along with accessories	Nos	100%	6
7	A.20.3,D.3.2,D.3.5,E.1.5,E.1.6,E.2.9,E.4.1,G.2.1,G.5.3,G.6.3,G.7.1,G.7.2	Temperature Elements(RTD/Thermocouple with Thermowell/RTD with Thermowell) / Flow Elements	Nos	100%	10
8	B.1.10,B.6.18,D.3.11,E.1.11,G.7.7	Position Transmitters	Nos	100%	6
9	B.6.9,B.6.10,B.6.11,B.6.12,B.6.13	MTM T/C (Route Length 20 to 28 MM) - 8MM OD	Nos	100%	1
10	A.20.13,J.1.1	Flow Transmitters (Other than DP type)	Nos	100%	4
11	A.20.12,B.11.1.1,B.11.1.2,B.11.1.3,D.4.4	Air Filter Regulator-(1/4 inch -1 inch)	Nos	100%	7
12	K.6.3	Multisensor Detectors	Nos	100%	68
13	K.6.12	Hooter cum Strobes	Nos	100%	30
14	K.6.11,K.6.13	Modules	Nos	100%	79
15	K.6.10	Digital Controllers	Nos	100%	45
16	K.7.2	Release Unit with Solenoid, CPG & Actuator	Nos	100%	9
17	K.6.15,K.7.13	EXIT/WARNING Signs	Nos	100%	98

TECHNICAL CONDITIONS OF CONTRACT (TCC)

18	A.23.2.A	Installation of mounting pad, brackets for shaft vibration, key phasers for Package 1. This broadly covers equipments of Unit#1, CWPB of Unit#1 and Common, Compressor Pump House, CPU, Fire Water Pump House, Sea Water Intake Pump House, RODM	Set	100%	0.2
19	A.27.1	2X20 kVA UPS	SET	100%	1
20	A.26.7.A	Battery 2140 AH/1820AH made up of around 252 cells with accessories for UPS System for Main Plant	SET	50%	0
				20%	1
				30%	1
21	A.27.6	Battery made up of around 110 cells, 200AH cells with accessories for UPS System for offsite locations	SET	50%	4
				20%	7
				30%	7
22	K.1.8,K.5.3	Battery & Battery Charger (including panels and accessories) for Fire Protection System	SET	100%	6
23	A.26.2,A.27.2	ACDB	Nos	100%	2
24	G.1.3	Grounding Brush Monitor	SET	100%	1
25	A.42.2	Slave Clock (RS 485 based)/NTP Based	Nos	100%	50
26	A.26.6,A.27.3	Battery Health Monitoring System Panels	Nos	50%	13
				20%	22
				30%	22
27	K.1.6,K.5.2	Diesel Engine Control Panel (Approx. dim 1200mm(h) x 600mm(w) x 300mm(b))	Nos.	100%	1
28	K.3.3,K.4.3,K.5.5	Deluge Valve Control Panels	Nos	100%	56
29	A.2.1,A.3.1,A.3.4,A.4.1, A.4.2,A.9.1,A.10.1,A.10.3,A.11.2,A.12.1,A.13.1, A.15.1,A.18.1,A.23.1.3, G.13.1	Suite of One Cubicles	Nos	100%	2
30	A.1.1,A.2.2,A.3.5,A.8.1, A.9.2,A.10.2,A.11.1,A.12.2,A.13.2,A.15.2,A.18.2,A.23.1.2	Suite of Two Cubicles	Nos	100%	1
31	A.36.1.3,A.36.1.4,A.36.1.5,A.36.1.6,A.36.2.2,A.36.3.3,A.36.3.4,A.36.3.5 ,A.36.3.6,A.36.3.7,A.36.4.2,A.36.4.3,K.6.17	Printers (Laser Jet/Dot matrix A4/A3/COLOUR/BW)	Nos	100%	29
32	A.21.9,A.23.4,A.36.1.1, A.36.1.2,A.36.2.1,A.36.3.1,A.36.3.2,A.36.4.1,G.13.2,G.13.3,K.6.16	OWS with Monitor/Servers (incl. monitor) /Stations/User PC/OPC Client, along with UPS upto 1kVA	Nos	100%	6
33	A.21.10,A.23.5,A.43.5, K.6.18,A.43.6,K.6.19	Computer Table / Printer Table, along with chairs	SET	100%	18
34	A.23.3,A.31.1,A.31.2,A.31.3,A.31.4,B.9.1,B.9.2, B.9.4,B.9.5,B.9.7,D.5.6, E.4.3,E.6.7,F.1.8,F.1.9, K.7.14	Junction Boxes upto 48 Way	Nos	100%	9
35	B.4.1	SADC	SET	60%	0
				15%	24

TECHNICAL CONDITIONS OF CONTRACT (TCC)

				25%	24
36	B.4.5	Dynavane Filter Pressure Control Damper with SMART positioner	SET	100%	1
37	E.9.10,K.3.2,K.4.2,K.5.4,K.7.8	Solenoid Valves	Nos	100%	49
38	A.26.3	UN 0000 - Uninyvin- Equivalent: 1Cx109 Sq mm Cu	Mtrs	100%	50
39	A.27.7	Uninyvin Cables, size 00 (68.3 sq.mm Cu Cable)	Mtrs	100%	1500
40	A.27.5	Uninyvin Cables, size 00 (68.3 sq.mm Cu Cable)	Nos	100%	30
41	B.7.17,D.5.4.1,K.1.9,K.3.4,K.4.4,K.4.5,K.5.10,K.7.15,K.6.21,K.6.22	2CX1.5 SQMM/2CX2.5 SQMM	Mtrs	100%	1300
42	A.29.4.1,A.29.4.3,B.7.14,D.5.3.1,D.5.4.2,F.4.1,A.42.4,B.7.25,G.4.1	3CX1.5 SQMM/3CX2.5 SQMM/4CX2.5 SQMM/4CX6 SQMM	Mtrs	100%	21856
43	A.29.4.2,A.29.5.1,B.7.15,B.7.18,B.7.19,K.5.9	5CX2.5 SQMM/7CX2.5 SQMM/5CX1.5SQMM	Mtrs	100%	16561
44	B.7.20,B.7.21,D.5.3.2	9CX2.5 SQMM/10CX1.5 SQMM/10CX2.5 SQMM/12CX2.5 SQMM	Mtrs	100%	1500
45	A.29.1.1,A.29.1.4,A.29.2.1,A.29.3.1,A.29.5.2,A.29.5.4,A.42.5,B.7.1,B.7.2,B.7.6,B.7.7,B.7.10,B.7.16,B.7.24,D.5.1.1,F.3.1,J.2.1,J.3.1	2PX0.5 SQMM/ 2TX0.5SQMM/ 2PX1.5SQMM/ 2PX1.31SQMM/ 2PX16AWG KX/NX/G CABLE, Heat Flux Sensor Cable 2P	Mtrs	100%	34191
46	A.29.1.2,A.29.2.2,A.29.3.2,A.29.3.3,A.29.5.3,B.7.3,B.7.8,B.7.11,B.7.13,B.7.22,D.5.1.2,D.5.2.1,E.8.1,J.2.2,J.2.3,J.3.2	4PX0.5 SQMM/ 6PX0.5SQMM, F/G CABLE, 4PX1.31 SQ.MM KX,	Mtrs	100%	10658
47	A.29.1.3,A.29.2.3,A.29.3.4,B.7.4,B.7.9,B.7.12,D.5.1.3,D.5.2.2,J.2.4,J.3.3	8PX0.5 SQMM CABLE, 8PX1.31SQMM KX Type	Mtrs	100%	19522
48	A.29.2.4,A.29.3.5,B.7.5,B.7.23,D.5.1.4,D.5.2.3,J.2.5,J.3.4	12PX0.5 SQMM/ 12PX1.31 SQMM KX CABLE	Mtrs	100%	2435
49	A.29.6.1,A.42.6,G.13.5	CAT-6 UTP CABLES/Ethernet Cables	Mtrs	100%	1200
50	A.26.4,A.27.4,A.42.3	RS-485/RG-58 CABLE	Mtrs	100%	200
51	A.29.6.3,K.6.23	HDPE Conduits	Mtrs	100%	500
52	A.23.6,A.29.6.2,A.42.7,K.6.24	Laying of Optical Fibre Cable	Mtrs	100%	10000
53	A.23.7,A.29.6.4,A.42.8,K.6.25	Splicing of Optical Fibre Cable	Nos	100%	36
54	A.30.1,A.30.3,B.8.1,D.5.5.1,E.8.2,F.1.10	PERFORATED CABLE TRAYS 50 MM WIDE	Mtrs	100%	350
55	A.30.2,A.30.4,B.8.2,D.5.5.2	PERFORATED CABLE TRAYS 100 MM WIDE	Mtrs	100%	200
56	B.8.3,E.8.3,F.1.11	PERFORATED CABLE TRAYS 150 MM WIDE	Mtrs	100%	100

TECHNICAL CONDITIONS OF CONTRACT (TCC)

57	A.41.1,B.12.1,D.5.8,E.7.1,E.7.2,F.1.13,G.10.3,K.5.11	STRUCTURAL STEEL (ISMC/ISMB/ANGLE etc)	MT	100%	2
58	A.32.4,B.11.2.3,B.11.2.6,C.1.8,C.1.9,C.1.10,G.9.5,G.9.6,G.9.7,G.9.8,G.9.9	AS tubes upto 1 inch	Mtrs	100%	200
59	A.32.1,A.32.2,A.32.3,B.11.2.1,B.11.2.2,B.11.2.4,B.11.2.5,C.1.5,C.1.6,C.1.7,E.7.3,E.7.8,G.9.1,F.1.12,G.9.3,G.9.4	CS tubes upto 1 inch, 16X2.6mm, 13.5 X 2.6	Mtrs	100%	600
60	A.22.5,A.32.5,A.32.6,A.32.7,B.11.1.4,B.11.1.5,B.11.1.6,B.11.1.7,B.11.1.8,B.11.2.7,C.1.4,D.5.11,E.7.5,E.7.6,E.7.7	SS upto 1 inch, 12.7x2.1, 6x1.5, Cr. Al. Pipe 21.3 x 3.73mm	Mtrs	100%	200
61	A.33.0	CPVC Pipes	Mtrs	100%	200
62	B.12.2	1/2 inch GI Pipe	Mtrs	100%	500
63	B.13.8	Burner Tilt Shear Pin Failure Indication JB with accessories	Nos	100%	8
64	B.13.1,B.13.6,D.3.15,D.5.9.1,D.5.9.6,G.12.5	Limit Switches/Level Switches	Nos	100%	92
65	B.13.5,D.4.2	Pneumatic Actuators for Dampers	Nos	100%	28
66	H.1.1,D.4.7	RTDs/Thermowell of various drives	Nos	100%	4
67	L	Electronic Earth Pits: Treated Earth pit of Galvanised MS pipe of 65 mm Dia, 3000 mm long perforated with clamp, funnel and accessories including all civil works, filling of earth pit of size min 400x400x3000 mm with alternate layer of charcoal & salt as per IE specification and making of brick chamber, with both side plastering, supply and fixing of manhole with CI cover plate/RCC Slab etc. complete as per IS 3043 (only 3000 mm long, 65 NB Galvanized MS pipe shall be supplied by BHEL; All other accessories as mentioned above are in vendor's scope). 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.	Nos	100%	4
68		Skilled Manpower	Man month		24
69		Semi-Skilled Manpower	Man month		6

The following manpower required to completed milestones i.e. Full load, Trial operation, Area cleaning, temp structure cutting/removal and return of scrap and Punch points/pending points liquidation for a period of Three months (03 months).

