

**E-TENDER SPECIFICATION**

<b>Sl. No</b>	<b>E-Tender Specification Number</b>
1	<b>BHE/PW/PUR/KPD-C&amp;I-R&amp;M/3250</b>

UPGRADATION/R&M OF UNIFIED DISTRIBUTED CONTROL SYSTEM (DCS) OF UNIT#1 OF MAHAGENCO, KHAPERKHEDA TPS-210 MW.

**VOLUME – I**

**FOR**

**VOLUME I – TECHNICAL BID**

**THIS TENDER SPECIFICATION CONSISTS OF:**

<b>Notice Inviting Tender</b>	
<b>Volume-IA</b>	<b>Technical Conditions of Contract</b>
<b>Volume-IB</b>	<b>Special conditions of Contract</b>
<b>Volume-IC</b>	<b>General conditions of Contract</b>
<b>Volume-ID</b>	<b>Forms &amp; Procedures</b>
<b>Volume-IE</b>	<b>Technical Specifications</b>
<b>Volume II</b>	<b>Price Bid</b>

**Bharat Heavy Electricals Limited**



*(A Government of India Undertaking)*

Power Sector - Western Region

345-Kingsway, Nagpur-440001

<b>CONTENTS</b>		
Volume No	Description	Hosted in website bhel.com (Briefly) and detailed in BHEL e-Procurement Portal as files titled
NIL	Tender Specification Issue Details	(Part of <b>Vol-IA-3250</b> )
NIL	Notice Inviting Tender	(Part of <b>Vol-IA-3250</b> )
<b>I-A</b>	<b>Technical Conditions of Contract</b>	<b>Vol-I-A-3250</b>
<b>I-A</b>	<b>ANNEXURE-B</b>	<b>Vol-I-A-3250</b>
<b>I-A</b>	<b>ANNEXURE-C</b>	<b>Vol-I-A-3250</b>
I-B	Special Conditions of Contract	Vol-I-BCD-3250
I-C	General Conditions of Contract	(Part of Vol-I-BCD-3250)
I-D	Forms & Procedures	(Part of Vol-I-BCD-3250)
<del>I-E</del>	<del>Technical Specifications</del>	<del>Vol-I-E-3250</del>
II	Price Bid Specification as specified in E-Procurement Portal	Volume-II-3250

E-TENDER SPECIFICATION

Sl. No	E-Tender Specification Number
1	<b>BHE/PW/PUR/KPD-C&amp;I-R&amp;M/3250</b>

UPGRADATION/R&M OF UNIFIED DISTRIBUTED CONTROL SYSTEM (DCS) OF UNIT#1 OF MAHAGENCO, KHAPERKHEDA TPS-210 MW.

EARNEST MONEY DEPOSIT: Refer Notice Inviting Tender

LAST DATE FOR TENDER SUBMISSION      Refer Notice Inviting Tender

THESE TENDER SPECIFICATION DOCUMENTS CONTAINING VOLUME-I AND VOLUME- II ARE ISSUED TO:

M/s. ....

.....

PLEASE NOTE:  
THESE TENDER SPECS DOCUMENTS ARE NOT TRANSFERABLE.

For Bharat Heavy Electricals Limited

**GM (Purchase)**

Place: Nagpur

Date:

3250

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED



# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – I: Project Information

---

SI No	DESCRIPTION	Chapter
<b>Volume-IA</b>	<b>Part-I: Contract specific details</b>	
1	Project Information	Chapter-I
2	Scope of Works	Chapter-II
3	Facilities in the scope of Contractor/BHEL (Scope Matrix)	Chapter-III
4	T&Ps and MMEs to be deployed by Contractor	Chapter-IV
5	T&Ps and MMEs to be deployed by BHEL on sharing basis	Chapter-V
6	Time Schedule	Chapter-VI
7	Terms of Payment	Chapter-VII
8	Taxes and other Duties	Chapter-VIII
9	Specific Inclusion	Chapter-IX
10	Annexures & Technical details	Chapter-X
11	Weightages/ factor & BOQ	Chapter-XI

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – I: Project Information

---

<b>1.0</b>	<b>Project Information</b>																					
<b>1.1</b>	<table><tr><td>1</td><td>OWNER</td><td>: Maharashtra State Power Generation Company Ltd.</td></tr><tr><td>2</td><td>PROJECT</td><td>: <b>UPGRADATION OF UNIFIED DISTRIBUTED CONTROL SYSTEM (DCS) OF UNIT#1 OF MAHAGENCO KHAPERKHEDA TPS 210 MW</b></td></tr><tr><td>3</td><td>PROJECT RATING</td><td>: 210 MW</td></tr><tr><td>4</td><td>LOCATION</td><td>: KHAPERKHEDA TPS Thermal Power Station, Dist – Nagpur, Maharashtra</td></tr><tr><td>5</td><td>NEAREST RAILWAY STATION</td><td>: Nagpur Railway Station- 20 Km from project site</td></tr><tr><td>7</td><td>NEAREST AIRPORT</td><td>: Nagpur - 19 Kms</td></tr><tr><td>8</td><td>MAIN ROAD HIGHWAYS</td><td>: <b>National Highway</b>– NH-6 connecting Mumbai to Kolkata and NH-7 connecting Varanasi to Kanyakumari.</td></tr></table>	1	OWNER	: Maharashtra State Power Generation Company Ltd.	2	PROJECT	: <b>UPGRADATION OF UNIFIED DISTRIBUTED CONTROL SYSTEM (DCS) OF UNIT#1 OF MAHAGENCO KHAPERKHEDA TPS 210 MW</b>	3	PROJECT RATING	: 210 MW	4	LOCATION	: KHAPERKHEDA TPS Thermal Power Station, Dist – Nagpur, Maharashtra	5	NEAREST RAILWAY STATION	: Nagpur Railway Station- 20 Km from project site	7	NEAREST AIRPORT	: Nagpur - 19 Kms	8	MAIN ROAD HIGHWAYS	: <b>National Highway</b> – NH-6 connecting Mumbai to Kolkata and NH-7 connecting Varanasi to Kanyakumari.
1	OWNER	: Maharashtra State Power Generation Company Ltd.																				
2	PROJECT	: <b>UPGRADATION OF UNIFIED DISTRIBUTED CONTROL SYSTEM (DCS) OF UNIT#1 OF MAHAGENCO KHAPERKHEDA TPS 210 MW</b>																				
3	PROJECT RATING	: 210 MW																				
4	LOCATION	: KHAPERKHEDA TPS Thermal Power Station, Dist – Nagpur, Maharashtra																				
5	NEAREST RAILWAY STATION	: Nagpur Railway Station- 20 Km from project site																				
7	NEAREST AIRPORT	: Nagpur - 19 Kms																				
8	MAIN ROAD HIGHWAYS	: <b>National Highway</b> – NH-6 connecting Mumbai to Kolkata and NH-7 connecting Varanasi to Kanyakumari.																				

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

**NOTE: This tender is for Unit #1 (210 MW) at MSPGCL Khaperkheda TPS. However, depending on requirements, a similar scope of work may be carried out in another unit of the same rating within the same premises instead of Unit #1.**

### **Brief Scope of Work**

**Dismantling, Erection & Commissioning of Unified Distributed Digital Control Monitoring & Information System (DDCMIS) for Renovation & Modernization of complete Control & Instrumentation system, including regulating controls, interlocks, operator interface units and requisite terminations.**

**Complete dismantling, erection and commissioning of the system are in Bidder's scope.**

**(A) Being R&M work, erection consists of two major parts:**

- 1) Proper identification and dismantling of existing system wise panels, control desks, cables, marshalling etc.
- 2) Erection/ installation of new system wise panels, control desks, marshalling panels with proper glanding and termination of old field cables, laying and termination of new cables.

**(1) Proper identification and dismantling:**

(Dismantling of system wise panels, control desks and HMI)

All existing cables are armoured and lifted up through panel bottom gland plate with proper glanding. Because of the weight of the cable, glanding is necessary and to be maintained in new DDCMIS panels. Proper identification of the cables with core wise usage details to be established before removal of termination/ disconnection.

After de-glanding, all cables with proper identification tags can be pulled down. Now old panels can be removed. Existing base frame with anti-vibration pads if cannot be re-used for new DDCMIS panels, to be removed.

**Important Note:**

Existing field cables terminated in marshalling or control panel are having different length because of allocation in various racks or location. New cables from marshalling or inter-panels are to be laid and terminated with proper glanding and identification tags/ ferrules.

**(2) Erection/ installation of new system wise panels, control desks, and HMI:**

- a. New power supply cables are to be laid and terminated as per requirement.
- b. Existing cut-out size if necessary to be modified.
- c. Civil works like modification in cut out for panels, making approach through walls, breaking of concrete floors to suite DCS Panels erection etc. wherever required.
- d. Base frames with anti-vibration pads to be erected and properly grouted after proper alignment.
- e. Panel earthing where ever required to be extended.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

- f. New panels/ desks are to be installed.
- g. Modification/ laying of trays, conduits as per system requirement.
- h. Gland plate of required size and number of gland holes to be fixed/ erected.
- i. Glanding, lifting, dressing, clamping and termination of identified old and new cables in marshalling, supply distribution systems, power supply units and HMI including all peripherals.

### **(B) Commissioning**

Systems commissioning is a critical activity and hence following conditions are to be fulfilled:

Bidder has to ensure availability of expert commissioning team to successfully commission new DDCMIS system.

Commissioning of the system will comprise of activities in three parts viz. Pre-commissioning, Trial and Tuning.

#### **1. Pre-commissioning:**

- i) Pre-commissioning activities starts with the powering of new panels/ HMI system.
- ii) Analog and Binary field input signal loop tests and correct signal validation.
- iii) Analog and Binary output signal to field and HMI tests and validation.
- iv) Interfacing relay pick up through O/P modules and auxiliary contact changeover.
- v) Proper window alarm through binary O/P.
- vi) Proper HMI signal/ event validation.
- vii) Inter-panel signal validation.
- viii) HT/ LT breakers cold trial in “TEST POSITION”
- ix) Motorised valves limit switches, torques switches correct status validation.
- x) Solenoid operated valves, open/ close type of dampers/ valves correct status validation
- xi) 220V DC, 24V DC, 110V AC, 240V AC solenoid valves trials through relays and allocated feeders.
- xii) HT/ LT auxiliaries’ permissive, interlock and protection checking with breaker in test position.