Sl No	Description	Qty/Month	Total Qty for three months
1	Impulse Line Fitter (Instrumentation Fitter)	01	03

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2	Welder	01	03
3	Helper	02	06
4	Commissioning Technician	06	18

NOTE:

1. The BOQ Ref. no given above may be linked with the BOQ Ref no in Price bid.
2. The Price bid contains the consolidated list of BOQ with brief description of items.
3. Before quoting in the Price bid, the bidder shall go through the detailed specification of all items of BOQ as well as Scope of Work as specified in relevant Clause of this document.
4. The quantity indicated in the BOQ / Price bid is approximate only and is liable for variation. Payment will be as per actual quantity erected / commissioned as certified by BHEL Engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART –I CHAPTER –X **GENERAL**

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

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

- 1.10.1** The scope of the work will comprise of but not limited to the following:
All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.
- 1.10.1.1 Bidders are requested to furnish the following at PSSR-HQ immediately after release of Letter of Intent (LOI).
- Security Deposit and Additional Security Deposit
 - Unqualified Acceptance of Detailed LOI/Work Order.
 - Rs.100/- Stamp paper for preparation of Contract Agreement
- 1.10.1.2 Bidders are requested to furnish the proof of documents for the following at PSSR-Site.
- Provident Fund (PF) Registration Number
 - Labour License Number
 - Workmen Insurance Policy Number
- 1.10.2 **In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following:**
- 1.10.2.1 BOCW ACT & BOCW WELFARE CESS ACT :**
- 1.10.2.1.1 The Contractor should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice Of Commencement / Completion of Building Other Construction Work) to the respective Labour Authorities i.e.,
- Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.–NTPC, NTPL etc.
 - Appropriate State authorities in respect of the project premises which is under the purview of State Govt.
- 1.10.2.1.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL.
- 1.10.2.1.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.2.1.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.
- 1.10.2.1.5 Contractor shall make remittance of the BOCW cess as per the Act **in consultation with BHEL** as per the rates in force (presently 1%). BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and contribution of Beneficiaries remitted
- 1.10.2.1.6 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as it deems fit. Only upon total compliance to the BOCW Act and also discharge of total payment of Cess under the BOCW Cess Act by the Contractor, BHEL shall consider refund of the Amounts

1.10.2.2 PROVIDENT FUND & MINIMUM WAGES

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

1.10.2.3 OTHER STATUTORY REQUIREMENTS

- 1.10.2.3.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no along with the first running bill.
- 1.10.2.3.2 The contractor 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

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

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

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

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

1.10.2.4 **DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN**

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

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain

TECHNICAL CONDITIONS OF CONTRACT (TCC)

approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.10.1 OTHER GENERAL REQUIREMENTS

- 1.10.1.1 The scope of specification covers the installation, testing and commissioning of the erected equipment / instrument along with accessories as detailed in Bill of Quantity.
- 1.10.1.2 Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting the equipment, aligning, fastening, supporting, cleaning, checking and carrying out statutory tests as required, trial operation, pre-commissioning, commissioning and post-commissioning activities up to the time of completion of commissioning activities and commercial operation of the unit and handing over to customer or till completion contract period (including extended period) whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.
- 1.10.1.3 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.
- 1.10.1.4 It is not the intent to specify herein all details of material. Any item related to this work not covered here but necessary to complete the system will be deemed to have been included in the scope of the work.
- 1.10.1.5 The contractor shall have valid ELECTRICAL LICENCE as required to carry out the scope of work indicated in the BOQ.
- 1.10.1.6 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.
- 1.10.1.7 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

from the methods of erection/commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.

- 1.10.1.8 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations and Field quality plans of BHEL.
- 1.10.1.9 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.
- 1.10.1.10 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.
- 1.10.1.11 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.
- 1.10.1.12 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. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.
- 1.10.1.13 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 any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.
- 1.10.1.14 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.
- 1.10.1.15 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.1.16 Contractor shall remove all scrap materials periodically generated from their working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc., shall be returned to the BHEL stores / customer's stores by the contractor.
- 1.10.1.17 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, to be produced along with the running bill.
- 1.10.1.18 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.,
- 1.10.1.19 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.
- 1.10.1.20 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.
- 1.10.1.21 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.
- 1.10.1.22 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.
- 1.10.1.23 Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
- 1.10.1.24 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.1.25 The contractor must ensure the necessary formalities like availability of gate pass, etc. 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.
- 1.10.1.26 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.
- 1.10.1.27 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 draws at the rate prescribed by manufacturing units.
- 1.10.1.28 No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 1.10.1.29 Contractors shall ensure that all their Staff/Employees are exposed to periodical training program conducted by qualified agencies/ personnel on ISO 9001/2015 Standards.
- 1.10.1.30 For other agencies, such as piping, Boiler, ESP, TG, 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. Some time it may be required to re-schedule the activities to enable other agencies to commence/continue the work so as to keep the overall project schedule.
- 1.10.1.31 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.
- 1.10.1.32 For the purpose of planning, contractor shall furnish to BHEL Site Engineer the estimated requirement of power (month wise) for execution of work in terms of maximum kW demand, before starting the work at site.
- 1.10.1.33 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 their cost. In the event of their failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.
- 1.10.1.34 Prior to erection of any components, inspection to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.
- 1.10.1.35 All the equipment /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.1.36 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 the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 1.10.1.37 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
- 1.10.1.38 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.
- 1.10.1.39 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.
- 1.10.1.40 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, SP Bus duct, heater JB, Transformers are to be done by the contractor as per the requirement decided BHEL Engineer at site.
- 1.10.1.41 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there (if required) and there is no extra cost in this regard.
- 1.10.2 Any modification work required by inspector shall be attended by the contractor. Modifications which had raised due to execution deficiencies are at the cost of contractor whereas modifications which are due to design change shall be treated as extra work.**
- 1.10.3 SITE INSPECTION**
- 1.10.3.1 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.
- 1.10.3.2 The owner / employer or their authorized agents may inspect various stages of work during the currency of the contract awarded to them. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.
- 1.10.3.3 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

- 1.10.3.4 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 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.

1.10.4 MANPOWER REQUIREMENT

- 1.10.4.1 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/Electronics/C&I Engineering Degree with minimum 5 years' experience or Diploma in Electrical/Electronics/C&I Engineering with minimum 10 years of experience in Thermal Power Station.
- c) Area Engineer should have minimum qualification of Diploma in Engineering or any graduate with minimum 3 years of experience in Thermal Power Station.
- d) Supervisor should have a minimum qualification of Diploma in Electrical/Electronics/C&I engineering or any graduate with minimum 3 years of experience in Thermal Power Station.
- e) Lab Technicians should have 2 years' experience in Thermal Power Stations.
- f) Contractor should have one Store Keeper, one Transport Supervisor for the safe transportation of materials.
- g) Planning / safety Engineers should be available and they should have experience in construction field especially in power plant.
- h) Dedicated commissioning engineer should be deployed for commissioning of the equipment.

- 1.10.4.2 There shall be three separate Erection In-charges, each for Boiler, TG, Station C&I. They shall work independently with required manpower, T&P etc., including storage facilities. Each Erection In-charge shall have minimum two erection engineers with adequate Supervisors and Technicians.

- 1.10.4.3 There shall be separate engineers for Planning, Safety and Quality.

- 1.10.4.4 Planning/Safety Engineers should have experience in construction field especially in power plant.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.4.5 Each area engineer shall be provided with minimum four (04) supervisors and adequate number of Technicians / electricians and other erection staff and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately for each unit and the minimum requirement shall be as indicated in previous Clause. Besides, there shall be separate engineers for Planning, Safety and Quality.
- 1.10.4.6 The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor.
- 1.10.4.7 The testing Engineers/supervisors/electricians shall be identified separately for each unit as per the site requirement.
- 1.10.4.8 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.
- 1.10.4.9 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.
- 1.10.4.10 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.
- 1.10.4.11 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.
- 1.10.4.12 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.
- 1.10.4.13 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.
- 1.10.4.14 The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.10.5 DOCUMENTATION

1.10.5.1 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.

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

- a) Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan.
- b) **As built drawings:** After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

1.11.1 FOUNDATIONS, GROUTING AND CIVIL WORKS

- 1.11.1.1 Foundation for the equipment to be erected shall be provided by BHEL/ clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. Minor adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipment plants shall be carried out by the contractor.
- 1.11.1.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., de-watering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form/shuttering work are within the scope this work.
- 1.11.1.3 The contractor at their cost shall arrange for grouting of foundation bolt holes of equipment as specified in the drawings / specification or as advised by the Engineer of BHEL after preparing the foundation top surface for grouting, all the materials for grouting (sand, gravel & cement including special Cement) shall be arranged by the contractor. The grouting has to be done up to basement level. The required consumables like Portland cement, gravel, sand etc., have to be provided by the contractor at their cost. 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 various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates/shims, which may be required for the erection of the equipment/plants will have to be carried out by the contractor without extra cost.
- 1.11.1.5 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipment.
- 1.11.1.6 Foundation pockets are to be cleaned thoroughly before placing the equipment. Verticality of foundation bolts to be checked along with correctness of the threads

TECHNICAL CONDITIONS OF CONTRACT (TCC)

and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.

- 1.11.1.7 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.
- 1.11.1.8 The certificates of the grout are to be submitted to BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc to be arranged by the contractor including the fine aggregates.
- 1.11.1.9 Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates/sheets at site by the contractor to meet site requirement. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.
- 1.11.1.10 Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.
- 1.11.1.11 The contractor at their cost shall arrange for grouting of anchor points of T & Ps issued to them. Necessary grout materials are to be arranged by the contractor at their cost.
- 1.11.1.12 Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.
- 1.11.1.13 Minor civil works like drilling, chipping and punching holes on slabs and brick- walls and grouting related to installation of LIR / LIE / Local Gauge Board, control panels, Junction boxes etc., shall be included in the erection cost of such items. No separate payment is applicable. The scope also includes supply of grouting material. More details regarding scope of civil are given in the respective equipment erection.
- 1.11.1.14 **PROCEDURE FOR GROUTING:** Contractor has to carry out the grouting as per the work instructions for grouting available at site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

1.12.1 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS

- 1.12.1.1 BHEL shall issue materials covered in BHEL scope from their stores at site. The contractor shall collect such materials from BHEL stores and transport to site of work at their cost.
- 1.12.1.2 The contractor shall inspect such materials as soon as received by the contractor and shall bring to the attention of the Engineer-in-Charge any shortage / damage or other defects noticed before taking over the materials. Materials once taken over will be deemed to have been received in good condition and in correct quantities except for intrinsic defects which cannot be observed by visual and dimensional inspection and weighing.
- 1.12.1.3 Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.
- 1.12.1.4 All materials issued by BHEL shall be properly stored and systematic records of receipts, issue and disposal will be maintained. Periodic inventory shall be made available to BHEL Engineer-in-Charge.
- 1.12.1.5 All materials issued by BHEL shall be utilized as directed by Engineer-in- Charge or most economically in the absence of such direction. The contractor shall be responsible for the return to BHEL Stores of all surplus material, as determined by the Engineer-in-Charge.
- 1.12.1.6 If the materials issued by BHEL are lost, damaged or unaccounted, the cost of such items shall be recovered from payments to the contractor. However, the contractor shall raise FIR and inform BHEL all details.

1.12.2 STORAGE

- 1.12.2.1 Materials shall be stacked neatly, preserved and stored in the contractor's shed/ work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area/ site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
- 1.12.2.2 The equipment should be preferably in its original package and should not be unpacked until it absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.12.2.3 The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damp, sinking into ground and to circulate air under the stored equipment. This will also help in lifting the packing with fork lift truck.
- 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, mould growth, condensation of water etc. which can damage the equipment.
- 1.12.2.7 Contractor shall keep BHEL informed about such problem and try to rectify the problem at their cost.
- 1.12.2.8 All the instrument, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site.
- 1.12.2.9 Packing material shall be retained if the cubicle to be repacked after inspection
- 1.12.2.10 The loose items supplied for the main equipment falling into various categories like tools, modules, prefabricated cables, console inserts, recorders, modules and display units, printers, sensors and transducers, PCs, monitors, cable glands, cable ducts, frames etc. are to be categorized and stored separately with proper identification.
- 1.12.2.11 Sub-Assemblies:**
- a) All sub-assemblies should be kept in a separate place where it is easily accessible.
 - b) Sub-assemblies should have a protective cover in case it is stored without wooden packing / case to prevent accumulation of dust. Silica gel packets should also be kept along with it.
 - c) Sub-assemblies should not be stacked one above the other.
- 1.12.2.12 **Loose items (wherever applicable):** The loose items supplied for the main equipment falling into various categories like tools, modules, prefabricated cables, console inserts, recorders, modules and display units, printers, sensors and transducers, PCs, monitors, cable glands, cable ducts, frames are to be categorized and stored separately.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.12.2.13 Sometimes it may become necessary for the contractor to handle certain unrequired components at Customer's / BHEL's stores in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
- 1.12.2.14 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components at site.
- 1.12.2.15 Contractor has to arrange required fire resistant tarpaulins to protect the machined components / assembled parts drawn from BHEL, before and after erection at their cost.
- 1.12.2.16 The contractor shall take delivery of item, materials and consumables from the storage yard / stores / sheds of BHEL / customer which are within a radius of 5 kms, after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer. He shall also make arrangements for safe custody, watch and ward of equipment after it has been handed over to them till they are fully erected, tested and commissioned.
- 1.12.2.17 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators, Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.
- 1.12.2.18 The equipment / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

THE SCOPE OF THE WORKS WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

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

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

1.13.1 DETAILED SCOPE OF C&I WORK

The scope of work for C&I items like Instruments, Panels, Hardware etc. covers identification of items at stores / yards, checking, reporting the damages if any, loading, transportation, unloading at Contractor's stores / working yard, keeping in safe custody in contractor's stores, pre-assembly, calibration, checking, erection, testing, loop checking & commissioning, supply of consumables like electrodes, gas, cable dressing materials, tag plates, ferrules, lugs (specific sizes), specific types of fasteners, paints and consumables. deployment of skilled / unskilled manpower, engineers / supervisors, T & P, Material handling equipment, testing instruments (excepting proprietary type instruments). Returning of un-used materials / items to stores are also covered in the scope of work.

1.13.2 SCOPE OF WORK FOR C&I PANELS / CONTROL DESK:

1.13.2.1 The different types of Microprocessor based panels like VALMET DNA DCS Panels, Instrument Panels, unit control desk etc. are covered in the scope of work for erection and commissioning.

1.13.2.2 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.

1.13.2.3 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 per rate schedule, on tonnage basis

1.13.2.4 For panels to be mounted on trenches, if any channel supports are required, the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 shall be paid be as per rate schedule, on tonnage basis.

- 1.13.2.5** 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.
- 1.13.2.6** 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.
- 1.13.2.7** All the panels and JB's shall be electrically earthed to the nearest earth grid by means of GI wire/Flats as per the instructions of BHEL engineer.
- 1.13.2.8** 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.
- 1.13.2.9** Closing the Panel openings and unused drilled holes with non-flammable sealant materials, including supply of above material, shall be part of erection work.
- 1.13.2.10** 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.
- 1.13.2.11** 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 are involved, the same may be carried out as extra work. The decision of BHEL Engineer shall be final in respect of above extra works.
- 1.13.2.12** Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Any variation within $\pm 20\%$ shall not be considered for payment. However, for variations beyond $\pm 20\%$, payment shall be considered proportional to the length of the panel.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Variations in depth, height or weight of the panel shall not be considered for payment.

1.13.3 UPS, AC & DC DB AND OTHER ELECTRICAL CONTROL PANELS, VFD Panels, etc.

The erection & commissioning scope of above panels will be in line with clauses above in 1.13.2.

1.13.4 SCOPE OF WORK OF DCS PACKAGE / HMI / STATION LAN / / OPERATOR STIMULATOR / MASTER AND SLAVE CLOCK / PADO SYSTEM / EPBAX/ WIRELESS COMMUNICATION / OPERATING DESK AND FURNITURES etc WITH RELATED INSTRUMENTATION:

1.13.4.1 BHEL will supply sophisticated VALMET DNA DCS system. The tentative details of are furnished in the BOQ.

1.13.4.2 The scope of DCS system includes erection of sophisticated microprocessor based systems, VALMET DNA DCS for Main plant DCS control panels, I/O panels, Ethernet switching panels, Network Enclosure cabinets, GIU, CPU, MIS System, Engineers workstations, operator workstations, large video screen, server, printers, plant security system, portable UPS power supply, furniture and interconnecting cables like Ethernet/ Fiber-optic etc.

1.13.4.3 The scope of work for DCS Panels will generally be in line with that for C&I Panels as detailed in Clause 1.13.2

1.13.4.4 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.

1.13.4.5 Laying and termination of all cables including Ethernet and fiber 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.

1.13.4.6 If any underground C&I works for firefighting systems, the earth excavation and earth filling is excluded from the scope of the C&I contractor.

1.13.5 SCOPE OF WORK FOR UPS, BATTERY AND BATTERY CHARGER

1.13.5.1 The charger and batteries are of heavy duty type. The cells will be mounted on insulators carried on suitable wooden / fiber stands. Tentative details are given in the BOQ.

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

1.13.5.3 Lump sum shall be quoted for Erection and commissioning of Battery. No additional payment shall be made for any variation in the number of cells. The unit rate quoted

TECHNICAL CONDITIONS OF CONTRACT (TCC)

for erection of battery will include the following works.

- 1.13.5.3.1 Filling the individual cells with Acid/alkali – if applicable.
- 1.13.5.3.2 Arranging suitable resistive load banks for charging and discharging during charging and discharging cycles.
- 1.13.5.3.3 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.
- 1.13.5.3.4 Modifications or changes if any for the loose supplied items or any minor changes in wiring.
- 1.13.5.3.5 Arranging necessary tools, T&P, testing equipment's required for erection and commissioning of the battery.
- 1.13.5.3.6 For laying and termination of cables of battery/ battery charger system, separate rate shall be applicable as per rates in Rate Schedule.

1.13.6 SCOPE OF WORK FOR BATTERY CHARGER PANELS

- 1.13.6.1 The scope of work will be in line with scope of work for control panels, as detailed under Clause above in 1.13.2.

1.13.7 SCOPE OF WORK FOR INSTRUMENTS:

- 1.13.7.1 The type of instruments to be erected and commissioned shall be as detailed below:
 - 1.13.7.1.1 Panel mounted Instruments like indicators, recorder, electronic modules etc.
 - 1.13.7.1.2 All types of transmitters like temperature, pressure, flow, level and position feedback transmitters etc.
 - 1.13.7.1.3 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.
 - 1.13.7.1.4 Air filter regulator sets, Air lock off valve, Power cylinders etc.
 - 1.13.7.1.5 Panel/ Control desk mounted Instruments like indicators, recorder, console and electronic modules etc.
 - 1.13.7.1.6 I/P converters and local controllers.
 - 1.13.7.1.7 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.
 - 1.13.7.1.8 Pneumatic operated control valves, trip valves, solenoid valves, and

TECHNICAL CONDITIONS OF CONTRACT (TCC)

electrically operated valves. (commissioning only)

- 1.13.7.2 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.
- 1.13.7.3 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.
- 1.13.7.4 Unit rate 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.
- 1.13.7.5 Unit rate 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.
- 1.13.7.6 Unit rate 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.
- 1.13.7.7 Unit rate for erection of Casing temperature thermocouple of turbine/ metal temperature thermocouple (MTM) shall cover laying, dressing and clamping, supply and fixing of tag plates, etc. Welding of MTM pads shall be carried out by mechanical contractor. Necessary tray supports for routing of MTM thermocouples shall be erected as part of tray erection covered in the tender. Proper care shall be taken during cleaning the crevices where MTM Thermocouples are inserted.
- 1.13.7.8 Unit rate for erection and checking of thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells.
- 1.13.7.9 Unit rate for erection and checking of temperature switches, gauges, thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells.
- 1.13.7.10 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 extra works basis.
- 1.13.7.11 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

- 1.13.7.12 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.
- 1.13.7.13 Unit rate quoted for erection / commissioning of special instruments like, Flame scanner, H.E.A Igniters systems, Vibration monitoring System, Smart wall blowers, Large video screen, Sonic Tube Leak Detection system, Automatic leakage controller for air preheater, SWAS, Flue Gas analyzers, Station LAN / HMI plant management system, PC based instruments, C&I lab, EPABX, Wireless communication, UPS with battery and charger, GPS clock system, Graphical interphase system, Video conference network 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 equipments.
- 1.13.7.14 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.
- 1.13.7.15 Some of the Flue Gas Analyzers are to be installed at Chimney 71 Mtrs as indicated in BOQ. For the erection of associated hardware for these analysers, like cables, trays, GI pipe etc. that are to be routed from the analyser panels at 71 Mtrs of Chimney to zero-meter level, payment will be made at twice the unit rate quoted against each item.
- 1.13.7.16 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.
- 1.13.7.17 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.
- 1.13.7.18 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

removal, calibration and re-fixing of Instrument of similar type.

- 1.13.7.19 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.
- 1.13.7.20 The scope of work for panels for TSS System, Sonic Tube Leak Detection System, Furnace Flame Viewing System, Master Clock System, Siemens core turbine panel etc. will be in line with the scope of work of C&I panels covered under clause above in 1.13.2

1.13.8 SCOPE OF WORK FOR IMPULSE PIPES:

- 1.13.8.1 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.
- 1.13.8.2 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.
- 1.13.8.3 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.
- 1.13.8.4 For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.13.8.5 Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work.
- 1.13.8.6 The contractor shall obtain necessary approval for welding electrodes, filler wire from BHEL welding engineer at site.
- 1.13.8.7 Impulse pipes Welder shall undergo test and get approval from BHEL welding engineer according to the nature of welding.
- 1.13.9 SCOPE OF WORK FOR PRE-FABRICATED/ SEMI-FABRICATED LIR/ LIE/ GAUGE BOARDS**
- 1.13.9.1 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.
- 1.13.9.2 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.
- 1.13.9.3 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.
- 1.13.9.4 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.
- 1.13.10 SCOPE OF WORK FOR COPPER / STAINLESS STEEL TUBES:**
- 1.13.10.1 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 6 meter. The connectors and tees will be of brass / Stainless Steel of different sizes as per site requirement.
- 1.13.10.2 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 airline instruments. The unit rate shall also include providing tag plates on instruments / power cylinders.
- 1.13.10.3 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.13.10.4 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.
- 1.13.11 SCOPE OF WORK FOR INSTRUMENT AIR LINES (GI PIPES):**
- 1.13.11.1 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.
- 1.13.11.2 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.
- 1.13.11.3 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.
- 1.13.11.4 After installation of instrument airlines, the line shall be blown and leak test shall be conducted for all the joints as per the guidelines given elsewhere in this tender.
- 1.13.12 SCOPE OF WORK OF ELECTRIC & PNEUMATIC ACTUATORS:**
- 1.13.12.1 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.
- 1.13.12.2 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 airline, 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.
- 1.13.12.3 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

- 1.13.12.4 For calibration of any Pneumatic Actuator at field, temporary air supply if required shall be arranged by the contractor.
- 1.13.12.5 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.
- 1.13.12.6 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.
- 1.13.12.7 Erection and Commissioning of MCCs and laying of power cables to bi-directional electrical actuators shall be done by other agency. The C&I 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.

1.13.13 SCOPE OF WORK FOR CABLES:

- 1.13.13.1 BHEL will supply LT, 1.1 kV, armoured/ unarmoured, Copper PVC FRLS, HR PVC insulation, Power, Control and Instrumentation cables of different sizes. The special cables supplied shall be Compensating cable, Ethernet cables and Fibre-optic cable of different sizes and type.
- 1.13.13.2 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.
- 1.13.13.3 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.
- 1.13.13.4 Unit rate quoted for cable shall cover laying, termination, 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.
- 1.13.13.5 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 upto 2.5 sq.mm. apart from the work mentioned above. Supply of above material shall conform to the specification detailed elsewhere in this tender.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.13.13.6 Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, underground, cable shafts etc.
- 1.13.13.7 Ethernet cables and Fibre optic cables shall be isolated from other cables and laid in a separate cable tray as directed by site Engineer. Wherever required I/O Box shall be installed for Ethernet cable termination and Punch Down crimping tools shall be used for Ethernet cable termination.
- 1.13.13.8 The scope of work for Fibre Optic cable shall be laying and termination including fixing of fibre optic components and termination kits LIU, space splits cabinets, couplers, grounding etc. Wherever required, the Fibre optic cable shall be laid through HDPE Conduit.
- 1.13.13.9 The contractor shall provide Tools/ equipment required for the connections and termination of cable wherever necessary. No separate rate shall be paid for cable terminations. For cable joining, if any, separate rate shall be considered on extra works basis.
- 1.13.13.10 The contractor shall carry out cable dressing and clamping for all the cables laid by the contractor. However, if any other agency laid cables of lesser quantity for which no separate trays have been allotted, the contractor shall do clamping along with the cables.
- 1.13.13.11 Wherever cable entry holes have not been provided for equipment installed by another agency, the contractor shall co-operate to get the same done.
- 1.13.13.12 During testing and commissioning, if the equipment on which the cables are terminated (including electrical drives) is 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 his supervisor or technicians to assist the commissioning agencies to check the interconnecting cables at no extra cost.
- 1.13.13.13 Contractor shall carefully plan the cutting schedule for each cable drum in consultation with Engineer such that wastage is minimized and any resultant short lengths can be used where appropriate route lengths are available.
- 1.13.13.14 If the cables are to be laid on the angles or routed in conduit pipe as per site condition, the unit rate for erection of angles and conduit pipes shall be as per the rate quoted elsewhere in the tender.
- 1.13.13.15 Any fabrication required at site for cable support shall be carried out at the rate quoted for fabrication.
- 1.13.13.16 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services any such adjustment shall be done with the approval of Engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.13.13.17 The approximate number of termination for the purpose of estimation to be assumed as follows: The average RUN length shall be considered as 150 metres. However, for 10% of the 2 pair and below, the average length shall be considered as 30 metres.

1.13.14 SCOPE OF CABLE TERMINATION

1.13.14.1 Laying and termination of all cables including Ethernet, fibre optic cable is part of the scope.

1.13.14.2 The scope of termination shall include termination of cables on various panels / JB's / Push buttons / equipment etc. including those installed by other agencies.

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

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

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

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

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

1.13.14.8 Also refer clause 1.13.13.2 above

1.13.15 SCOPE OF WORK FOR CABLE TRAYS/ CONDUITS/ FLEXIBLE CONDUITS/ HOSE:

1.13.15.1 CABLE TRAYS

Scope of cable tray works covers erection of various sizes of perforated trays with accessories mostly for branch trays in Power House building. All type of cable trays including, standard trays accessories shall be supplied by BHEL.