#### **2. Trials:**

Trials are to be taken to ensure proper functioning of the following:

- i) HT/ LT auxiliaries’ actual trial with valid permit.
- ii) Motorized valves actual open/ close with designed permissive and interlocks operation.
- iii) Solenoid operated valves actual trials.
- iv) Function testing of auto control loops in limited final control element action.
- v) Boiler, Turbine, HT auxiliaries permissive, interlock and protection trials.
- vi) System wise interlock and protection trials with correct alarm and event recording.

#### **NOTE:**

Trials to be hold up in case any concerned parameter is not available because of new system.

#### **3. Tuning:**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

- i) Auto control loops are to be finally tuned to achieve better result than with previous system.
- ii) Drum level control, Furnace draft control, are required to be finely tuned quickly.
- iii) Co-ordinated master control (CMC), Boiler master, Fuel master, Feeder speed controls are to be finely tuned with runbacks of coal mills (02 nos. simultaneously), ID fan, FD fan, PA fan, BFP, CEP, BCWP.
- iv) Island Grid/ House load operation to be tried if permitted.
- v) FGMO/ RGMO to work.

### **SCOPE OF WORK**

#### **PRE-SHUTDOWN WORK:**

1. Mobilization of site within 07 days from the date of LOI or as informed by BHEL.
2. Arranging Gate pass, Insurance, medical fitness certificate, police verification & Accommodations to the contract personnel.
3. Shifting of material and T&Ps to and from the site.
4. Shifting of materials from Customer (owner) store to site.
5. Laying of Cables, Cable Trays, Junction Boxes (JB's), Instrument Calibration, Ferrule Printing, Cable Tag preparation, etc.
6. Any work pertaining to this contract that the Customer (MSPGCL) provides the permit for may be carried out during pre-shutdown.

#### **SHUTDOWN WORK:**

Following is the package wise scope of E&C work. The scope of work is indicative type and Bidder has to carry out all the related works for completion of the project whether it is specifically mentioned or not.

<b>S N</b>	<b>ITEM DESCRIPTION</b>	<b>QUANTITY</b>
<b>1.0</b>	Dismantling, Testing, Erection & Commissioning of Unified Distributed Digital Control Monitoring & Information System (DDCMIS) for Renovation & Modernization of complete Control & Instrumentation system, including regulating controls, interlocks, operator interface units and requisite terminations.	

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

<b>1.1</b>	<p><b>Steam Generator Controls:</b> Electronic System Cabinets of size (800 mm X 800 mm X 2355 mm) Catering to</p> <ul style="list-style-type: none"><li>a) Steam Generator Controls (SG) comprising of Electronic System Cabinets.</li><li>b) Existing power supply and field cables are to be removed after proper tagging/ Ferruling.</li><li>c) Existing panels are to be removed and replaced with newly supplied panels.</li><li>d) All civil works such as changes in cut-out size, grouting etc. are in Bidder's scope.</li><li>e) Base frames with anti-vibration pads are to be installed.</li><li>f) New panels with canopies are to be installed. Proper alignment like Levelling, verticality etc. are to be checked.</li><li>g) All existing cables are entered in the panel through proper gland of panel bottom gland plate.</li><li>h) Existing Field control element and primary sensors shall be retained except newly offered system.</li><li>i) Existing field cables shall be retained with suitable marshalling panels and gland plates. However, new field/main cables may need to be laid and terminated with proper glands, tags and ferrules as per requirement.</li><li>j) Minimum emergency backup console to be installed. Necessary wirings with DDCMIS panels to be done.</li><li>k) Power supplies to be distributed from existing UPS, G1/ G2 board, 110V ACCSP panels and new UPS if supplied.</li><li>l) 110V AC both sources are available and are to be connected to newly supplied static switch panel and commissioned.</li><li>m) Static switch panel output through newly supplied distribution board to be connected to FSSS panels.</li><li>n) Existing Safe <b>Flame Scanners</b> to be replaced by New flame scanner system for all six coal elevations and three oil elevations with necessary mechanical modifications and field cabling.</li><li>o) Existing power supplies are to be used where ever possible. Additional supplies if required are to be hooked up from existing UPS, G1/ G2 boards etc. by Bidder. If new UPS is supplied/provided by the Customer, necessary incomer feeder installation and commissioning, cabling work along with accessories shall be in the Bidder's scope.</li><li>p) All civil works such as removal of existing grouted base frame, changes in cut-out size of floor etc. are to be in the scope of Bidder.</li></ul>	1set Approx. 12 Panels
------------	--	------------------------------

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

1.2	<p><b>Steam Turbine Controls:</b> Electronic System Cabinets of size (800 mm X 800 mm X 2355 mm) Catering to</p> <ol style="list-style-type: none"><li>1. Electro Hydraulic Governor</li><li>2. Introduction of Axial shift 2/3 electrical Trip/ Electrical over speed Trip/ Variable condenser Vacuum set point protection/ Low M.S. temperature protection.</li><li>3. Provision of Vacuum Pump Control in proposed DDCMIS to replace existing local control panel with solenoids and necessary cabling.</li><li>4. Main Turbine Existing moving coil type Electro-Hydraulic Governor (EHG) along with feedback transmitter is to be replaced with I/H converter or proportional valve with amplifier and capacitor module and 02 no. of LVDT/Micro pulse type position feedback transmitter along with necessary mechanical accessories.</li><li>5. LP Bypass existing plunger coil type EHG and its feedback unit is to be replaced with proportional-directional control valve and minimum 01 feedback unit. All necessary modifications like piping, mounting &amp; any mechanical work to upgrade the system will be in agency's scope.</li><li>6. Installation and commissioning of <b>Turbovisory System</b> for main turbine along with Analysis and Diagnostic software package.</li><li>7. Installation and commissioning of new type of speed probes for main turbine speed measurement with necessary mechanical arrangement as per requirement.</li><li>8. Existing Field control element and primary sensors like orifice, flow nozzles etc. shall be retained.</li><li>9. Existing field cables shall be retained with suitable marshalling panels. However, new field/main cables may need to be laid and terminated with proper glands, tags and ferrules as per requirement.</li><li>10. Existing power supply shall be retained for powering of panels. If new UPS/Battery Charger is supplied by buyer, necessary incomer feeder installation and commissioning along with cabling works including accessories shall be in bidder's scope.</li><li>11. TSE indicator function shall be realized in the operator workstation. Hence the conventional TSE available in the existing system shall not be used.</li><li>12. Installation and commissioning of new Auto Synchronizer and LSR is in Bidder's scope.</li></ol>	1set Approx 15 panels
-----	---	-----------------------------

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

13. Existing panels are to be removed after proper cable tagging and MTP disconnection. New panels are to be accommodated in the available space.
14. Existing power supplies shall be retained for powering the panels. However, new power cables may need to be laid, terminated with proper glands, tags etc. as per requirement.
15. Vibration probes are to be installed in X-Y direction with necessary cabling where vertical provision on bearing housings is available.
16. MOT/FRF/Hotwell Tank Level measurement of guided wave radar type of level transmitters are to be installed and commissioned with required cabling up to DDCMIS.
17. FCNRVs PFTs are to be replaced and hooked up to DDCMIS.
18. Local panel analog indicator for seal oil pressure, hydrogen pressure, seal oil/ Hydrogen DP, Hydrogen purity and current of all general auxiliaries to be retained.
19. All cabling to and from DCDB chargers and distribution board to individual panels is in the scope of Bidder.
20. All three no. of existing load transducers to be replaced.
21. AVR, GCB, Field breaker and control interface to be covered in DDCMIS along with hard wired back-ups on control desk as per existing scheme.
22. Replacement of existing phase reversal thyristor drives for Siemens Germany make motorised control valves of lub. Oil temperature control, Primary water temperature control, Cold gas temperature control, HP C/F temperature control.
23. Existing pressure, level, differential pressure, flow transmitters of critical parameters are to be replaced with necessary mechanical piping changes.
24. Existing RTD and Thermocouples temperature transmitters are to be replaced with proper field mounting.
25. Installation and commissioning of newly supplied transmitters along with manifolds and required accessories shall be in Bidder's scope
26. Installation and commissioning of new GAMP (Generator Auxiliary Monitoring Panel) system in place of existing panel with complete electrical and switchgear accessories, cables and interfacing of the same to DDCMIS.
27. Limit Switches are used for open and close feedback of ESVs of HPT and IPT. These are to be replaced with 2-wire proximity sensors.
28. Control Valves position is measured using resistive type rotary pot which are to be replaced with LVDT sensors or any other suitable linear technology.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

S N	ITEM DESCRIPTION	QUANTITY
1.3	<p><b>Station C&amp;I:</b></p> <p>Electronic System Cabinets of size (800 mm X 800 mm X 2355 mm) Catering to</p> <ol style="list-style-type: none"><li>1. Hooking-up of Temperature signals pertaining to HT auxiliaries with proposed DDCMIS system.</li><li>2. Hooking up of 350 nos. of signals (temp. signals with thermocouple-200, with RTD-50 and 100 other signals) in the proposed new DDCMIS to be done. Other events/ SOE shall be integral to the proposed system.</li><li>3. Existing Control Desk (related to AVR, GCB, and field breaker) shall be removed and existing PB and indicators of the same or new PB and indicators shall be provided and shall be placed under extended new HMI desk. Also paralleling of the same shall be done with the proposed DDCMIS system. However, operations like GCB and field breaker shall be proposed through Hardwired. The cable from existing control desk-8 to the respective areas shall be retained and used.</li><li>5. Existing Field control element and primary sensors like orifice, flow nozzles etc. shall be retained.</li><li>6. Existing field cables shall be retained with suitable modifications of existing marshalling cabinets or supply of new cabinets. However, new field/main cables may need to be laid and terminated with proper glands, tags and ferrules as per requirement.</li><li>7. Minimum emergency backup console shall be provided.</li><li>8. Existing power supply shall be retained for powering of panels. However, new power cables may need to be laid, terminated with proper glands, tags etc. as per requirement.</li><li>9. 24V DC driven relays to interface other system like CPU.</li><li>10. 220V DC contact rating relays to be supplied in relay panel mounted on bases and wired up to TB.</li><li>11. Existing field cables shall be retained with supply of suitable marshalling panel. Marshalling panel TBs are to be replaced and re-termination of field cables to be done. Marshalling panel to DDCMIS cabling to be done.</li><li>12. Existing pressure, level, differential pressure, flow transmitters of critical parameters are to be replaced with necessary mechanical piping changes.</li><li>13. Existing RTD and Thermocouples temperature transmitters are to be replaced with proper field mounting.</li></ol>	01 Set Approx. 32 Panels