The scope of work for cable trays shall be as follows:

- a) Different Junction The unit rate for erection of trays shall be on meter basis. The unit rate quoted for erection of tray shall also include erection of all tray accessories such as elbow, cross, Tees, bends such as vertical and Horizontal, reducers, coupler plates/fixing plates, anchor bolts, fasteners etc.
- b) For routing of trays standard tray accessories supplied by BHEL shall be used. However, if above standard tray accessories are not supplied, the same shall be fabricated and installed at no extra cost.
- c) If standard tray accessories like Tees, Reducers, Bends, cross etc. require any modification to suit the tray routing, the same shall be carried out at no extra cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- d) The unit rate quoted for trays shall also cover making of offsets by means of cutting standard tray sections and inserting suitable trays to match with the existing arrangement.
- e) Site fabrication / modification of trays or on tray accessories will be paid on extra work basis.
- f) The contractor shall quote a uniform rate on meter basis for erection of trays and Tray accessories like Tees, Reducers, Bends, cross etc.
- g) Tray covers are to be erected after completion of cable laying and no separate payment will be made for fixing these covers. GI strip clamps are to be used for fixing the tray covers.
- h) 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.

1.13.15.2 RIGID & FLEXIBLE CONDUITS

- a) 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.
- b) Unit 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.
- c) Unit quoted on meter basis for GI rigid conduit includes supply of suitable clamps / fasteners / tag plates etc.
- d) 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 WORK FOR JUNCTION BOXES/CJCBs /PUSH BUTTON BOXES:

1.13.16.1 Different Junction Boxes/ Push Button boxes with gland plates shall be supplied by BHEL.

1.13.16.2 The unit rate quoted for erection of junction boxes/push button boxes shall cover the following also.

1. Providing necessary supports
2. Drilling of bottom gland plates for cable glands as required
3. Painting the tag Nos. or fixing a separate tag plate on junction boxes/push button boxes.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

4. Minor chipping, grouting as required for mounting the JB/PB
 5. Supply of all bolts and nuts (Fasteners) including grouting bolts as required for mounting the junction box/push button.
 6. Closing all unused holes on the gland plates using grommet or any other suitable materials.
 7. Any modification like replacement of terminals, enlarging gland holes etc. that may be required to accommodate power cables.
- 1.13.16.3 All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.
- 1.13.16.4 For CJCBs/ RJCBs, the rate for Junction Boxes similar size, as per Rate Schedule, will be applicable.
- 1.13.16.5 For fabrication and fixing of supports/Frame, rate shall be paid on tonnage basis.
- 1.13.17 SCOPE OF WORK FOR FABRICATION & ERECTION OF STEEL MATERIALS:**
- 1.13.17.1 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.
- 1.13.17.2 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.
- 1.13.17.3 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.
- 1.13.17.4 All fabricated steel materials shall be painted as detailed in the scope of painting.
- 1.13.17.5 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.
- 1.13.18 SCOPE OF EARTHING**
- 1.13.18.1 The scope of earthing covered in this contract is above ground earthing i.e. equipment earthing. Scope of earthing covers earthing of field Instruments, JB, 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.
- 1.13.18.2 Different type of earthing materials shall be supplied and same shall be erected as per site requirement.
- 1.13.18.3 The scope of work shall include supply of fasteners, lugs, minor civil works etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.13.18.4 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.

1.13.18.5 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.

1.13.19 SCOPE OF CALIBRATION:

1.13.19.1 The contractor shall calibrate all the local instruments, panel mounted instruments including transducers, protective relays, recorders, Indicators etc. that will be supplied along with equipments mounted in or in loose.

1.13.19.2 Contractor has to calibrate all the instruments covered in their scope at site with their own calibration and testing equipment's under the supervision of BHEL / Customer Engineers and maintain the calibration records as per the BHEL prescribed format / relevant FQP formats.

1.13.19.3 All testing Instruments / Equipment deployed for calibration shall be calibrated before taking into service. All testing instruments shall have calibration certificate issued by recognized /accredited agencies. A copy of calibration certificate shall be submitted to the engineer for his verification and approval.

1.13.19.4 BHEL shall provide vendor supports for proprietary type of microprocessor – based instruments, protective relays, which requires software loading and programming etc. However overall responsibility lies with contractor and contractor shall provide all supports like manpower, standard T&P, Instruments etc., for calibration and testing of above proprietary instruments.

1.13.19.5 If BHEL is unable to provide or arrange vendor support for proprietary instruments, contractor shall carry out the calibration through authorized agency, at extra cost. The actual cost of such calibration carried out by the 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 with in quoted rate.

1.13.20 TURBINE SUPERVISORY CONTROL SYSTEM (TSS): For Main Turbine:

1.13.20.1 The indicative scope of works for TSS for Main Turbine is as follows: Collection of materials from stores, Preparation of mounting surface and mounting arrangement to suit the surface of the machine, Installation of JBs, Laying & Terminations of Instrumentation cable from Local JB and Cabinet, Laying and termination of Power cable to TSS panel, Laying and termination of ethernet cables (as applicable), Laying and Termination of FO cables. (Mounting sensors on the Machines, Laying and termination of cables between sensors to Local JB, Pre-commissioning check, energizing cabinets & PC (as applicable),

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Commissioning, Installation of software packages, handing over to the end-user are in the scope of OEM).

1.13.21 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

- 1.13.21.1 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.
- 1.13.21.2 The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.
- 1.13.21.3 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.
- 1.13.21.4 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.
- 1.13.21.5 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.
- 1.13.21.6 For all site-fabricated steel items such as supports, racks, frames, Canopy etc. physical measurement shall be made and then converted to tonnage. For steel material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.
- 1.13.21.7 Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard proforma prescribed for this purpose by the site in charge.
- 1.13.21.8 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 his own cost.

- 1.13.21.9 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
a)	Fabrication steel	2
b)	Each size of power cables	1
c)	Each size of control / instrumentation cables	2
d)	Impulse pipe / tubes / GI pipes / copper tube	1

NOTE:

- (i) Salvageable scrap shall mean lengths of pipes, multi core cables, other cables etc., that can be used one time or other at a later date and normally they are recovered from the cut-pieces of tubes, pipes, multicore cables, cables etc.
- (ii) 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

- 1.14.1 Refer forms F -14 and 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 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 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding erection progress, labour availability, equipment deployment, testing, etc.
- 1.14.4 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
- 1.14.5 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
- 1.14.6 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.
- 1.14.7 The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.8 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes / ferrules / lugs) report, cranes availability report and other reports as per Performa considered necessary by the Engineer as per the BHEL formats.
- 1.14.9 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.14.10 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 1.14.11 The monthly report shall be submitted at the end of every month as a booklet and shall contain the following details:-
- a. Colour Progress photographs.
 - b. Erection progress in terms of tonnage, percentage of work completion, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
 - c. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan
 - d. Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operations, store keepers, lab technicians, helpers, security etc. Data shall be split up under the work areas like Boiler (pressure parts, structures) Rotating machines, Electro static precipitator, Insulation, Piping, Steam turbine, Condenser, Generator etc.
 - e. Consumables report giving consumption of all types of gases and electrodes during the previous month.
 - f. Availability report of cranes & T&Ps
 - g. Safety implementation report in the format
 - h. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.
- 1.14.12 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

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

- 1.15.1 The scope of commissioning works covers commissioning of all instruments covered in the BOQ including loop checking and establishing the operation of instruments / systems to meet plant commissioning / operation. The contractor shall be responsible for overall commissioning of all the instruments and systems covered in the BOQ.
- 1.15.2 Scope of pre-commissioning / commissioning starts with the commissioning of various equipment erected by the contractor and making them available to commission various materials / systems and main power plant. The scope of work of various commissioning activities of the main plants is referred below:
- a. Trial run of various equipment.
 - b. Light up of boiler.
 - c. Boiler EDTA / Chemical Cleaning.
 - d. Turbine barring gear.
 - e. Steam blowing of piping.
 - f. Turbine rolling.
 - g. Safety valve floating.
 - h. First synchronization
 - i. Trial Operation / Full load.
- 1.15.3 The above activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer / consultant / statutory authorities like boiler inspector, electrical inspector etc.
- 1.15.4 The contractor shall co-ordinate with BHEL and other contractor's during the main plant commissioning to ensure successful commissioning of total plant.
- 1.15.5 The pre-commissioning activities of the main power plant will start with run of various equipment prior to light up of boiler and commissioning operations shall continue till the unit is handed over to customer. The contractor shall simultaneously start commissioning activities for the equipment erected to match with the various milestone activities of commissioning programme of the project.
- 1.15.6 Contractor shall arrange experienced commissioning engineers, supervisors including electrician / instrument mechanics in each area to be associated with BHEL commissioning staff. Contractor shall earmark separate manpower for

TECHNICAL CONDITIONS OF CONTRACT (TCC)

various commissioning activities. The manpower shall not be disturbed or diverted. It shall be specifically noted that above employees of the contractor may have to work round the clock along with BHEL commissioning engineers involving considerable payment of overtime, which forms part of Contractor's Scope.

- 1.15.7 The mobilization of these commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and necessary recoveries with overhead cost will be made from the bills of the contractor.
- 1.15.8 After erection of various equipment, prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers.
- 1.15.9 For electrical works, 415 volts and above, the contractor has to bring qualified electricians and the total work has to be certified by electrical license holder. The expenditures towards work certificate and all statutory requirements connected towards the high voltage system shall be borne by the contractor.
- 1.15.10 In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost. If during commissioning, any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.
- 1.15.11 During commissioning activities and carrying out various tests, if any of the instruments has to be temporarily erected and commissioned to suit the commissioning activities, the contractor has to carry out the erection of the same. After completion of activities the temporary systems have to be removed and returned to stores and no extra rate shall be paid for this.
- 1.15.12 All the T&P instruments required for commissioning are to be arranged by the contractor. However, any special instruments, which are of proprietary nature, shall be arranged by BHEL.
- 1.15.13 It shall be the responsibility of the contractor to arrange and complete all the testing, pre-commissioning and commissioning activities for the particular equipment as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. All the above will be witnessed by the BHEL engineers and reports signed shortly. Contractor shall follow checklist of BHEL and testing & commissioning activities shall be carried out in accordance with the checklist.
- 1.15.14 The scope of commissioning shall also cover the commissioning of the equipment

TECHNICAL CONDITIONS OF CONTRACT (TCC)

/ drives erected by the mechanical contractors. (as detailed in the BOQ)

- 1.15.15 The mobilization of testing team shall be planned in time and shall be undertaken round the clock. The contractor shall discuss on day to day / weekly / monthly basis the requirement of testing manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and the cost shall be recovered from contractor.
- 1.15.16 Prior to commissioning and after commissioning, protocols have to be made with BHEL / customer. The formats shall be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL commissioning engineers which may involve over time payment which forms part of Contractor's Scope
- 1.15.17 Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost.
- 1.15.18 Commissioning Engineers also shall be identified separately for each package and the minimum requirement shall be as indicated below (Requirement given below is per Package).

	Boiler	TG	Station C&I	BOP and Misc	TOTAL
Engineer (C&I)	1 No.		1 Nos.		2 Nos.
Supervisor (C&I)	1 Nos.		1 Nos.		2 Nos.
Technician(C&I/ Electrical)	3 Nos.		3 Nos.		6 Nos.

- 1.15.19 The above commissioning group shall be identified at the Pre-commissioning and commissioning time. The above commissioning group shall have knowledge of various systems referred in the tender and also should have adequate experience.
- 1.15.20 The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor. Besides the above, there will be separate engineers for Planning, Safety and Quality. For all practical purposes, each of the above In-charges shall be provided with a PC and good communication facilities.
- 1.15.21 If the contractor fails to deploy the above Engineer / Supervisor / Technician at appropriate time of commissioning, BHEL Engineer will have the right to withhold the payment towards commissioning activities as defined in terms of payment.
- 1.15.22 T & P / instruments required for testing are to be arranged by the contractor.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

The scope of work also includes collecting the replacement instruments / parts from BHEL / customer stores, stockyard etc.

Separate group shall be identified for commissioning. The above group shall be available right from Trial run to full load operation including shift operation.

1.15.25.1 PNEUMATIC (ALL TYPES OF VALVES AND POWER CYLINDERS)

- 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.

1.15.25.2 FLOW METERS / SWITCHES

- a) Checking the calibration and servicing if required.
- b) Setting the alarm value
- c) Replacement of defective components if any

1.15.25.3 LIMIT SWITCHES & LEVEL SWITCHES

- a) Checking the operation
- b) Replacing defective components if required

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.15.25.4 SOLENOID VALVES

- a) Checking the healthiness of coil
- b) Checking the operation
- c) Replacement of defective components if required.

1.15.25.5 TEMPERATURE ELEMENTS (MOTORS AND GENERATORS WINDING AND BEARING)

- a) Checking the healthiness
- b) Replacement of defective element (only for bearing)

1.15.25.6 DIRECT WATER LEVEL GAUGES (REMOTE & LOCAL)

- a) Checking the calibration
- b) Fixing of bulbs and extending Power supply
- c) Replacing defective components

1.15.25.7 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.

- 1.15.26 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.
- 1.15.27 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.
- 1.15.28 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.
- 1.15.29 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.30 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.
- 1.15.31 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.
- 1.15.32 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.
- 1.15.33 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance till handing over of sets to customer.
- 1.15.34 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.
- 1.15.35 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.
- 1.15.36 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER-XVI **PAINTING**

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

1.16.1 FINAL PAINTING

- 1.16.1.1 The scope of work shall also include supply and application of final painting of all the components, other equipment etc., erected under the scope of this tender. The painting shall be as required and specified in the painting schedule which forms the part of this tender book.
- 1.16.1.2 The quoted rate / price shall be inclusive of supply and application of final painting of all the erected equipment as per the painting specifications of customer / BHEL like supports, racks, frames, canopy, LIE / LIR / LGB, impulse pipes etc. carried out by the contractor. Painting shall be carried out for any bare copper tube also.
- 1.16.1.3 In the case of steel fabricated items, raw steel after fabrication has to be surface cleaned and subsequent painting to be carried out.
- 1.16.1.4 The scope also includes supply of paints, primers, tools/consumables like brushes, rollers, emery papers, thinner etc., at no additional cost.
- 1.16.1.5 All the exposed metal parts of the equipments including busducts, transformers,, structures, etc., wherever applicable after installation unless otherwise specified the surface protected, are to be first painted with at least one coat of suitable primer and required number of finish coats as 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 If needed and insisted either by BHEL / Customer in certain cases, spray painting has to be carried out within the Quoted rates. Spray painting gun and compressed air arrangement has to be made by the contractor himself.
- 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 equipments; tag Nos of valves, marking the directions of flow and other data required by BHEL within the quoted rate.
- 1.16.1.12 All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots. Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.
- 1.16.1.13 Finish coat paint, No. of coat and DFT shall be as indicated in the painting specification enclosed in this tender / relevant BHEL document/ customer's specifications. The painting specification which is forming part of this tender as in TCC shall be used as guidelines to be followed.
- 1.16.1.14 The actual colour to be applied shall be approved by the customer before starting of actual painting work.
- 1.16.1.15 Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only, and the paints should be as per the customer painting specification. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities.
- 1.16.1.16 No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.
- 1.16.1.17 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
- 1.16.1.18 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.16.2 PRESERVATION / TOUCH UP PAINTING

- 1.16.2.1** Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other consumables like wire brushes, emery paper, cotton waste, cloth etc., at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to

TECHNICAL CONDITIONS OF CONTRACT (TCC)

customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.

- 1.16.2.2** Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint is to be applied on all the bare / unpainted surfaces. Touch up painting is generally required for trays, control panels.
- 1.16.2.3** All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
- 1.16.2.4** Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipments 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

SI No. 1

Following clauses in GCC are not applicable for this contract.

- 1) Clause No. 1.9 (Earnest Money Deposit)
- 2) Clause No. 2.12 (Over Run Compensation)
- 3) Clause No. 2.13 (Interest Bearing Recoverable Advances)
- 4) Clause No. 2.16 (Supplementary Items)
- 5) Clause No. 2.17 (Price Variation Clause)

SI No. 2

Following Clauses are Modified / Revised / Added in GCC as below:

Clause No. 2.14 is revised as under

The quantities given in the contract are tentative and may change to any extent (both in plus side and minus side). No compensation against quantity variation is applicable for this contract.

Sl no.	GCC Clause No.	GCC clause Modified / Revised / Added
I.	1.9.1, Sl. No. (ii)	The following mode of deposit, Sl. No. (e) is added: e) Insurance Surety Bonds
II.	1.10.3, Sl. No. (vi)	The following Clause, Sl. No. (vi) is deleted: Security deposit can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required security deposit is collected. However, in such cases at least 50% of the required Security Deposit, including the EMD, should be deposited in any form as prescribed before start of the work and the balance 50% may be recovered from the running bills as described above
III.	1.10.3, Sl.No.(vii)	The following mode of deposit, Sl. No. (vii) is added: e) Insurance Surety Bonds

TECHNICAL CONDITIONS OF CONTRACT (TCC)

IV.	Note mentioned under the GCC Clause 1.10.3	<p>Note mentioned under GCC Clause 1.10.3 is revised as below:</p> <p>Note: (1) BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith.</p> <p>(2) In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate +4%) for the delayed period, shall be submitted by the bidder.</p>
V.	1.10.8	<p>GCC Clause 1.10.8 is revised as below:</p> <p>Bidder agrees to submit security deposit required for execution of the contract within the time period mentioned. In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate+4%) for the delayed period, shall be submitted by the bidder. Further, if security deposit is not submitted till such time the first bill becomes due, the amount of security deposit due shall be recovered as per terms defined in NIT / contract, from the bills along with due interest</p>
VI.	2.13.6	<p>GCC Clause 2.13.6 is revised as:</p> <p>The rate of interest applicable for the above advances shall be the repo rate prevailing on the date of release of advance plus 4%, and such rate will remain fixed till the total advance amount is recovered</p>
VII.	2.22.1	<p>GCC Clause 2.22.1 is revised as:</p> <p>Retention Amount shall be 5% of the Contract Value and shall be furnished through BG in line with clause 1.12 of GCC before payment of first RA Bill. The validity of the said BG shall be initially for the contract period & shall be extended, if so required, up to acceptance of final bill. In case of increase in contract value, additional BG for 5% of differential amount shall be submitted by Contractor before payment of next RA Bill due.</p> <p>Retention amount can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required retention amount is collected.</p> <p>In case, contractor opts cash deduction from RA bills in the beginning & subsequently offers to submit BG later on, then refund of deducted retention amount may be permitted against submission of BG for 5% of the Contract Value.</p>

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VIII.	New Clause is added and replace the existing clause of Risk & Cost (i.e. 2.7.2.1 to 2.7.3)	<p>Clause 2.7.2 and 2.7.3 are revised as:</p> <p>2.7.2 Breach of Contract, Remedies and Termination</p> <p>2.7.2.1 BHEL shall terminate the contract after due notice of a period of 14 days in any of the following cases, which if not rectified/ improved within the time period mentioned in the notice, then, Breach of Contract will be considered to have been established:</p> <ul style="list-style-type: none">i). Contractor s poor progress of the work vis- -vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution.ii). Withdrawal from or abandonment of the work by contractor before completion of the work as per contract.iii). Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor.iv). Repeated failure of contractor in deploying the required resources, to comply the statutory requirements etc. even after given by BHEL is writing.v). Strike or Lockout declared is not settled within a period of one month.vi). Termination of Contract on account of any other reason (s) attributable to Contractor.vii). Assignment, transfer, subletting of Contract without BHEL s written permission.viii). Non-compliance to any contractual condition or any other default attributable to Contractor. <p>2.7.2.2 Remedies in case of Breach of Contract is established</p> <p>In case Breach of Contract is established, Security Deposit and Retention Amount shall be encashed/ forfeited. This is without prejudice to BHEL s right to levy of liquidated damages, debarment etc. which shall be applied as per the provisions of the contract. Sequence of recovery to be made in case of breach of contract is established, is as below:</p> <ul style="list-style-type: none">a) In case the value of Security Deposit & Retention Amount, available for the Contract, is less than 10% of the Contract Value, the balance amount shall be recovered from dues available in the form of Bills payable to contractor, BGs against the same contract etc.b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above.c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery:<ul style="list-style-type: none">i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery.ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other
-------	--	---

TECHNICAL CONDITIONS OF CONTRACT (TCC)

		<p>Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor.</p> <p>iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.</p> <p>Note:</p> <p>1) In addition to above, levy of liquidated damages, debarment, termination, short-closure etc. shall be applied as per provisions of the contract.</p> <p>2) If tendering is done for the balance work, the defaulted contractor (including all the members/partners in case of JV/ partnership firm) shall not be eligible for either executing the balance work or to participate in the tender(s) for executing the balance work.</p> <p>2.7.3 In case Contractor fails to deploy the resources as per requirement informed by BHEL in writing to expedite the work, BHEL can deploy own/hired/otherwise arranged resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.</p>
--	--	---

IX.	2.7.7	<p>GCC Clause 2.7.7 is revised as:</p> <p>BHEL may permit or direct contractor to demobilize and remobilize at a future date as intimated by BHEL in case of following situations for reasons other than Force majeure conditions and not attributable to contractor:</p> <ul style="list-style-type: none"> i) suspension of work(s) at a Project either by BHEL or Customer, <li style="padding-left: 20px;">or ii) where work comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than three months <p>In such cases, charges towards demobilization and remobilization shall be as decided by BHEL after successful remobilization by contractor at site, and decision of BHEL shall be final and binding on the contractor. After remobilization, all conditions as per contract shall become applicable. In case Contractor does not remobilize with adequate resources or does not start the work within the period as intimated, then BHEL reserves the right to terminate the contract and effect remedies under Clause 2.7.2.2.</p> <p>Duration of the contract/time extension shall be revised suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.</p>
-----	-------	---

TECHNICAL CONDITIONS OF CONTRACT (TCC)

X.	2.11.3	<p>GCC Clause 2.11.3 is revised as:</p> <p>However, if any Time extension is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/LD for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take under clause 2.7.2 of GCC i.e.</p> <p>Breach of Contract, Remedies and Termination.</p>
XI.	2.19.1	<p>GCC Clause 2.19.1 is revised as:</p> <p>The contractor will be fully responsible for all disputes and other issues connected with his labour. In the event of the contractor's labour resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of one month, it may be considered as Breach of Contract under Clause 2.7 and the remedies under Clause 2.7.2.2 may be executed, at the discretion of BHEL.</p>
XII.	2.24.1	<p>GCC Clause 2.24.1 is revised as:</p> <p>Even though the work will be carried out under the supervision of BHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of Twelve months from the date of commencement of guarantee period as defined in Technical Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works, by itself, without prejudice to any other rights and recover the cost incurred for the same along with 5% overheads from the Security Deposit.</p>

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – II CHAPTER 2 **DATASHEET**

2.11.1	SPECIFIC TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS	
2.11.1.1	Clamps	
	Material & Type	Nylon self-locking ties aluminium strips clamps as mentioned in Chapter-III of Technical Conditions of Contract (Volume-IA Part-I in Book-I)
	Sizes	To meet the requirements mentioned in Chapter-III of Technical Conditions of Contract (Volume-IA Part-I in Book-I)
2.11.1.2	Ferrules	As as mentioned in Chapter-III of Technical Conditions of Contract (Volume-IA Part-I in Book-I)
2.11.1.3	Tag	
	Material	Aluminium / Fibre / Stainless Steel
	Markings	Engraving / Embossing / Printing
	Size	As required.
2.11.1.4	Cable lugs	Copper / Aluminium (crimping type)
2.11.1.5	CLAMP SPACING:	
	Other Clamps	
	A. Power Cables:	
	<u>Above 35mm OD</u>	
	i) Horizontal runs	Individually clamped at 3000 mm Interval (max)
	ii) Vertical runs	Individually clamped 3000mm intervals (max).
	<u>Upto 35 mm OD</u>	
	i) Horizontal runs	Collectively clamped at 3000 mm intervals (max)
	ii) Vertical runs	Collectively clamped at 2000 mm interval (max)
	B. Control Cables:	
	i) Horizontal runs	Collectively clamped at 3000 mm interval (max)
	ii) Vertical runs	Collectively clamped at 3000 mm interval (max)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

	C. Spacing for cables supported along structure / ceiling	
	i) In horizontal runs	750mm (max)
	ii) In vertical runs	750mm (max)
	iii) Spacing between cables	30 mm (min)
	Note: a. Supports shall also be provided at each bend. b. For any change in above spacing, prior approval of Engineer shall be taken.	
2.11.1.6	Cable termination:	
	Type of Lugs:	
	a. Power Cables	Copper / Aluminium / Both crimping type
	b. Control Cables	Copper pin type, copper screw type, Direct termination
	c. Special Cables	Pin type, maxi-termi type.
2.11.1.7	Wastage Allowances	
	LT cables	1%
	Control, Instrument & Special cables	2%
	Fire Survival cables	1%
	Structural Steel materials	2% (by weight)
	Impulse Pipe/tubes/GI pipes/copper tube	1%
	Cable trays and earth Flats	2%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART- II CHAPTER -3