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

	<p>14. Complete E&amp;C of Field Instruments including JB's for marshalling existing field cables with new cabinets etc.</p> <p>15. Hooking up of Temp. Signals (Approximately 300 Nos.) directly coming from Field to Temp. Scanners on existing UCP pertaining to HT auxiliaries (Existing Field cables to be retained).</p> <p>16. Installation and commissioning of newly supplied transmitters along with manifolds and required accessories shall be in Bidder's scope.</p>	
<b>2.0</b>	<p><b>Control Desk and Control Panel tiled for back-up consoles</b></p> <p>1. Control operating desks and panels:</p> <p>a. Control operating desks (COD) 1 to 8 including AVR console to be removed and replaced with suitable latest look type desk.</p> <p>b. DDCMIS Remote I/O panel for Compressor system along with suitable connectivity to main control room for information/monitoring of signals only. (No output/operation is required).</p> <p>a. The Tentative Nos. of signals shall be 100 Nos.</p> <p>b. Compressor: Analog: 50 Nos., Digital: 100 Nos.</p> <p>2. Any communication cable to be routed underground if required.</p>	

### **CIVIL WORK:**

**All civil work involved in up-gradation of C&I system is in the scope of Bidder.**

#### **Scope of civil works involves:**

- Removal of existing panels and re-accommodation of all panels with required base frames and anti-vibration pads with base frame grouting / welding and extending.
- Fabrication of base frames for panels/ cabinets is in Bidder's scope along with supply of fabrication material as per BOQ. Bidder must provide material test certificate along with supply material as per BOQ.
- Existing control desk and minimum back up console panel excluding electrical panel are required to be removed and replaced by Bidder.
- Dismantling of existing Boiler, Turbine and Station C&I cabinets and Installation of new cabinets for control system, marshalling cabinets as applicable and termination of existing field cables through suitable marshalling elements to new DCS panel. After dismantling of existing equipment/ panels/ cabinets etc. which are to be replaced/ modified, the Bidder shall hand over the dismantled material at the Customer's designated place. This will also include disconnection/replacement of the existing cabling/ piping as applicable.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

- The bidder shall carry out all necessary **civil works for floor cut-outs** required for installation of additional panels and new panels in the **available free space within the existing control room and local control room (LCR) etc.** This may involve the use of specialized tools and techniques for cutting through reinforced concrete. After completion of installation, all floor openings shall be **properly sealed, restored, and finished** to match the existing floor condition. **All materials, tools, plants (T&P), and consumables required for the same shall be within the bidder's scope.**
- The bidder shall undertake all required **civil works involving breaking and restoration of concrete in control room areas and/or cable galleries** for laying and termination of new and existing cables. Upon completion, all floor cut-outs and disturbed areas shall be **properly sealed, finished, and restored to their original condition.** All associated materials, manpower, tools, and equipment **shall be in the bidder's scope.**
- Extension of earthing system as per requirement.
- Laying and termination of power cables.
- Laying and termination of additional cables as per scope.
- Underground routing, Laying and termination of optical fiber cable as per requirement.
- Erection of HMI system with peripherals.
- Erection and Commissioning of the instruments is under the scope of Bidder.
- Any other civil work arising because of system up-gradation is in Bidder's scope.
- All materials (Cement, concrete, Iron/TMT bars etc.) related to civil work including T&P and manpower shall be in the scope of bidder.

### **MECHANICAL WORKS:**

**All the mechanical work involved in up-gradation of C&I system is in the scope of Bidder.**

**Scope of mechanical works involves:**

1. Replacement/retrofitting of existing main turbine and LPBP moving coil type EHG by I/H or proportional valve-based system and position feedback transmitters along with necessary mechanical piping changes.
2. Cutting/ welding of instruments impulse pipes for (If Applicable):
  - a. Primary water bushing flow transmitters.
  - b. Hot well level control radar type transmitters.
  - c. MOT/ FRF Guided wave radar type level transmitters.
  - d. Control panels, Control desks etc.
  - e. Flame scanner guide pipe assemblies.
  - f. Any other works as per requirement.
3. Main turbine key-phasor/ notch preparation for diagnostic system.
4. Main Turbine's any mechanical work required for the new **Turbovisory system (TSS/TSI)**. This involves drilling/tapping of holes, modifications in the brackets etc required for mounting of TSI sensors.
5. Any other mechanical work arising because of system up-gradation is in Bidder's scope.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### **NOTE:**

**Whatever Minor Works required for complete C&I up-gradation of KHAPERKHEDA TPS U#1 210 MW shall be in the scope of work, irrespectively whether it is specifically mentioned in the enquiry specification/ scope of work or not.**

## **2. Scope of work involving Dismantling, Erection, Testing, Commissioning, and Calibration.**

### **2.1 Brief description of work**

#### **2.1.1**

The intent of specification is to procure services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the contractor of the responsibility of providing such facilities to complete the work without any extra compensation.

#### **2.1.2**

The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship, engineering and construction management. The contractor should ensure proper planning and successful & timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, measuring instruments, calibrating equipment, modern/ latest construction aids etc. He must also deploy adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor should match requirement of sophistication involved with the items mentioned in the BOQ.

#### **2.1.3**

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

#### **2.1.4**

Contractor shall erect, align and commission all the equipment and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the contractor. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods/ sequences adopted in erection of similar sets elsewhere.

#### **2.1.5**

The services, tests and support to be provided by the agency for the work mentioned in the various sections of this tender are indicative and not exhaustive, but not limited to these for the completion of the work in all respects.

#### **2.1.6**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, dismantling, erection, calibration, testing, air flushing, pre-commissioning tests, commissioning of systems, trial run of various auxiliaries, achieving various activities till handing over of the unit to BHEL's customer, providing maintenance team to cater to guarantee responsibilities and maintenance thereafter. The work shall conform to dimensions and tolerances specified in various drawings that will be provided during the erection. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done departmentally or by engaging other agencies and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges.

### 2.1.7

Contractor shall dismantle, calibrate, erect, commission all the equipment, cabinets/panels, instruments and cabling etc. as per sequence prescribed by BHEL at site. The sequence of dismantling/ erection / commissioning methodology will be decided by the BHEL engineers depending upon the availability of materials/work fronts etc. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of dismantling/ erection / commissioning adopted in erection / commissioning of similar jobs or for any reasons whatsoever.

### 2.1.8

The services, tests and support to be provided by the agency for the work mentioned in the various sections of this tender are indicative and not exhaustive, but not limited to these for the completion of the work in all respects.

### 2.1.9

Plant materials should not be used for any temporary supports/ scaffolding/ preparing pre-assembly bed etc.

### 2.1.10

The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, or any loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL Engineer's instructions. The machined surfaces/ finished surfaces should be greased and covered.

### 2.1.11

At all stages of work, equipment/ materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL. The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work (excepting, those specifically included in BHEL scope). However, necessary steel will be provided from the scrap/ surplus materials available at site.

### 2.1.12

The terminal points as decided by BHEL shall be final and binding on the contractor.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

### 2.1.13

Descriptions of certain packages appearing in the rate schedule are available in this section to give general idea to tenderer about the type of equipment to be erected, calibrated, tested and commissioned.

### 2.1.14

During the course of dismantling, erection, testing and commissioning of C&I work, certain rework/ modification/ rectification/ repairs/ fabrication etc., will be necessary on account of feedback from various thermal power stations or units already commissioned and/or units under erection and commissioning and also on account of design discrepancies and manufacturing defects and site operation/ maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication repairs etc. promptly and expeditiously. Daily log sheets indicating the details of work carried out, man-hours, consumables used etc., shall be maintained by the contractor and got signed by BHEL engineer every day. Claims of contractor, if any, for such works will be dealt as per clauses 2.15 of GCC

### 2.1.15 Void

### 2.1.16

All tools, tackles, fixtures, equipments, materials, manpower, supervisors/ engineers, consumables, electrodes including oxygen, acetylene argon etc. gases, primers, paints etc. required for this scope of work shall be provided by the contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor's quoted rates should be inclusive of all such contingencies. Electrodes shall be baked / dried in the electrode drying oven (range 375 – 425 deg C) to the temperature and period specified by BHEL Engineer before their use. Necessary drying oven / portable oven shall be provided by the contractor at his cost.

### 2.1.17

The scope of work under this tender specification covers transportation (to & fro and before erection & after dismantling), calibration, dismantling, erection, testing and commissioning, etc. of control / instrumentation and electrical equipment of the following packages.

#### **A. Boiler Control & Instrumentation and its Auxiliaries**

Digital Distributed microprocessor based max DNA system panels for FSSS, SADC, HP Bypass, auxiliary PRDS, Soot blowers, Blanks Cabinets for flame scanner system etc.

#### **B. Steam Turbine Control & Instrumentation and its auxiliaries**

Digital distributed microprocessor based maxDNA system panels consist of Turbine Stress Evaluator, Electro Hydraulic Governor (EHG), LPBP Seal/ Gland Steam control, Turbovisory System (TSS/ TSI) for Main Turbine, turbine extended protection, Turbine & generator auto control loops, Turbine protection Channel, TDBFP controls along with interlocks, protection and TSS, GAMP (Generator Auxiliary Monitoring Panel), Main turbine existing moving coil type Electro-Hydraulic Governor (EHG), etc.

#### **C. Station C&I / Balance of Plant**

Digital Distributed microprocessor based maxDNA system panels for Balance of Plant controls, consisting of Open Loop and Closed Loop controls, interlock and protection systems for various HT, LT, pneumatic, hydraulic drives, remote multiplexed signal acquisition, alarm processing, HMI

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

including computers and accessories, computer furniture, control desk, Large Video Screen, instrumentation, cabling, etc, etc.

### 2.1.18

Equipment /instruments required to be erected for this work, though not limited to but are generally as per rate schedule. For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However, the payment of these items/class of work shall be regulated as per the General Condition of the contract. Contractor shall provide necessary resources for completion of such work within the stipulated time schedule. Value of such work shall be included while computing the total value of work finally executed for all contractual purposes, particularly for contract variation purpose.