GENERAL TECHNICAL REQUIREMENTS AND GUIDE LINES FOR INSTALLATION, TESTING & COMMISSIONING

2.12.1 Guidelines for Installation of C & I Equipments

- 2.12.1.1 Instruments location shall be decided to the convenience of operation and maintenance. The location shall have least mechanical vibration and placed where corrosive, toxic and explosive gases and dust particles will not deposit and the place is not subject to high-temperature atmosphere or radiation. However, actual location shall be decided in consultation with customer / consultant.
- 2.12.1.2 Maintenance platforms & approach facilities shall be provided for all sensing & primary devices wherever possible. Instruments shall be located in weatherproof enclosures and wherever required suitable canopy shall be provided.
- 2.12.1.3 High & Low pressure impulse lines shall not be grouped and run together. Also impulse lines for explosive & inert gases shall not run together.
- 2.12.1.4 Impulse lines of high pressure steam, harmful gases, etc. shall not be brought into the control room, as far as possible.
- 2.12.1.5 Intrinsically safe circuits shall be used for explosion hazardous areas.
- 2.12.1.6 Separate cable routing shall be followed for high and low voltage lines.
- 2.12.1.7 All electrical equipments shall meet the requirements of Indian Electricity Rules.
- 2.12.1.8 Wherever severe vibrations are expected, shock absorbers shall be provided
- 2.12.1.9 Installation of instruments with radioactive isotopes, mercury and other toxic substances shall be as per statutory regulations provided by authorities.
- 2.12.1.10 Compensating cables should be connected directly to instruments, i.e. no junction boxes shall be used if CJCBs are not provided.
- 2.12.1.11 Orifice plates or flow nozzles must be provided with at least 10D upstream and 5D downstream straight length of pipe from bends tees, branch pipes & control valves.
- 2.12.1.12 Pressure gauges shall be provided with snubbers, syphons (for more than 100°C), three way valve manifolds wherever applicable.
- 2.12.1.13 For pneumatic instruments, air shall be dry & free from oil. Air must be supplied from oil-free compressors specially erected for this purpose. After drying, air must be restored in receiver. Pressure gauges must be provided on each supply line and after the pressure reducer.
- 2.12.1.14 Correct level (height) between detecting element and tapping point and transmitter shall be maintained.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 2.12.1.15 The equipment shall maintain its normal posture (level, perpendicular, front and back).
- 2.12.1.16 Connection between detecting element/tapping point and transmitter shall be maintained at short distances wherever practicable to avoid any time lag.
- 2.12.1.17 Orifice plates and control valves shall be mounted on process piping, only after completion of cleaning of the process piping in order that these instruments may not suffer damage from metal waste, etc.
- 2.12.1.18 For details of installing each measuring instruments, instruction manual issued by the respective manufacturer of instruments may be referred to, wherever necessary.
- 2.12.1.19 The drain pipes shall be terminated in a common closed header and finally the common header shall be connected to plant open drain.
- 2.12.1.20 Impulse pipe material shall be identified for each individual pipe prior to its use at site. For this purpose, coloring is to be done immediately after receipt.

2.12.2 Guide Line for Erection of Impulse Lines

- 2.12.2.1 All impulse lines burrs and airlines shall be thoroughly cleaned of any foreign matter by cleaning with compressed air and the same shall be done before installation.
- 2.12.2.2 The routing of pipelines shall include sufficient flexibility near tappings to allow for thermal expansion of the process equipment.
- 2.12.2.3 The pipes shall be cold bent using hydraulic bending machines only.
- 2.12.2.4 The horizontal impulse lines shall be laid with proper slopes towards the tapping point.
- 2.12.2.5 Supports for piping and tubing shall be adequate and in no case exceed limits shown below:
 - a) 1/4" OD / 3/8" OD Copper - Continuous
 - b) 1/2" NB Pipe / Tube - 5'
 - c) 3/4" NB Pipe / Tube - 5'
 - d) 1" NB Pipe / Tube - 8'
- 2.12.2.6 All impulse line welding shall be done through welding generator/rectifier and only structural welding could be done through welding transformer.
- 2.12.2.7 Impulse pipe of Alloy Steel / Stainless Steel / Carbon Steel shall be TIG welded wherever required. Welding of impulse pipe shall be carried out in accordance with BHEL welding procedure. The welding electrodes shall be approved by BHEL welding Engineers. Impulse pipes welders shall undergo welding Test and approved by BHEL welding engineer at site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 2.12.2.8 Minimum number of fittings shall be used on all lines wherever possible, to keep threaded joints to a minimum wherever thread connections are to be made.
- 2.12.2.9 The impulse pipe laying is recommended to be limited to a maximum of 10 metres (each limb) generally, unless otherwise specified, to have optimum response from the transmitter. However, this will depend upon plant layout.
- 2.12.2.10 Where the tapping point is subjected to mechanical shift due to heating / cooling of main equipment, care should be taken to route the impulse pipe in such a way as to absorb the shift of tapping point without straining the impulse piping. To accommodate this, sufficient loop for the impulse pipes can be provided near to the tapping point.
- 2.12.2.11 Alternatively, hose assembly - S.S. flexible may be used for connection between tapping point and impulse pipe.
- 2.12.2.12 The expansion bends are to be avoided as far as possible, as these act as air/sedimentation traps hampering the system performance.
- 2.12.2.13 Impulse piping shall be arranged as short as possible with a minimum of bends.
- 2.12.2.14 Horizontal piping shall be avoided and 1/10 slope shall be maintained.
- 2.12.2.15 Pipes shall not be laid parallel to high temperature process piping.
- 2.12.2.16 Pipe joints shall be carried out using sockets and flanges. Union fittings may be used when pressure is low. In the case of D.P. instruments both piping on low side and high side shall be maintained at same length and in the same route.

2.12.3 Impulse Piping for Air & Flue Gas System

- 2.12.3.1 For furnace pressure and furnace flue gas, suitable piping for air and furnace flue gas pressure, the impulse pipe shall be arranged to rise vertically from the tapping point to a distance at least of 300 mm before a change of direction is made.
- 2.12.3.2 Arrangements should be made for air purge in the impulse piping system at the end of the instrument airline or roding facilities may also be provided with suitable tees and cross.
- 2.12.3.3 In order to take care of the boiler expansion, suitable flexible connecting pipes can be arranged either at the tapping point end or at the instrument end.

2.12.4 Impulse Piping for Vacuum Measurement

The measuring instruments used on vacuum measurement should always be installed above the level of the tapping point in order to minimize measuring errors as much as possible. A suitable condensing chamber can be arranged which will eliminate the condensate or any blocking in the impulse pipe.

2.12.5 Impulse Piping for Steam and Water System

- 2.12.5.1 As a rule, instrument installation position for steam and water shall be downward from root valves.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 2.12.5.2 Impulse pipes shall have a minimum slope of 1:10 and shall be supported at every 2 metres length.
- 2.12.5.3 At the transmitter end, the connection can be either through 2-way valve manifold or nipple with coupling.
- 2.12.5.4 In case 2-way manifold used and connected with nipple and coupling, it is necessary to provide tee with plug for purging or venting. The impulse pipe connection to the transmitter from the main pipe may be either upper side or lower side of the transmitter. In any case sufficient slope shall be maintained.
- 2.12.5.5 Some supplier recommends capillary type tube for transmitter connection from the impulse pipe to instrument by using S.S. tube and compression fittings.
- 2.12.5.6 It is always preferable to mount the instrument below the tapping points because the condensate shall protect the instruments against high temperature. In any case, the temperature entering the instrument should not exceed 150 F. In case the instrument is installed above tapping, before opening the process root valves, the impulse pipe shall be filled with water.
- 2.12.5.7 In the case of high temperature steam applications, sufficient length or siphon shall be provided to ensure certain length of condensate is formed thereby protecting breaking the measuring instruments from high temperature. Snubbers can also be provided if there is likely to be any pulsating of the medium measured.

2.12.6 Bending

- 2.12.6.1 It is recommended for cold bend for the impulse pipes with the help of a hydraulic bending machine to achieve a particular shape.
- 2.12.6.2 Use of 45° elbow and 90° bends (ready-made) is restricted to bare minimum to minimize the number of joints in a system. Hot bending is not to be used as this leads to flattening of pipes at the bends and also results in thinning of walls, apart from introducing changes in metallurgical properties of the pipe material.
- 2.12.6.3 Hot bending may be permitted for carbon steel pipe for low pressure service as instructed by supervisor only when it cannot be avoided. In the case of 90° bending radius shall be more than 3 times the outside diameter of pipe and in the case of 'u' bending, radius of bending shall be 5 times the outside diameter of pipe. When the radius of bending becomes small, elbow fitting shall be used.
- 2.12.6.4 Large bending shall be so made as to form smooth curve.

2.12.7 Cutting

- Pipe cutter or wheel grinder shall be used for pipe cutting.
- Gas cutting shall be avoided.
- Burr inside the cut end shall be removed.
- The cutting surface shall be as perpendicular to the axis as possible.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.12.8 Impulse Pipe Welding

Generally, welding of impulse pipe and fitting shall be carried out by arc welding and socket welding is adopted. Welding shall be performed by a qualified welder only.

D.C. arc welding is recommended for impulse pipe. Motor generator is preferred to rectifier transformer, since it may damage the welding joints due to surge.

In order to prevent the cracking of the weld it is recommended to provide a small gap between the bottom of the socket and pipe end.

2.12.9 Testing

On completion of pipeline, installation, the pipelines shall be hydraulic tested. Contractor shall arrange for hydraulic pump and standard gauges and conduct the test satisfactorily.

The impulse lines shall be isolated from the instruments and tested at two times the maximum working pressures. The fall in pressure shall not be more than 1 kg/cm² or 1% of the working pressure whichever is less, in 30 minutes and there shall be no leaks, at any of joints / welds, when isolated from source of press.

2.12.10 Guidelines for Installation of Pneumatic Line

2.12.10.1 Copper tubing shall be connected with Olive type of compression fittings,

2.12.10.2 When two or more lines run together, the joint in the adjacent alternate line shall be a offset.

2.12.10.3 In case of copper tubing, the single run copper tube may be supported with an angle. However, suitable trays shall be used for more than one tubing.

2.12.10.4 Copper tubing shall not to be bend less than 10 D where is the OD of the copper tube.

2.12.10.5 All air distribution, main and branch lines shall be galvanized internally as well as externally and the galvanized pipe, never, shall be braced or welded.

2.12.10.6 The joints shall be screwed with Teflon tapping wherever the pipes are to be removed frequently for cleaning and other purposes and suitable union fittings shall be used.

2.12.10.7 Care shall be taken while taking a branch pipe to see that the line is not taken from the lower part of the main line or main header in order to avoid entry of any drain or dust into the system.

2.12.10.8 Instrument airline should not be routed where severe vibration, high temperature exists and adequate space should be available for maintenance.

2.12.10.9 Care shall be taken when removing the PVC sheeting, while connecting the copper tube. The exposed portion after jointing shall not be excessive and also while removing PVC, the tube should not get damaged. Pipe cutters should not be used for cutting the copper tube, instead the specific copper tube cutter shall

TECHNICAL CONDITIONS OF CONTRACT (TCC)

be used. Similarly, for bending copper tubes, specific copper tube bender should be used and the radius of the bending shall be more than 2.5 times of the OD of the copper tube.

2.12.10.10 While using the pipe cutter, care shall be taken to remove burr from the cutting side.

2.12.10.11 In locations where the copper tube is likely to be damaged from outside, the copper tube can be routed near a different pipe. While laying copper tube either inside angle or trays, the tube shall be supported at least at every one metre distance.

2.12.10.12 While fixing the copper tube fittings only Teflon tapes should be used. However, no tape shall be used while tightening the ferrules.

2.12.11 Instrument Airline Testing

– All instrument air lines shall be isolated from the instruments and pressurized pneumatically to maximum working pressure. It shall then be isolated from the source of pressure and fall shall be less than 1 psi in 20 minutes.

– All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurized pneumatically 20 psi, and checked with soap solution for leak.

2.12.12 General Guidelines on Installation of Flexible Hoses

2.12.12.1 Flexible hoses can be classified into two broad categories, viz., Rubber hoses and Metallic hoses. The selection of the hoses is made depending upon the service conditions (pressure, temperature and other environmental conditions).

2.12.12.2 Under pressure, a hose may change in length. Always provide some slack in the hose to allow for this shrinkage or expansion. (However, excessive slack in hose lines is one of the most common causes of poor appearance).

2.12.12.3 At bends, provide enough hose for a wide radius curve. Too tight a bend pinches the hose and restricts the flow. The line could even kink and close entirely. In many cases, use of the right fittings or adapters can eliminate bends or kinks.

2.12.12.4 In applications where there is considerable vibration or flexing, allow additional hose length. The metal hose fittings, of course, are not flexible and proper installation protects metal parts from undue stress, and avoids kinks in the hose.

2.12.12.5 Hose assemblies in service should be inspected frequently for leakage, kinking, corrosion, abrasion or any other signs of wear or damage. Hose assemblies that are worn or damaged should be removed from service and replaced immediately.

2.12.12.6 The service life expectation of a flexible hose mainly depend on the correct installation layout. In most cases, when flexible hoses fail prematurely, the reason of failure may be found in an incorrect layout.

2.12.12.7 As a rule, the hose is not to be bent over its limit of elasticity. The choice of the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

right hose length is of crucial importance. The hose should not be subject to torsion. Torsion can be usually eliminated by changing the layout.

2.12.13 General Notes on Installation of Local Instrument Racks and JB Frames

- 2.12.13.1 In cases where the local instrument stands are to be installed on a concrete foundation, it shall be fixed by anchor bolts.
- 2.12.13.2 In cases where the local instrument stands are to be installed on the base plate, the stand can be placed on an angle and the same can be welded. However, in cases where there is a probability for removal of stand is likely to arise, it shall be fixed by bolts.
- 2.12.13.3 Installation of local junction boxes shall be installed in such a way that they are fixed on a column by welding or by fixing bolts.
- 2.12.13.4 Local Instrumentation rack, which shall be installed utilising the Beam and Structure, shall be fixed by welding. Care shall be taken while deciding the location in order to ensure that no hindrance is caused to the maintenance personnel in their moving space within the work area. Further, as a standard practice, it should be ensured that no instrument stands/racks/JBs shall be supported by/welded on to any of the working equipment, or even hand grided or floor grided, as per safety norms.
- 2.12.13.5 Proper care should be taken to ensure that welding of the stand on any structure or Beam is fully welded.

2.12.14 General Guideline on Flow Instruments Installation

- 2.12.14.1 Extreme care shall be taken when welding and assembling the flow element on the pipe. Any misalignment or rough particle or edge inside the welded area may cause inaccuracy and this will increase as the flow increases.
- 2.12.14.2 Flow elements should always be located in upstream from any valve. Downstream side of valve shall no longer be a homogenous mixture and this may cause erratic behaviour of reading periodically.
- 2.12.14.3 Care shall be taken while welding the impulse pipe. Improper arrangement of piping of DP instruments can create error in the reading and even it gives an indication of negative flow of steam even though the flow is to be positive. Inadequate exchange of steam and condensate in the piping may cause negative flow. The presence of burr or dirt in the pipe can impede the flow of condensate back to the pipe, and when this happens, the pipe becomes full of water and has the effect of creating negative head.
- 2.12.14.4 Always $\frac{3}{4}$ " to 1" pipe is recommended for free flow condensate. Gate valve shall be used for the tapping and pipe should be insulated up to condensing pot.
- 2.12.14.5 The Measuring instrument shall be located close to the flow-sensing element. The speed of response is reduced if there is a long run.
- 2.12.14.6 The orifice plates shall be installed such that the extreme face is perpendicular to

TECHNICAL CONDITIONS OF CONTRACT (TCC)

the axis of the pipe within the +2 deg or -2deg. and it should be ensured that when the extreme face is facing the direction of flow, invariably the sign of positive (+) is marked on the upstream.

- 2.12.14.7 Location of Flow element should have clear straight run of 10D in upstream and 5D in downstream.
- 2.12.14.8 For non-viscous liquid flow measurements, the best location for the instruments shall be below the pipeline, If the instrument is above the line, more maintenance will be involved. Suitable vapour traps shall be provided.
- 2.12.14.9 In the case of air and gas flow measurement system, as part of basic requirement, it should be transmitted to the instruments without any change in the differential head due to leakage.
- 2.12.14.10 If the flow of any dry gases are to be measured, the location of instrument can be kept above or below the tapping points.
- 2.12.14.11 For air flow measurements, it is always preferable to install the instruments above the pipeline. In case, if the instrument must be installed below the duct/pipeline, suitable Dust Collection Chamber can be installed.
- 2.12.14.12 The condenser pot should be located nearer to the tapping point and both condenser chamber should be at the level of upper tapping,
- 2.12.14.13 The unequal level will cause significant error due to false heads. If the flow nozzle is installed in vertical pipe, the lower tapping pipe which is bent and taken up to upper tapping in order to align with the upper condensate pot, must be insulated, otherwise, error is created when the bent pipe fills with condensate. The error may add or subtract depending upon the direction of flow.
- 2.12.14.14 For flow measurements, the instruments should always be located below the condenser pot, otherwise, the condensate will be lost from the system and the instrument will reach 'O' during the shutdown and the total system must be vented after the startup of the boiler in order to remove Air and Vapour which might have got entrapped.
- 2.12.14.15 In an installation where the instruments must be located above the tapping points and the condensing chamber should be equally located above the instruments the pipeline up to the condensing pot should be insulated.
- 2.12.14.16 In the case of viscous fluids, flow measurements which are likely to freeze or concealed in the pressure pipe or like such corrosive type fluids, suitable sealing chamber shall be used, the sealing liquid should not mix or react with the medium to be measured.
- 2.12.14.17 The commonly used sealing liquid includes water, light oil, glycerol, ethylene glycol and mixtures of the last two with water.
- 2.12.14.18 The sealing chambers, in each pressure pipe, should be installed at the same level and as close as possible to the pressure tapplings.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.12.14.19 The general arrangement for pressure tapplings from the Sealing Chamber to the instrument is shown in the sketch.

2.12.14.20 The flow elements should be inspected before installation to find out the presence of any corrosion/rusting or any blockage on the pressure tapping holes or any deposits on the face of the orifice plate.

2.12.15 General Guideline on Installation of Valves

2.12.15.1 Primary isolating valves (root valves) must be located at the tapping which can be of globe valves.

2.12.15.2 These valves shall be installed where access is possible.

2.12.15.3 Secondary isolating valves shall be located at the end of inter-connecting pipe. It should be as nearer as possible to the measuring instruments and should be of needle type.

2.12.15.4 For pressure more than exceeding 40 kg, 2 isolating valves shall be provided.

2.12.15.5 In the case of heavy duty isolating valves, suitable support shall be provided to avoid any loading on the stubs.

2.12.15.6 In viscous fluids, suitable steam tracing shall be provided.

2.12.15.7 These valves are always located as nearer to the measuring device as possible.

2.12.16 Blowdown Valves or Drain Valves

- a. These valves are fixed at the lowest end of impulse pipe.
- b. In the case of high-pressure line always 2 valves shall be fitted in series. Normally, these valves will be of globe type.
- c. For low-pressure application, single valve is used.
- d. In case of air and flue gas measurements, either a plug or a suitable gate valve of gunmetal 'on/off' valve shall be provided.
- e. The drain valve shall be connected to the common drain header which finally is terminated at plate operation drain system.

2.12.17 PAINTING

All the supporting steelworks impulse pipe shall have protective painting. The surface shall be free from rust, foreign adhering matters, grease etc. Two coats of rust preventing red-oxide primer and final painting of two coats as per the colour DECIDED by the site engineer. After cleaning the surface is painted with one coat of Red oxide zinc chromate primer conforming to IS 2074 and allowed to dry completely. The primer-coated surface is painted with two coats of final painting of desired colour which shall be selected from IS-5.

2.12.18 GUIDELINES FOR CABLE LAYING

2.12.18.1 In the plant building, substations, switchgear rooms, control rooms etc. Power and control cables shall generally be laid on cable trays installed in concrete trenches,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

tunnels, cable basements, cable vaults, cable shafts or along building and structures as the case may be.

- 2.12.18.2 In case of multicore cables of diameter upto 20 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of more than 300 mm.
- 2.12.18.3 Power & control cables installed along buildings and structures, ceilings, walls, etc. which are required to be protected against mechanical damage shall be taken in G.I. conduits.
- 2.12.18.4 GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.
- 2.12.18.5 In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy-duty PVC pipes shall be provided.
- 2.12.18.6 Entry of cables through trenches/tunnels into buildings shall be by means of one of the methods indicated in drawing as applicable for different buildings.
- 2.12.18.7 Cables laid exposed in racks / trays and routed through trenches / tunnels / basements etc. to individual drive / control devices etc. shall be taken in embedded surface exposed rigid GI conduits and or flexible conduits unless directly terminated to the equipment in the panels located, above trenches, tunnels or basement.
- 2.12.18.8 All cables routed along walls or in equipment rooms shall be protected by means of laying them through GI pipes or by providing sheet metal covers up to a height of 2000mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be of enclosed type.
- 2.12.18.9 Tray covers shall not be provided for the cable trays within trenches, tunnels and basements. Non-perforated type sheet steel covers shall be provided for the trays in the areas susceptible to accumulation of coal dust/atmospheric abuses etc.
- 2.12.18.10 Cable trays shall be supported on ISA 50 X 50 X 6mm MS / GI brackets. Brackets shall be welded to steel plate inserts in the trenches / tunnels or supporting channel angle / inserts in other areas.
- 2.12.18.11 Wherever direct heat radiation exists, heat isolating barriers (subject to customer's approval), for cabling system shall be adopted.
- 2.12.18.12 For 415V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded / exposed GI conduits or rigid PVC pipes as applicable.
- 2.12.18.13 If required, a few number of cables in exceptional areas may be directly buried into the earth.
- 2.12.18.14 Wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth as decided by Engineers.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 2.12.18.15 At certain places where hazardous fumes / gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.
- 2.12.18.16 In corrosive atmosphere, PVC conduits shall be used for cables.
- 2.12.18.17 Single core cables, when pulled individually shall be taken through PVC pipes only.
- 2.12.18.18 Laying and installation of power, control and special cables shall generally conform to IS: 1255
- 2.12.18.19 The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
- 2.12.18.20 In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks / trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. Only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.
- 2.12.18.21 Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.
- 2.12.18.22 Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of cable. The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS 1255.
- 2.12.18.23 All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Tags shall be fixed at both ends of cables (both inside & outside of panel) both sides of floor / wall crossings, every 25m spacing for straight runs or as specified by Engineer for easy identification of cable.
- 2.12.18.24 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.
- 2.12.18.25 Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material.
- 2.12.18.26 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacings not less than one cable diameter of bigger diameter cable.
- 2.12.18.27 All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanised MS saddles / aluminium strips / nylon cable ties. Cables above 35mm diameter shall be clamped individually.
- 2.12.18.28 Control cables shall be laid touching each other and wherever required may be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

taken in two layers. All control cables shall be clamped with a common clamp / tie.

2.12.18.29 Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formation:

- a. HT cables shall be laid in the top tier(s)
- b. LT power cables to be laid in the tray(s) below the HT cable trays.
- c. LT control cables to be laid in the Tray(s) next below to the LT power cable tray(s)
- d. Special control cables including screened control cables to be laid in the bottom most tray(s).

2.12.18.30 For vertical formations, the trays closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed. However, where there is no clear distinction of bottom / top trays, the order convenient for linking the horizontal and vertical formations shall be followed.

2.12.18.31 When it may not be possible to accommodate the cables as per the criteria indicated in the two clauses indicated above, the following rules shall override the criteria. However, prior approval of the Engineer will be required.

In hierarchical order:

- a. Control cables are mixed up with the special control cables with clear minimum gap of 100mm between them.
- b. LT power cables are mixed up with control cable with clear minimum gap of 150mm between them.
- c. LT power cables are mixed up with HT power cables with clear minimum gap of 200mm between them.
- d. LT power cables are mixed up with special control cables with clear minimum gap of 200mm between them.

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

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

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

2.12.18.35 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic scoop or

TECHNICAL CONDITIONS OF CONTRACT (TCC)

other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.

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

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

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

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

2.12.19 Support Spacings & Clampings

Support spacing and clamping suitably provided and as required.

2.12.20 Laying of cables directly buried in ground

Laying and installation of directly buried cables in ground shall conform to the requirements of IS 1255.

2.12.21 Codes and Standards

Installation of cabling work shall comply with the following Indian Standards (Latest editions):

IS 1255 Code of practice for installation and maintenance of power cables upto and including 33 kV rating.

IS 732 Electrical wiring installation (system voltage not exceeding 650 V).

IS 5216 Guide for safety procedures and practices in electrical works.

IS 226 Structural steel (Standard quality).

IS 800 Code of practice for use of structural steel.

IS 316 Code of practice for use of metal arc welding for general construction in mild steel.

IS 1363 Hexagonal bolts, nuts and screws

IS 1572 Electroplated coatings of cadmium on iron and steel.

IS 2629 Code of practice for hot dip galvanising for iron and steel.