### 2.1.19 Void

### 2.1.20 Electronic Earth Pit

**If required**, erection of separate electronic earth pit for new system will be in scope of bidder including material.

### 2.1.21 Pre-commissioning / Commissioning and Post Commissioning activities.

#### 2.1.21.1

**The work is also inclusive of various commissioning activities of BHEL scope. The various 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.**

#### 2.1.21.2

In case any malfunctioning and/or defects are found during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects/ malfunctions and take necessary corrective measures. If any readjustment and realignment is necessary, the same shall be done as per BHEL engineer's instructions.

#### 2.1.21.3

During each stage of commissioning, if any part of the instrument needs repair/rectification/rework/replacement, the same shall be done expeditiously and promptly by the contractor. Contractor's claim, if any, for such repair/rectification/ rework/replacement etc. for reasons not attributable to contractor will be dealt as per clauses 2.15 of GCC. The parts to be replaced shall however be provided by BHEL free of cost.

#### 2.1.21.4

Simultaneous commissioning activities will be in progress in various areas. All these works need specialized gangs including electricians/instrument mechanics in each area. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

The mobilization of these commissioning gangs 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.

### 2.1.21.5

Contractor shall cut open works if needed as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over without any extra payment.

### 2.1.21.6

In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning or at any stage, the same has to be rectified by the contractor at his cost. If 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 of contractor, if any, for such works will be dealt as per clauses 2.15 of GCC

### 2.1.21.7

It is the responsibility of contractor to provide for necessary labour, tools and tackles and consumables till the completion of work under these specifications even in case dismantling, erection, testing and commissioning of this work is delayed due to reasons not attributable to the contractor.

### 2.1.21.8

During commissioning activities and carrying out various tests, minor items like gauges, manometers, etc., have to be temporarily erected and put in service to suit the commissioning activities. BHEL will provide the necessary gauges and equipment. Contractor has to carry out the erection, calibration, dismantling of the same. After completion of activities the temporary systems have to be removed and returned to stores. No extra charges will be payable towards these.

### 2.1.21.9 Commissioning

During pre-commissioning, commissioning, post commissioning and trial operation stages of various systems, certain category of manpower with T&P and consumables will have to be provided to BHEL commissioning engineers exclusively at their disposal. It shall be the responsibility of the contractor to provide Engineers, Electricians, technicians, Helpers, Fitters etc along with necessary consumables, hand tools, calibration equipment etc, for the various commissioning activities in progress. During shutdown period there could be requirements of separate commissioning gangs simultaneously in even up to 12 to 15 areas. Contractor has to augment the manpower as and when required as per work demand and necessity at site. The quoted rates shall include this.

### 2.1.21.10

It shall be specifically noted that contractor manpower may have to be engaged round the clock simultaneously at different areas and hence considerable number of personnel and their overtime payment may be involved. *This aspect must be considered by the contractor while quoting their rate.*

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

No additional compensation by for the same shall be payable, irrespective of number of persons engaged or number of working hours per day.

### 2.1.21.11

For electrical works, 415 volts and above, the contractor has to bring qualified electricians.

### 2.1.21.12

Certain systems may be supplied with portable programming units, which are to be connected at various locations during pre-commissioning to handing over. Necessary cabling interconnecting the programming units and other connected panels has to be carried out by the contractor and are to be dismantled after work. For the purpose of testing, monitoring, commissioning, etc., these programming units will have to be repeatedly connected and disconnected at various locations. These will be considered as part of commissioning activities and no separate payment will be entertained for the above.

### 2.1.21.13 Calibration, Testing & Commissioning

Calibration, testing & commissioning activity as specified in this technical specification and rate schedule against various equipment, devices, systems etc. are broadly classified below. However, there may be some overlapping between the activities (dismantling, erection, calibration and testing, commissioning). The classification of activity is only a guideline for understanding the total volume of work in each activity. The contractor shall have no claim for performing or providing manpower for such overlapping work, which is also within the scope of the work.

#### **(A) Calibration**

Verification after drawing of material of various types, range of the field devices with respect to instrument schedule, data sheet or system document.

- Codification of instruments as per system tag numbers
- Calibration / adjustment of instrument as per system requirement / set values.
- Providing head correction in case of pressure measurement as per calculated values or actual measured value for the instrument, which are used for interlock protections / monitoring. This is generally applicable for turbine / generator, lube oil systems, lube oil system of fans etc.
- Verification of installation of instruments for range, type, tag number as per physical location of process point as per process, instrumentation diagram.
- Checking and ensuring the proper function of instrument.
- All the recorders shall be made functional with proper chart movement and ink marking (if applicable).
- Preparation of computerized calibration certificates in the formats specified by BHEL Engineers and getting those signed by the customer is in the scope of the contractor.

#### **(B) Erection**

- Withdrawal of material from store, verification, inspection as per shipping list, drawings and documents.
- Preservation, up keeping, safe custody of the erected equipment till handing over to the customer.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

- 
- Verification of installation as per drawing and document for the correctness of cabling, JB's, impulse pipe, various field device, panels, instruments etc.
  - Continuity check and IR value check of cables.
  - Verification of correction of cable termination with respect to instrument, electrical hook-up diagram, panel interconnection diagram, JB schedule.
  - Checking earthing of the equipments and cable shield wire continuity.
  - Energizing the functional group control panels and field devices.
  - Flushing of impulse pipe before making the instruments process connections through.
  - Any leakages, damages to impulse pipe, field device connections, air connections etc. shall be fully attended by contractor.
  - All cable glands/piping/tubing to be fixed as per installation requirement before commissioning.

### **(C) Testing, Commissioning & Trial Operation**

- Checking/verification of binary/analogue input and output signal from field and panel and upto recording/indicating instrument/HMI monitors.
- Checking the operating electrical/pneumatic drive through functional group panel, remote control desk, HMI, CRT operation and repeatability and smooth operation to be checked.
- Checking the interlock, protection and alarm for various process by simulation of field devices/process changes.
- Functional check of sub-loop control, sub group control and auto loop and fine tuning.
- Adjustment of limit switches/feedback position transmitter checking the actuator for correct Limit switch operation for correct position indication and repeatability shall be ensured.
- Motor IR value measurement, bearing/winding RTD checking, drying out of motor, providing assistance for trial run of motor which includes monitoring temperature rise winding/bearing during trial run.
- **Contractor shall prepare calibration/testing report/protocols.**
- During trial run of various systems, if the performance of any instrument is found erratic, unsatisfactory and requires re-adjustment, re-calibration etc., the defect shall be attended by contractor.
- Observing and checking the performance of the various devices on load/process variation. Any deficiencies/defect noticed during the variable load conditions, the same should be attended properly.
- Observe the proper functioning of sub-group/sub-loop control.
- Check the operation of various controls in manual/auto mode for smooth functioning.
- Clearing of all bad / invalid signals noticed during commissioning.
- Providing necessary assistance during restart of the unit is in scope of this specification. Smooth operation and availability of all instrument/controls of the systems installed under the scope herein, shall be ensured by the contractor. Contractor shall provide adequate number of skilled manpower

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

and T&P for this purpose. Interruption during restart till stable operations at full load or any mutually agreeable load for reasons attributable to the Contractor may result in re-start of the unit all over again, consequential extension in Time Schedule / Contract Period shall be to the contractor's account.

- If any small wiring correction or minor modification in control panel wiring is noticed during the commissioning, it shall be carried out as a part of commissioning activity.

### **(D) Post-commissioning**

- Contractor shall rectify the defect observed/informed by customer during the restart of the Unit
- Contractor shall submit the as-built drawing as per guidelines and instruction of BHEL engineer.
- After restart/handling over of the equipment, if due to unforeseen reasons, certain works crop up, the contractor shall provide all the assistance.

### **(E) Tests & PG Test Assistance (Kindly refer Annexure-C)**

#### **2.1.22**

The work under this scope being quite sophisticated and also quite extensive, for proper planning, monitoring, reporting, etc of ongoing works, the contractor shall establish his own computer(s) and printer(s) at his site office, along with suitable operator(s), consumables, etc. *Non-establishment of above equipment will attract penalty @ Rs 10000 (Rupees Ten thousand only) per month.*

BHEL uses its own software SOMS (Site Operation and Management System) for total project execution and billing. The contractor shall also provide adequate and suitable manpower for updating / entries into SOMS in BHEL computers at site.

#### **2.1.23**

During pre-commissioning / commissioning stages when the plant will be under various stages of operation, it will be necessary to have continuous (day and night) presence of suitable manpower along with required tools to attend to any defects etc that may arise during such operation. The contractor will be required to put such personnel in shifts in C&I area. The bidder must also take this aspect into consideration.

As the Shutdown Activities (from complete steam generation stoppage up to first Synchronization of Unit) has to be completed within prescribed period, the contractor has to ensure round the clock (24X7) availability of manpower and deploy required number of manpower/personnel in shifts during the complete shutdown period.

## **2.2 Collection of materials**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### 2.2.1

The contractor shall take delivery of equipment, materials from the storage yard/ stores/sheds of BHEL/Customer. He shall also make arrangements for verification of equipment, safe custody, watch and ward of equipment after it has been handed over to bidder till these are fully erected, tested and commissioned and taken over by the customer. The contractor should note that the transport of equipments to erection site, assembly yards, etc. should be done by the prescribed route in the most professional manner without disturbing other on- going works of various contractors. Special equipment (whichever applicable) such as laboratory equipments, measuring and control equipments, gauges, panels, console inserts, switches, transmitters, controllers, power cylinders, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions. The contractor should also note that while taking delivery of materials from BHEL stores (open/closed), it may be necessary to handle other items which could be blocking the exit route of the materials. The dismantled material shall also be transported from site to the place designated by the Customer.

*This aspect shall be taken care of in the quoted rates and no extra payment shall be done in this regard.* It shall be the contractor's responsibility to arrange necessary cranes/tractors, trailer, trucks, slings, labour, etc., etc., for transport of equipment to and from site to designated location as decided by BHEL/ Customer.

### 2.2.2

The contractor shall take delivery of the components, equipments and special consumables from the storage area/sheds of BHEL/customer after getting the approval of the engineer/customer on standard indent forms to be specified by BHEL/customer.

### 2.2.3

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

### 2.2.4

All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments/components for checking and cleaning, fabrication of tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing of cut outs/openings for mounting of console inserts, modules, indicators, recorders, drilling of holes for gland entries, reaming, scrapping, cable laying, dressing, fitting up etc. as may be applicable in such erection works are treated as incidentals to erection work and are necessary to complete the work satisfactorily shall be carried out by the contractor as part of the work.

### 2.2.5

Overhauling, cleaning, revisioning, servicing of equipment / instruments, valves etc. during erection and commissioning stages will be arranged by the contractor. However, gaskets /packing for replacement will be provided by BHEL free of cost. All equipment shall be preserved and protected before and after erection as per the advice of BHEL engineer.

### 2.2.6

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

The contractor should take all reasonable care to protect equipment and materials under his custody either in his stores or at site. Copper tubing, brass fittings, brass valves etc. forming an integral part of equipment or system are liable to greater damages / pilferages / theft / losses. It will be responsibility of contractor to arrange for adequate security round the clock for protection from such damages / pilferages / theft / losses.

### 2.2.7

All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc. shall be used for unloading and/or handling of the equipment without the specific written permission of the engineer. The equipment from the storage yard shall be moved to the actual site of erection/location at the appropriate time as per the direction of BHEL engineer to avoid damage/loss of such equipment at site.

### 2.2.8

The contractor shall collect all scrap materials periodically from various levels of power house, working area of the power station, auxiliary and piping around power station and collect the same at one place earmarked for the same. Loads of scraps are to be shifted to a place earmarked by BHEL/Customer. 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.

### 2.2.9

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.

### 2.2.10

All pipes and tubes, equipment, instruments issued to contractor and kept at site for erection shall be covered with plastic caps/steel caps or shall be closed with suitable plugs by the contractor.

### 2.2.11

The contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipment are erected in position.

### 2.2.12

Contractor shall plan and transport equipment/components from storage yard/sheds to erection site and erect them in such a manner and in a sequence that material accumulation at site should not lead to congestion. Materials shall be stacked neatly, preserved and stored in the contractor's shed and work areas in an orderly manner. It may be specifically noted that the space available in the thermal power plant is limited and accumulation of material may lead to the necessity of shifting and restacking the materials to enable other agencies to carry on with their work or to comply with customer's requirements. If required, the contractor shall arrange shifting of surplus material expeditiously failing which the same will be arranged by BHEL and all charges together with departmental charges at 30% will be recovered from his bills.

### 2.2.13

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

House-keeping in the erection and pre-assembly area is as important as the well-planned and orderly work. The access to site for inspection approaches by BHEL and customer engineers and leading of the material shall be made available by the contractor at all times. The shifting and re-shifting of erection materials, tools and plants and clearance of restrictions, filling of ditches, undulation near the preassembly and boiler area is the responsibility of the contractor. Contractor should visit the site and acquaint himself with all restrictions and difficulties that he may encounter during erection/commissioning stages.

### **2.3 Installation of Cable trays/cable ducts (If applicable)**

#### **2.3.1**

Various types of sheet metal, galvanized cable tray, i.e. Perforated, ladder type, seal metal duct, solid bottom tray, shall be provided in standard lengths along with accessories like hardware, bends, reducers, coupler plate, tray covers and tray clamps etc.

#### **2.3.2**

Installation of cable tray/cable duct shall include cutting, laying, jointing, supporting, drilling holes in the support, providing tees/reducers/bends/clamps as per tray route layout, fabrication of bends/tees/reducers from straight length, fixing of tray covers, welding of tray on support, cleaning and application of cold galvanising paint on weld joints (supply of paint is in the scope of contractor). *Installation of tray/duct covers, wherever provided, will be done as a part of tray erection and no extra rates will be payable.*

#### **2.3.3**

In case cable trays are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instance.

#### **2.3.4**

Cable trays/ducts have to be routed underground in cable trench, over head on structure, valves, floors etc. for various applications such as cable laying, copper tubes, conduits, thermocouple, temperature gauge capillary etc.

#### **2.3.5**

Installation of Copper tubes/SS tubes/copper pipes shall include cutting into required length, laying, bending, cleaning, brazing wherever required, fixing of brass fittings like compression fittings/tees/end connectors/straight connectors/bulk heads/valves etc., supporting clamping including supply of clamps and hardware, flushing and conducting leak test.

### **2.4 Cable laying (power / control / instrumentation shielded / unshielded cables / plug-in cables / coaxial / UTP / STP / data highway, armoured / un-armoured, single / multi-core, PVC/HR PVC/FRLS/TEFLON/XLP insulation, optical fibre)**

#### **2.4.1**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

Cable laying includes cutting to the required length, laying in overhead/underground cable trench/through pipes/flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JB's, providing PVC numerical/alphabetical / printed ferrules, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, providing identification PVC/aluminium cable tags (at both the ends and at 15 m intervals throughout the route length and also at each bend), continuity checking, insulation resistance checking, high voltage test on HT cables.

Laying, etc of Optical fibre cables on cable trays /cable trench shall necessarily be done using flexible conduit

### 2.4.2

Entry to the panels and JB's may be at top, sides or bottom. All cables are required to be properly supported and clamped near to the JB/panel.

### 2.4.3

Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, prefab plug-in cables, etc., for such cases cables may have to be lifted inside the panel by either making cut-out in gland plate and providing rubber profile for sharp edge protection or alternatively, providing 4" or 6" PVC pipe coupling gland and these pipe coupling gland shall be supplied by contractor within the quoted rate of cable laying.

### 2.4.4

Copper tinned lugs of various types (pin, ring, fork, snap-on) upto 4 sq.mm, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/metallic, clamping and dressing material with hardware, PVC sleeves etc. shall be supplied by the contractor within the quoted rates for cable laying. The quality of material shall be got approved from BHEL engineer prior to their use on job.

### 2.4.5

All care should be taken to avoid abrasion, tension, twisting, kinking, and stretching of cables during installation.

### 2.4.6

Cable shielding – all signal cables are supplied with bare shielded copper wire/with braided wire shield. Generally shield wire is kept isolated at instrument/field device end and continuity is maintained through JB's and grounded at panel end only. While terminating the shield wire either in panel or JB's, PVC sleeves are to be used to avoid two-point earthing.

### 2.4.7

Wherever cables run through ducts, conduits, valves, etc., they shall be sealed using fire/weather proof compound. In addition to this, cable entry in panels, MCC's, instruments, electrical actuators etc., are also required to be sealed. The required material for doing so shall be included by contractor in the cabling scope.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

### 2.4.8

Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed.

After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc., at his cost.

### 2.4.9

Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagrams or as required is to be done by contractor at no extra cost.

### 2.4.10

Contractor shall carefully plan the cutting schedule of each cable drum in consultation with site engineer such that wastages are minimized.

#### 2.4.10.1

The erection contractor shall make every effort to minimize wastage during erection work. In any case, **the wastage shall not exceed the following limits;**

Sl. No.	Item	% Wastage on issued Qty
1.	Fabrication steel	2
2.	Each size of power cables	1
3.	Each size of control/Instrument cables	2
4.	Impulse pipe/tubes/GI pipes/copper tube	1

If however, the bidder quotes for more wastage than specified above, the excess portion will be considered for adjustment during the tender evaluation at the quoted supply rate of material.

If the actual wastage be more than the specified figure, then equivalent price of the excess portion will be deducted from the contractor's bill.

#### 2.4.11 Terminal Connections:

The types of cable terminations are generally as detailed below:

SG package, TG package, Station C&I and Auxiliaries

- 1) All field cables in SG package are crimp type of different sizes.
- 2) All JBs are both side screw type.
- 3) All console tiles wiring: screwed or plug-in type to be fabricated at site.

### 2.4.12

Existing/old cables are to be disconnected from old Panels and re-connected to the new DCS Panels. If the existing cables are short in length, same has to be joined by straight lugs of various types (pin, ring, fork, snap-on) upto 4 sq.mm and reconnected to the new DCS Panels.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### **2.5 Junction Boxes:**

#### **2.5.1**

Different types of junction boxes are to be erected by the contractor like junction boxes below 48 ways and above 48 ways. The junction boxes are to be located at the locations jointly decided at site during erection. The junction boxes are to be erected on the frames fabricated at site.

### **2.6 Laying of pipes and tubes (Impulse pipe & Instrument air pipe)**

#### **2.6.1**

Root valves are generally provided on process pipe line by other agencies. Prior to starting impulse pipe, contractor to identify the process point with respect to PIDs.

#### **2.6.2**

Installation of impulse pipe of CS/AS/SS material shall include cleaning, air flushing, cutting to length from running meter, edge preparation, cold bending, welding of sockets / reducers / tee / cross / isolating valves / union, nut and tail pieces / nipples, condensing and other pots, etc., mounting of SS/CS valve manifolds and compression fittings, providing supports, clamping, conducting leak test / hydraulic pressure test, painting as per colour code (primer and two coats) and erection and commissioning of other standard accessories as per instrument hook-up diagram.

Piping works shall involve either arc or TIG welding. Paint, primer etc supply is in the scope of the contractor. Colour codes for impulse piping, etc will be as per standard codes. Contractor to follow the BHEL supplied welding schedule and welding procedures. The decision of BHEL engineer will be final in this regard.

#### **2.6.3**

If applicable, IBR certified welders shall be deployed for welding of impulse pipe and contractor shall take approval for welder and welding consumables from BHEL site engineer.

#### **2.6.4**

Laying of GI pipe for instrument airline shall include air blowing, cutting from the running meter length, threading, installation of elbows/tee/reducer /moisture traps/auto drain pot/check valves/isolating valves, supporting clamping, conducting leak test and also seal welding of threaded joints, if required.

#### **2.6.5**

Threaded joints of airline shall be made leak proof by using Teflon tapes or sealing compound. All consumables shall be in the scope of contractor.

#### **2.6.6**

All fittings and accessories for impulse pipe and airline shall be provided by BHEL. Quoted rate for piping shall include cost of installation of such fittings and no separate rates are envisaged.

#### **2.6.7**

*Contractor shall provide GI "U" clamps for impulse pipe and GI pipes within the quoted rates for installation of the same.*

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### 2.6.8

Impulse pipes (as per paint schedule) shall be applied with one coat of primer red oxide paint and two coats of synthetic enamel of prescribed shade of final paint. BHEL may prescribe a time gap between first coat and second coat of final paint.