IS 2633 Method of testing uniformity of coating on zinc coated articles.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

IS 15908 Selection, Installation and Maintenance of Control and Indicating equipments for Fire Detection and Alarm System- Code of Practice

IS 2189 Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System-Code of Practice

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

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

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

2.12.22 Guidelines For Erection of Cable Trays, GI Pipes, Supports and Accessories

- 2.12.22.1 Constructional details and supporting arrangement for the cable trays shall be as shown in the drawings which will be handed over to the successful bidder. All cable trays, vertical raceways and supporting steel work shall be installed along the routes as indicated in the drawings and as per the instructions of the Engineer-in-charge. The contractor has to fabricate and install complete tray supporting structures as per the drawing / site requirement.
- 2.12.22.2 Wherever specified or directed by Engineer, the contractor shall install galvanised MS sheets covers over cable trays. The width of the covers shall be same as that of cable trays. Bolting shall be done to fasten covers to the cable trays, elbows, reducers, tees, crosses etc.
- 2.12.22.3 The contractor shall install all angles, channels, beams, hangers, brackets, clamps etc. as may be necessary to suit the actual site conditions to support the cable trays.
- 2.12.22.4 Straight pieces of standard MS angles / channels shall be used for fabrication of supports / racks. All welded joints shall be smooth enough to provide a good appearance and shall not cause injury to working personnel.
- 2.12.22.5 Cable trays within cable trenches, tunnels and basements shall be of ladder type. Bottom most tray within plant buildings for overhead runs of trays shall be of perforated type. Cable trays in the areas exposed to coal dust shall be installed in vertical formation. Wherever due to layout constraints, it is not possible to install the trays in vertical formation with Engineer's prior permission installing the trays in horizontal formation may be considered.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 2.12.22.6 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way or maintenance of adjacent equipment.
- 2.12.22.7 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.
- 2.12.22.8 For equipment and devices having GI conduit entry arrangement other than standard GI conduit adopter, adopters shall be provided as required to enable the GI conduit to be properly terminated, between conduit end and motor T.B.
- 2.12.22.9 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.
- 2.12.22.10 The entire G.I. conduit system shall be firmly fastened in position. All boxes and fittings shall generally be secured independently from the Gi pipes entering them.
- 2.12.22.11 Bends of G.I. pipes / conduits shall be made without causing damage to the pipes / conduits.
- 2.12.22.12 Occupancy of conduits shall not be greater than 40%.
- 2.12.22.13 The adopter for coupling rigid GI pipe / conduits and flexible conduit shall be of aluminum or galvanized steel.
- 2.12.22.14 Transportation and storage of cable drums
- 2.12.22.15 Transportation and storage of cable drums shall generally conform to the requirements of IS: 1255
- 2.12.22.16 All the cables shall be supplied to the contractor free of cost from BHEL / Customer's store / storage area. Transportation of cables from storage area to the work site shall be the responsibility of the contractor.
- 2.12.22.17 The cable drums shall be transported on wheels to the place of work.
- 2.12.23 Guidelines for Cable Termination and Jointing**
- 2.12.23.1 Contractor shall carry out cable terminations at various electrical and electronic equipment terminals.
- 2.12.23.2 When the equipment are provided with undrilled gland plates for cable / conduit entry into the equipment, drilling and cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site and drawings shall be prepared and take engineer's approval before drilling holes. Cutting shall not be allowed.
- 2.12.23.3 Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the contractor. Looping of cores / wires at terminals as shown in interconnection diagrams is to be done by the column at no extra cost as part of the termination.
- 2.12.23.4 All cable entries in the equipment shall be sealed after glanding the cables.
- 2.12.23.5 Adequate length of cables shall be pulled inside the switch boards, control panels,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

terminal boxes etc. as per near termination of each core / conductor.

- 2.12.23.6 Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals.
- 2.12.23.7 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes / nylon ties and suitably supported to keep them in position at the terminal block. All spare cores shall be connected to spare terminals wherever possible. If spare terminals are not available, spare cores shall be neatly dressed and suitably taped at both ends.
- 2.12.23.8 Screened control cables of 0.5 sq.mm cross-sectional area shall be terminated by means of wire rapping system.
- 2.12.23.9 Individual cores of control cables shall have ferrules for identification. Ferrule numbers shall be provided as per the control schemes and other related documents supplied.
- 2.12.23.10 End sealing / termination of cables shall be done by means specified on the specification for terminations. The system shall be suitable for types of cable specified and complete with stress relief system.
- 2.12.23.11 Termination and jointing of aluminium / copper conductor power cables shall be done by means of compression method using compression type aluminium / tinned copper lugs.
- 2.12.23.12 Copper conductor control cables shall be terminated directly into screwed type terminals provided in the equipment. Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.
- 2.12.23.13 Cable joints shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit, subject to BHEL's approval of Engineer shall be taken for deciding location of joint.
- 2.12.23.14 Junction boxes shall be used, wherever required, for jointing of control cables.
- 2.12.23.15 Termination and jointing shall generally conform to the requirements of IS: 1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.

2.12.24 Design Requirements of Items supplied for cabling installation work (if supply is covered in contractor scope).

2.12.24.1 Strip Cable Clamps

- a. Strip Clamps shall be of aluminium alloy or cast steel or M.S. and shall be used to fasten the group of multicore cables on the tray.
- b. Clamps shall be of simple construction, made of 4 mm thick, 25 mm wide strip to cover the entire width up to 300 wide tray and part of the tray for

TECHNICAL CONDITIONS OF CONTRACT (TCC)

more than 300 wide trays. Strip shall have two right angle bends for fixing on the rung with two bolts.

- c. Clamps shall be of different lengths for different sizes of tray width. The maximum size of clamp width shall be 300 mm and for cable trays of greater width, two clamps shall be used.

2.12.24.2 Self Locking Clamps

- a. Clamps shall be of nylon material / fibre glass.
- b. Clamps shall have self-locking feature when the cord is looped.
- c. Clamps shall be provided with manual lock release.
- d. Clamp cord shall not move in the backward position once it has been locked, unless the lock release is applied.
- e. Type test certificates to ascertain the strength of clamps shall be submitted for purchaser's approval.
- f. Nylon self-locking clamps shall be of BHEL approved make only.

2.12.24.3 Ferrules

- a. Ferrules shall be required for individual core of cable hence they shall be suitable for the insulated conductor diameter.
- b. Ferrules shall be of plastic material.
- c. Numbering on the ferrules shall be engraved type with contrast colour to the base. Engrave coloring shall be of durable quality to match the entire life of the plant. Engraving shall be legible from a distance of 600 mm.
- d. Ferrules shall be interlocking type in such a way that the interlocked ferrules take the shape of tube with complete ferrule number appearing in a straight line.

2.12.24.4 Tags

- a. Cables shall be provided with cable number tags for identification.
- b. Cable tags shall be of durable fiber, aluminum, stainless steel sheets or lead of suitable thickness
- c. Cable number shall be engraved type in case of aluminum or stainless steel tags, and printed type in case of fiber sheet.
- d. Tags shall be durable quality of size 60mm x 12mm with holes at both ends.
- e. Samples of tags shall be approved by BHEL Engineer before delivery.
- f. Tags shall be provided with non-corrosive wire of sufficient strength for tagging's.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.12.25 GUIDELINES FOR EARTHING INSTALLATION

- 2.12.25.1 All equipment shall be earthed by two separate and distinct connections. Earthing terminals will be available in all the equipment supplied by BHEL.
- 2.12.25.2 The earthing conductors shall be mild steel / G.I. strips / wires. 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 successful tenderer.
- 2.12.25.3 A continuous earthing conductor shall be installed in all cables trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run on parallel continuous earthing conductors shall be provided on one tray only with tap offs to the control cable trays. All valve and damper motor and rapping motors will be earthed to this conductor.
- 2.12.25.4 All joints in the earthing system shall be welded type. Earthing connections to all equipment including motors shall be bolted type.
- 2.12.25.5 Earthing connections shall be free from tinning scale, paint, grease, rust or dirt at the time of making joint.
- 2.12.25.6 Metallic sheaths, screens / shields and armor of all multicore cables shall be bonded and earthed.
- 2.12.25.7 Earthing conductors along with their run on columns, beams, walls etc., shall be supported by suitable cleats at intervals of 750 mm.
- 2.12.25.8 Conduits shall be bonded together and grounded at all switchgear and control centers.
- 2.12.25.9 M.S.Earthing conductors shall be coated with one coat of bituminous paint, wrapped with a layer of bitumen tape and finally coated with bitumen paint. For site welded GI strips / wires required coat of aluminium paint should be given.
- 2.12.25.10 If the equipment is not available at the time of earthing conductor laying tap connections from the main earthing conductor shall be brought out up to slab equipment foundation level with at least 200 mm spare length left for further connections to equipment earthing terminals.

2.12.26 Guidelines for Erection of Control Panels and Distribution Boards

- 2.12.26.1 The base frames will be supplied normally along with the boards. These will have to be aligned, levelled and grouted in position as per approved drawings. Wherever the base channels are not available, the same will have to be fabricated and painted at site. Base channels will have to be grouted. Suitable concrete drilling machine shall be used for making hole on the concrete floor.
- 2.12.26.2 For the panels which are 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. Fabrication and installation of these support structures shall be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

carried out as per drawings.

2.12.26.3 All the panels / board shall be placed on its foundation or supporting structures and shall be assembled equipment as required. All equipment should be installed with parallel, horizontal and vertical alignment by skilled craftsmen.

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

2.12.27 The following points shall be checked up during erection

- a. Layout of foundation channels.
- b. Floor level covered by the panel with respect to main floor level.
- c. Location and serial no. panels.
- d. Positioning of panels.
- e. Verticality of panels and breaker truck to station earth.
- f. Earthing of panels and breaker truck to station earth.
- g. Lugs for termination of HT and LT cables.
- h. Mounting and fixing arrangements all modules.
- i. Check the operation of:
 - (i) Remote control
 - (ii) Various required - closing / tripping / alarm / indications / interlocks
Installation position of instruments and relays
Operation of relays and instruments.
- j. AC / DC supplies for panel.
- k. Tightness of terminal connections for HT & LT connections.
- l. Working of ammeters and voltmeters for their entire range and other panel mounted instruments like recorder, indicator etc.

2.12.28 415 V switchgear and Electrical panels tests (as applicable)

- a. IR Test on each pole of breaker
- b. IR test on control circuit
- c. Measurement of contact resistance for all three phases of breaker
- d. Measurement of resistance of the closing and tripping coil of breaker
- e. Checking the close trip operation at 70% and 100% of the rated auxiliary D.C. Voltage.
- f. Checking of interlocks provided and tripping of breaker through relays
- g. Space heater operation check
- h. Opening and closing time check

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- i. Control and metering circuit checks.
- j. Primary and secondary injection tests.
- k. Thermal overload relay testing and checking
- l. Calibration of all instruments and meters
- m. Phase rotation checks
- n. High voltage test on 7C.1.3 kV switchboard

2.12.29 Cutting & Wastage Allowance

The following scrap allowances are permissible:

	Description	Non-salvageable	unaccountable
1.	Length below 0.5 m steel pipes, Stainless / Copper tubes, Single pair cables	2%	0.5%
2.	Length below 20m multi cable, multitubes	2%	0.5%

2.12.30 Guidelines for handling of solid state modules:

- All the solid-state modules shall be handled by qualified person.
- Electronic modules should only be touched when it is absolutely essential.
- Before touching any electronic modules, the operator should discharge the static electricity by earthing himself or better still, ensure constant discharge by wearing an earthed wrist strip.
- The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing atleast 65% cotton.
- PCB should always be held by the front panel or by the module frame and the electronic components should never be touched.
- The electronic modules should never be placed close to television sets or CRT units.
- Soldering irons and any other tools used must be grounded.
- All modules using CMOs components are packed in antistatic bags, when transported loose to avoid ESD failures. The antistatic bags must always be used to transport modules at site from one place to the other.

2.12.31 Guidelines for landing and storage of Electronic Cubicles / sub-assemblies / loose items.

- 2.12.31.1 Immediately after unloading at site, the electronic equipment should be kept in the covered area. Handling and lifting of the package should be done without jerks or impacts. Packing case should not be dripped or slid along the floor under any circumstances. Suitable forklift should be used to move the case to its final position. All the above points are to be strictly followed as the electronic equipments cannot withstand any stress due to vibration and shock.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 2.12.31.2 After unloading at site, the package of the equipment shall be inspected for external damage. In case the package is damaged, the package number and details of the damage should be noted. The details of the damage should be reported to the responsible site Engineer.
- 2.12.31.3 Cases should be opened / unpacked using correct nail pullers. While opening the planks, care should be taken to see that the equipment is not damaged. Cases should not be unpacked in areas where they are exposed to rain water / liquid splashing, dust or other harmful materials like chlorine gas, sulphur dioxide etc.
- 2.12.31.4 After opening the case, all supports provided for transport are to be removed with due care.
- 2.12.31.5 Hinged frames should not be opened when equipment is not secured to the floor as this is likely to cause it to topple over. The hinged frame can be opened only if the equipment is still fixed on to the bottom wooden pallet.
- 2.12.32 **Guidelines for installation of LHS cables** The actual guidelines as recommended by OEM are to be followed. BHEL Site Engineer's decision will be final.