## 2.7 Structural Steel Fabrication and Installation

### 2.7.1

Structural steel material like MS angles, channels, beams, flats, plates etc. shall be used for fabrication of panel base frame, cable tray supports, canopies, instrument and junction box frames, impulse pipe/instrument air pipe supports and instruments etc. **Supply of Structural Steel- the material shall be as per specifications mentioned as per BOQ will be in Bidder's/ Contractor's scope along with material test certificate for the supplied material.**

### 2.7.2

This shall include cutting into size, conduiting of end connections, if required, welding, grinding of excess weld deposits, drilling of holes for mounting of device/instrument, installation at location, levelling, alignment, providing bracings, painting etc. No gas cut holes will be permitted. Contractor to follow the BHEL supplied welding schedule and welding procedures.

### 2.7.3

All the fabricated supports/frames shall be applied with one coat of primer red oxide paint before installation and two coat of synthetic enamel of prescribed shade of final paint,. If required, BHEL shall prescribe time gap between first and second coat of final paint. Supply of paint, primer etc. are in contractor's scope.

### 2.7.4

Frame installation/cable tray accessories' installation at site may involve mounting either on concrete floor by grouting/using anchor fasteners or on steel structure by welding etc. *All consumables including anchor fasteners shall be arranged by the contractor.*

### 2.7.5

In certain packages, galvanised members of junction box frames and instrument racks shall be supplied in cut to sizes and frame assemblies are required to be done as per drawing by bolting/welding. The installation rate as quoted shall include the assembling of the frames.

### 2.7.6

*Gas cutting of tray/impulse pipe support and gas cut holes in frame shall be avoided. Only drilled hole shall be permitted in frame etc.*

## 2.8 Installation of Panels

### 2.8.1

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

Electrical control panels, electronic control panels, etc., are normally supplied in suite of either one/two/three/four/five or loose shipping sections with integral base frame or loose supplied.

These panels may have to be installed as stand alone or in groups consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.

### 2.8.2

Installation of panel shall include **construction/ fabrication of base frame**, levelling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubicle interconnection hardware, bus bar jointing, wiring interconnection, welding and grouting of panels and base frames, mounting of panel canopy wherever supplied as part of panel, drilling of gland plates and sealing of cable entries. In certain case where canopies are not supplied but have to be fabricated out of MS sheets **(to be arranged by the Bidder)**, payment will be done on square meter basis after all requisite documents

### 2.8.3

Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. which shall be part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panel have to be erected at different locations and elevation in boiler, TG, GTG hall, LT & HT switchgear room, unit control room, ESP control room etc.

### 2.8.4

Panel and instruments once erected in position should be properly protected using necessary care to prevent ingress of dust/moisture. This will have to be periodically cleaned and surroundings have to be kept tidy. Necessary canopies for Instruments and JBs shall be provided.

### 2.8.5

Wherever the panels to be mounted on cable trenches, channel supports have to be provided across the cable trench over which the base frame of panel shall be mounted. For such work, structural steel fabrication, installation rates shall be applicable.

### 2.8.6

Normally the panels shall be supplied with instruments, relays, meters, electronic modules etc. mounted and pre-wired. However, if these are supplied loose / separately for safety in transit, contractor shall mount/wire such devices as part of the panel installation work and no separate rates shall be applicable unless otherwise *specifically* listed in the rate schedule.

### 2.8.7

No separate payment shall be made for replacement of any devices like electronic modules, relays, conductors, terminal block, push buttons etc. which are found defective during pre-commissioning / post-commissioning of any equipment / item.

### 2.8.8

For the panels erected by other agencies, commissioning/calibration work and troubleshooting has to be carried out by the contractor as part of testing and commissioning work as per the quoted rates.

### 2.8.9

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

Associated civil works like drilling, chipping, punching holes and opening in concrete floors, slabs and brick walls, grouting, related to Rack, support fabrication and installation, associated civil works required for installation of control panels, Junction boxes etc., shall be included in the erection cost of such items. Also all associated civil works like chipping away and making good as necessary in floor slab/wall for cabling / earthing etc., as required are included in the scope for which no separate payment is applicable. The scope also includes supply of grouting material, if any. Mechanical works as per BOQ is also in the scope of the contractor.

### 2.8.10

Supplier's instruction manuals, packing slips, door keys etc. received along with the panels should be promptly handed over to BHEL's engineer on opening of the panels.

## 2.9 Control panels

SG, TG, Station C&I system panels are based on max DNA/metso DNA distributed digital control philosophy. Max DNA system is having communication through UTP cables amongst themselves. The system consists of computer network with servers and workstations and various peripherals like printers, etc. Optical fibre cables are also used for communication, especially for larger distances. The various components/devices are generally located in control room/computer room/diagnostic and shift in charge room. Some panels (viz. network panels) are also located in outdoor plants and other units.

The entire work of dismantling, erection, testing, commissioning of the connected devices/equipments as listed in rate schedule is to be carried out including laying of peripherals cables (either plug-in or plugs to be fabricated at site), placement of computer furniture in computer room as per lay out. The computer furniture shall be supplied either assembled or in knocked down condition, which have to be assembled at site. The quoted rate shall be inclusive of cable laying, termination and placement of furniture against each device as given in the rate schedule.

### 2.10.0 Void

## 2.11 Field instrumentation

### 2.11.1

Various type of primary/secondary indicating/recording instrument for pressure, temperature, flow, level and analytical measurement shall be supplied either loose or mounted along with the equipment.

### 2.11.2

Scope of work under erection/calibration/testing/commissioning shall include calibration, setting, adjustment, writing instrument tag number with paint, report making, installation, servicing, minor repairs/servicing, putting instrument into service, signal checking from field up to the functional group panels and remote indicating instrument, functional checks, interlock and protection/alarm checks by simulating the field devices, troubleshooting during pre-commissioning/post-commissioning till system is handed over to the customer.

### 2.11.3

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

It is the responsibility of contractor to make erection, calibration/testing protocols for various C&I equipment/devices and they should get duly certified by customer/BHEL engineer and should be submitted to BHEL engineer regularly. However, sample formats will be given by BHEL and have to be printed by contractor in adequate numbers.

### 2.11.4

**Contractor shall establish calibration laboratory with adequate facilities and they should arrange standard test instruments duly calibrated from recognized agencies and calibration report of the same to be submitted prior to start of calibration of the field instruments/devices.**

### 2.11.5

Wherever thermowells are supplied along with temperature gauges, thermocouples, temperature switches, thermostats, etc., the bidder has to fix the thermowells on the pipeline. However, actual fixing of thermowells on pipeline and seal welding shall be done by the bidder .

### 2.11.6

Installation of instrument shall also include drilling of holes and tapping for mounting of instrument and local instrument frames/panels and supply of hardware for mounting of the instrument.

### 2.11.7

Some devices line solenoid valves, position feedback transmitters, limit switches, air filter regulators, airlock relays, positioners etc., are supplied assembled along with mechanical equipment like pneumatic control valves, power cylinders, trip valves, dampers, motorized actuators, etc. These will need removal, calibration/testing, re-fixing, adjustment, etc., and commissioning. Separate payment shall not be made for this. The rates quoted for the commissioning of these equipments (viz., pneumatic control valves, power cylinders, trip valves, dampers, etc.) should take care of the above. Also, the contractor shall remove such devices prior to erection either at site or at store to avoid damages/pilferages and keeping in safe custody and the same shall be installed prior to commissioning of such equipment.

#### 2.11.7.1

Transmitter enclosure / open racks for various packages which are to be erected and commissioned at various locations of the Boiler, turbine and outdoors, shall be supplied with internal tubing, air filter regulators, rotameters, provision of continuous or intermittent purging arrangements wherever required, etc. The quoted rates for these racks / enclosures shall include the erection and commissioning of all such items inside these racks / enclosures.

### 2.11.8

Sometimes recalibration of equipment may become necessary due to reasons not attributable to the contractor, e.g. Lapse of Time after first calibration, Need for change in range/parameter, etc. If re-calibration is required due to no fault of the contractor, the rates payable for re-calibration shall be as under:

**Recalibration Charges = 60% of the Percentage Stage Payment for Calibration as per split-up defined in Terms of Payment**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

The contractor shall keep record of such instrument with the reason for re-calibration and certified by the BHEL Engineer.

**Note:** For recalibration of skid mounted items or other systems where lump-sum rates are quoted, the recalibration charges, if admissible, will be calculated from the relevant unit rates quoted for same / similar items elsewhere in the rate schedule. The decision of BHEL Engineer shall be final and binding on the contractor.

### 2.11.9

For the very few cases where required, the contractor shall carry out re-orientation of bottom/top entry arrangement for process connection if needed due to site condition in existing instrument rack/enclosure/JB and re-location of existing instrument including removing of the existing tubing and re-installation of the same at appropriate location due to any change in grouping of the instrument and no extra payment shall be applicable.

### 2.11.10

In certain cases instruments / devices are supplied on equipment or drawn by other agencies as part of mechanical package. The same are to be received or to be collected from other agencies for keeping in safe custody to avoid damages. The same are to be erected back after calibration for which unit rate shall be applicable for erection and calibration. Contractor shall maintain record of such instrument duly certified by BHEL engineer. However for removal of such instrument, no separate rate/payment shall be applicable.

## 2.12 Unit control desk and components

**2.12.1** Unit control desk will be supplied in a single shipping section for erection at site.

Console Inserts shall be supplied either mounted on console grid or supplied loose. Also, the items (indicators, pushbuttons, etc.) of the console insert may be supplied mounted in the console insert or may be supplied loose. The lump-sum rates quoted for console inserts should take the above into consideration. No separate payment will be done for the erection of individual components of console inserts. However, for the other items like recorders, indicators, etc., unit rate shall be applicable. Alarm facia on the control desk may be supplied mounted or loose. Mounting these, if required, will not attract any extra payments. The commissioning of these will constitute a part of the panel commissioning from where the alarm is driven.

### 2.12.2

Wherever control desk / panel is not supplied by BHEL or is in customer scope of supply and installation, loose item supplied by BHEL if any, shall have to be mounted by the contractor.

### 2.12.3

Console/console tiles shall have plug-in/screwed/soldering/crimp snap-on, connection. Interconnecting cable between console and process control panel shall be either of pre-fabricated plug-in cable or plugs are required to be made at site with crimp insertion type of pins. BHEL shall provide plugs and any special lugs at free of cost. However, other ordinary lugs required for the work shall be arranged by contractor.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### 2.12.4

Generally, 0.5 sq.mm multi pair shielded cables are envisaged for console cabling. Cable may have to be terminated at different console tiles, spliced wire of individual cable need to be routed through PVC sleeves up-to the plug end of the tiles.

### 2.13 Final painting

**2.13.1** All the fabricated frames, instrument racks, Junction box frame, trays / impulse pipes, supports, panel base frame, etc., wherever applicable shall be first painted with one coat of primer paint (metal red oxide) and then two coats of synthetic enamel paint of approved shade (decided by BHEL Engineer) after thoroughly cleaning the surface of dust, rust, scale, grease, oil, etc., by wire brushing, scrapping or any other suitable method. The quoted rates should be inclusive of all these including supply of paints and consumables.

### 2.13.2

Other equipment like JB's, Panels, transmitter racks, Local gauge boards etc., shall be painted with two coats of synthetic enamel paint. The quoted rates should be inclusive of application of two final coats of synthetic enamel paint. All the consumables such as wire brush, other cleaning materials, painting implements, etc., is to be arranged by the contractor at his own cost. All equipment painting will be done by spray painting. The quoted rates should be inclusive of all these including supply of paints and consumables.

### 2.13.3

Cable trays shall, in general, be connected by bolted joints. However, in some cases welding of joints may be required. All the weld joints of GI cable trays and GI structural members shall be applied with a coat of cold galvanizing zinc paint. Paint, etc. shall be arranged by contractor at his cost.

The contractor shall provide the Primer (ROZC as per IS:2074) for the scope of painting work indicated in Section-4 as well as for protection of site weld joints and gas cut locations. Contractor shall also arrange to provide the required thinner and other consumables, T&P etc. **required for application of ROZC Primer. All paints and thinners shall be sourced only from BHEL approved manufacturers. Some of them are as listed under:**

- M/ s Asian Paints
- M/ s Berger paints
- M/ s Jenson & Nicholson
- M/ s Shalimar Paints
- M/ s Akzo Nobel
- M/ s Kansai Nerolac Paints

In order to have consistency in painting system, it is preferable that all the supplies are sourced from one single manufacturer.

Touch up paintings on damaged areas: Surface preparation by manual tools, wire brush/ emery paper etc. Minimum 6" peripheral area, adjoining to damaged area to be covered of metal surface is exposed; it is to be painted with Zinc rich epoxy (70 micron) or suitable primer with existing paint scheme. If primer is intact, intermediate & top coat to be done with specified DFT in scheme.

All the fabricated frames, instrument racks, Junction box frame, trays/ impulse pipes, supports, panel base frame, etc., wherever applicable shall be after thoroughly cleaning the surface from dust,

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

rust, greases, oils, scales, etc., by wire brush, scrapping, sand blasting/ shot blasting (as applicable) as specified in relevant erection documents. The above parts shall then be painted with specified two coats of specified paint over the shop primer/ paint. Also, where the shop primer/ paint has peeled off, the affected area shall be cleaned thoroughly by the specified method and then primer coat applied. Similarly, certain components may be supplied without any primer/ paint coat from shop. The surface of such items shall be cleaned as per specifications, coated with suitable primer and then coated with final paint coats. The dry film thickness after final coat should be as per specification. The color, shade etc. shall be as per specification. Painting schedule will be furnished at site. The quoted rates should be inclusive of all these including supply of paints and consumables.

All metal parts of the equipment including supports, structures, etc., as applicable shall be painted after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc., by wire brush, scrapping, sand blasting/ shot blasting (as applicable) as specified in relevant erection documents. The above parts shall then be painted with specified two coats of specified paint over the shop primer/ paint. Also, where the shop primer/ paint has peeled off, the affected area shall be cleaned thoroughly by the specified method and then primer coat applied. Similarly, certain components may be supplied without any primer/ paint coat from shop. The surface of such items shall be cleaned as per specifications, coated with suitable primer and then coated with final paint coats. The dry film thickness after final coat should be as per specification. The color, shade etc. shall be as per specification. Painting schedule will be furnished at site.

Other equipment like JB's, Panels, transmitter racks, Local gauge boards etc., shall be painted with two coats of synthetic enamel paint. The quoted rates should be inclusive of application of two final coats of synthetic enamel paint. All the consumables such as wire brush, other cleaning materials, painting implements, etc., is to be arranged by the contractor at his own cost. All equipment painting will be done by spray painting. The quoted rates should be inclusive of all these including

All the weld joints of GI cable trays and GI structural members shall be applied with red oxide and aluminium paint and then coated with bitumen.

All damaged surfaces of galvanized or un-galvanized faces of steel structures etc. shall be brushed up and painted with red primer paint followed by two coats of aluminium paint/ enamel paint to the satisfaction of Engineer. The contractor has to arrange all the materials for painting at his cost.

Welded joints on GI earthing conductors shall be coated with one coat of bituminous paint in case of buried earth grid or earth flats to be laid in cable trench. For site welded GI strips/ wires which are exposed these are required to be painted with one coat of cold galvanizing zinc paint. Contractor to arrange the required paints and other items at his cost.

In case of GI Structure, the cold galvanizing paint to be applied as touch up where ever needed. This is to be done as per instruction of BHEL Engineer.

The primer shall be compatible with the final coat paint schedule.

Colour Banding, Legend and Identification Marking, Direction marking etc. shall be in scope of the contractor.

Impulse pipes shall be applied with one coat of primer red oxide paint and two coats of synthetic enamel of prescribed shade of final paint as instructed by BHEL Engineer/ painting schedule. BHEL may prescribe a time gap between first coat and second coat of final paint. Paint, primer, brush, etc. supply is in the scope of the contractor. Colour codes for impulse piping, etc. will be as per standard codes/ mother pipe.

The external & internal colour of the panels/ enclosures shall be RAL 7032 and brilliant white

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

respectively. The panels shall have matt finish to prevent any glare surface due to illumination.

The primer shall be compatible with the final coat paint schedule.

Supply of paint, primers, other consumables etc. for above and any other scope in these specifications shall be in Contractor's scope.

Irrespective to scopes of painting & supply of paint mentioned elsewhere it is to be noted that supply of paint, primers, other consumables etc. for all primer/ painting works to be done by the contractor, shall be in Contractor's scope. No dispute shall be entertained on the above matter.

### STRUCTURAL

Structural components may be supplied without any primer/ paint coat. The surface of such items shall be cleaned as per specifications and then coated with two coats of Primer.

### PANELS, JUNCTION BOXES

Panels and Junction Boxes shall be Touch-up painted as and where original shop paint is peeled off. Necessary surface cleaning and preparation shall be done by the contractor as per relevant painting codes followed by two coats of Primer and two coats of Finish Paint.

### **2.14 Misc. Other instrument/ equipment erection, calibration and commissioning.**

#### **2.14.1**

Wherever panels, pneumatic power cylinders and control valves have been erected by the contractor, calibration/ commissioning has to be carried out by the contractor.

#### **2.14.2**

If applicable-The calibration of position transmitters of the NRVs in the turbine extraction system has to be carried out by the contractor. Position transmitters are to be erected by contractor if supplied loose.

#### **2.14.3**

If applicable-The solenoids in the corner valves / HEA will be received in mounted condition and will be erected by the mechanical contractor. The contractor has to provide the services required for dismantling the solenoids and reinstalling the same after servicing/adjustment. Payments will be made as per testing/commissioning portion of the rate quoted for these items and no extra charges will be payable for removal and re-fixing. Small items like speed regulators, etc. will have to be fitted in the copper tubing route of corner stations. No separate rate will be applicable for such devices.

#### **2.14.4**

Dimension and weight as mentioned against control panels, MCCs, etc. in rate schedule are only approximate and there may be changes in dimension and weight in actual supply of the equipment and no rate variation shall be applicable on this account.

#### **2.14.5**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

Wherever brief description of the system is given under various sub-heads, it is only for the understanding system requirements. It does not indicate the total specification of work. For such system, other clauses are also applicable wherein work details are specified.

### 2.14.6

Normally, cable glands on junction boxes side are received in mounted condition. While terminating the cables as per drawings, the cable glands are to be removed and fixed. Wherever cable glands are not received along with junction boxes, the cable glands as per the requirement will be provided by BHEL and the contractor has to make necessary holes/adjust the available holes in the JB for fixing these. No separate payment will be made for drilling of holes and fixing the cable glands to the junction boxes. Nameplates for JBs will be supplied separately. These are to be suitably written and fixed onto the JBs. Wherever nameplates for JBs are not supplied, the JB no. are to be written with paint on JBs for identification. Separate payment will not be made for this.

### 2.14.7

The push buttons and indicators in C&I systems are provided as loose with different type of connectors. The fixing of connectors and their wiring from push buttons to indicators shall be the responsibility of contractor. No separate payment will be made for fixing of connectors. The cable laying and termination charges will be paid as per applicable rate schedule.

## 2.15 Guidelines for erection

### Impulse Pipelines

#### 2.15.1

All impulse lines, air lines shall be thoroughly cleaned by removing the dust, burrs etc., and any foreign matter inside the pipe/airline is to be cleaned by compressed air or any other suitable means before installation.

#### 2.15.2

The routing of pipe lines shall include sufficient flexibility near tap off points to allow for thermal expansion of process equipment.

#### 2.15.3

*The pipes shall be cold bent using hydraulic bending machines only.*

#### 2.15.4

The horizontal impulse lines shall be laid with proper slopes towards the tapping point.

#### 2.15.5

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 ft.      |
| C) 3/4" NB pipe/tube        | 5 ft.      |
| D) 1" NB pipe/tube          | 8 ft.      |

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### **2.15.6**

All CS impulse line welding shall be done through welding generator/rectifier and only structural welding may be done with welding transformer.

### **2.15.7**

Impulse pipes of alloy steel/SS/carbon steel etc. shall be TIG welded. Contractor shall arrange for necessary TIG welding sets, electrodes etc.

### **2.15.8**

Minimum number of fittings shall be used on all lines wherever possible, to keep threaded joints to a minimum wherever threaded connections are to be made.

### **2.15.9 Testing**

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

### **2.15.10**

The impulse lines shall be isolated from instruments and tested at 2 times the maximum working pressure. The fall in pressure shall not be more than 1 kg/cm<sup>2</sup> or 1% of the working pressures whichever less, in 30 minutes and there shall be no leaks at any of joints/welds when isolated from source of pressure.

### **2.15.11 Air Piping**

All instrument air pipelines shall be isolated from the instruments and pressurised pneumatically to maximum work pressure. They shall then be isolated from the source of pressure and fall shall be less than 1 PSI in 20 minutes.

### **2.15.12 Pneumatic Signal Lines**

All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurised pneumatically 20 psi and checked with soap solution for leaks and attended accordingly.

## **2.16 Electrical cabling /wiring**

### **2.16.1 Cabling /Wiring**

All the cables will be properly laid in cable trays, dressed and clamped with aluminium flats. The cable will be terminated at both ends with suitable lugs and *printed ferrules* and will be glanded properly. Suitable equipment and consumables for ferrule printing has to be arranged by the contractor at his own cost. For cable identification, the contractor shall provide at his cost aluminium tags at regular intervals (15 m) through each run of cable.

#### **2.16.1.1**

All electrical connections shall be tested for polarity and proper connections.

#### **2.16.1.2**

Insulation test of the various circuits shall be done.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### 2.16.1.3

The checking of operation of individual equipment and instruments to which the cabling/wiring connected shall also be done by the contractor.

### 2.16.1.4

Wherever supplied, GI cable trays shall be of bolted construction only with fixing screws and coupler plates.

### 2.16.1.5

To the extent possible, all the trays shall be fixed in vertical orientation

### 2.16.1.6

Sharp bends of cable trays shall be avoided in all type of cable trays.

### 2.16.1.7

Installation of cable racks and supports structure shall be carried out in all the required areas. Steel embedment shall be provided in the cable trenches, ceiling slabs and concrete blocks for installing the cable racks and support structures.

A) Ladder perforated type cable trays shall be used in cable trenches and vertical risers.

B) Perforated cable trays shall be used in higher elevations in boiler and TG area.

### 2.16.1.8

Cable racks in the trenches and control room are to be shared with other contractors installing cables in different areas wherever required. Contractor shall cooperate with the other contractors in sharing the cable trays and proper dressing and clamping the cables.

### 2.16.1.9

Where power and control cables are to be laid in the same route, suitable barriers to segregate them physically shall be employed.

### 2.16.1.10

Space equal to the diameter of cable shall be provided between power cables of six over 50 mm in diameter.

### 2.16.1.11

When cables pass through floors, walls etc., it shall be passed through a pipe for mechanical protection and the pipe ends sealed suitably.

### 2.16.1.12

Care shall be taken to avoid short bending and kinking of conductor damaging insulation and stressing the cable beyond pulling force recommended by the manufacturer. Cable shall be protected at all times from mechanical damage.

### 2.16.1.13

The minimum radius of formed bend of an insulated cable shall be 12d for un-armoured cables and 15d for armoured cables where 'd' is the overall diameter of the cables.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### **2.16.1.14**

No cable shall be laid in ducts or trenches where other services such as oil pipes, steam or water pipes are laid.

### **2.16.1.15**

Where cabling passes through brickwork or concrete work, the contractor shall provide suitable local protection against mechanical damage wherever necessary.

### **2.16.1.16**

The layout of all cables shall be arranged to give adequate clearance from other services and cables shall be routed to avoid hot zones.

### **2.16.1.17**

Jointing of cables shall be avoided as far as practicable. However, jointing if at all necessary shall be done by crimping type cable joints after getting approval of BHEL engineer.

### **2.16.1.18**

The cable schedules indicating cable sizes, tentative cables routing information will be furnished by BHEL at site to the contractor. Required steel inserts on cable trenches, ceilings of the platforms in TG hall for erecting the cables will be provided by BHEL. The contractor shall design number of cable/racks to accommodate the cables on racks/trays properly.

## **2.16.2 Earthing installations**

### **2.16.2.1**

All equipments shall be earthed by two separate and distinct connections. Earthing terminals will be available in all equipment supplied by BHEL.

### **2.16.2.2**

The earthing conductors shall be of mild steel/GI strip/ wires. All connections from equipment to main earthing conductors shall be made as illustrated in earthing drawing / as per instruction of BHEL engineer.

### **2.16.2.3**

A continuous earthing conductor shall be installed in all cable 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 in parallel, a continuous earthing conductor shall be provided on trays only with tap offs to the control cable trays. All valve and damper motors and rapping motors will be earthed to this conductor.

### **2.16.2.4**

All joints in the earthing system shall be welded type. Earthing connections to all equipments including motors shall be bolted type.

### **2.16.2.5**

Earthing connections shall be free from tinning scale paint, enamel, grease, rust or dirt at the time of making joint.

### **2.16.2.6**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

Metallic sheaths, screens/shields and armour of all multicore cables shall be bonded and earthed.

### 2.16.2.7

Earthing conductors along their run on columns, beams, walls etc. shall be supported by suitable cleats at intervals of 750 mm.

### 2.16.2.8

Welded joints on GI earthing conductors shall be coated with one coat of bituminous paint in case of buried earth grid or earth flats to be laid in cable trench. For site welded GI strips/wires which are exposed these are required to be painted with one coat of cold galvanising zinc paint. Contractor to arrange the required paints and other items at his cost.

## 2.17 Instruments and Equipment

### 2.17.1

All field mounted instruments are to be located in such a way as not to obstruct walk-ways or plant equipment access but shall be easily accessible for maintenance. Hand rails shall not be used for mounting or supporting instruments.

### 2.17.2

Racks/stands and supports for instruments and transmitters shall be fixed on RCC column/floor by chipping and grouting or by welding to steel structure. In no case these shall be welded to floor grills.

### 2.17.3

The power cylinders support/base erection will be welded to steel structure or by grouting. The power cylinder will be properly aligned and linkage mechanism wherever required shall be connected to the driven equipment. All accessories for power cylinders line air sets, solenoid valves, air lock, limit switches, if supplied loose, shall be fixed, aligned and connected up.

### 2.17.4

When installing flow and pressure transmitters/switches for Liquid /steam/condensate vapour services, the instrument is to be mounted below its primary element or tapping point. For gas service applications, the instrument is to be mounted above Primary element tapping point.

### 2.17.5

During erection and commissioning stage, the site mounted instrument shall be protected suitably. Contractor shall provide suitable security arrangement in main control room, and other areas where equipments are positioned, at no extra cost.

### 2.17.6

All brackets/racks and support steel work for tubing impulse lines/instruments shall be painted with two coats of primer and two coats of final colour prior to installation. Paints, etc supply in the scope of contractor. **(Also Refer 2.13)**

### 2.17.7

---

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

Contractor shall arrange for own firefighting equipment for the materials stored under contractor's custody.

### **2.18 Guidelines for handling and storage of electronic cubicles / subassemblies / loose items.**

#### **2.18.1**

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

#### **2.18.2**

After unloading at site, the package of the equipment shall be inspected for external damage. In case the package is damaged, package number and details of damage should be noted. The details of damage should be reported to concerned site engineer.

#### **2.18.3**

Cases should be opened/unpacked using correct nail pullers. While opening the planks, care should be taken to see that equipment inside 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.

#### **2.18.4**

After opening the case, all supports provided for transport are to be removed with due care.

#### **2.18.5**

Hinged frames should not be opened when equipment is not secured to 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 bottom wooden pallet.

### **2.19 Storage**

#### **2.19.1**

The equipment should be preferably in its original package and should not be unpacked until it is absolutely necessary for its installation or advised by BHEL engineer. The equipment should be best protected in its cases. It should be arranged away from walls.

#### **2.19.2**

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 packing with fork-lifter.

#### **2.19.3**

Periodic inspection if silica gel placed inside the equipment is necessary. It has to be replaced or regenerated when decolorization takes place.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

### 2.19.4

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.

### 2.19.5

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

### 2.19.6

All the equipment, 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 engineer.

### 2.19.7

The packing material shall be retained if the cubicle is to be repacked after inspection.

## 2.20 Sub-assemblies

### 2.20.1

All subassemblies should be kept in a separate place where it is easily accessible.

### 2.20.2

Subassemblies 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.

### 2.20.3

Subassemblies should not be stacked one above the other.

## 2.21 Loose items

The loose items supplied for the main equipment falls into various categories like tools, cables, prefabricated cables, console inserts, recorders, VDU/CRT, other display units, printers, sensors and transducers, cable glands, cable ducts, frames, racks, etc. These are to be categorised and stored separately.

## 2.22 Guidelines for handling of electronic modules

*2.22.1 All the modules shall be handled by qualified persons only.*

2.22.2 Electronic modules should only be touched when it is absolutely essential to do so.

### 2.22.3

Before touching any electronic module, the operator should discharge the static electricity by earthing himself or better still, ensure constant discharge by wearing an earthed wrist strap.

### 2.22.4

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – II: Scope of Works

---

The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing at least 65% cotton.

### 2.22.5

The PCB should always be held by front panel or by module frame and electronic components / connectors should never be touched.

### 2.22.6

The electronic modules should not be placed close to television sets or CRT units.

### 2.22.7

Soldering irons and any other tools used must be grounded.

### 2.22.8

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.

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – III: Facilities in the scope of Contractor/ BHEL**  
**(Scope Matrix)**

Sl. No	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
<b>1.1</b>	<b>PART I</b> <b>ESTABLISHMENT</b>			
1.1.1	<b>FOR CONSTRUCTION PURPOSE:</b>			
a	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with owner
b	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with owner
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipment, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
f	Fire-fighting equipment like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.1.2	<b>FOR LIVING PURPOSES OF THE BIDDER</b>			
a	Open space for labor colony (as per availability)		Yes	<i>Agency has to make his own arrangement at his own cost.</i>
b	Labor Colony with internal roads, sanitation, complying with statutory requirements		Yes	
<b>1.2</b>	<b>ELECTRICITY</b>			
1.2.1	<b>Electricity For construction purposes of Voltage 415/440 V</b>			<b>Chargeable;</b> Any penalty due to non-maintenance of power factor by the customer shall be passed on to the contractor.
a	Single point source	Yes		
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – III: Facilities in the scope of Contractor/ BHEL**  
**(Scope Matrix)**

Sl. No	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
	<b>PART I</b>			
1.2.2	<b>Electricity for the office, stores, canteen etc of the bidder</b>			<i>Agency has to make his own arrangement at its own cost.</i>
a	Single point source	Yes		
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
1.2.3	<b>Electricity for living accommodation of the bidder's staff, engineers, supervisors etc</b>			<i>Agency has to make his own arrangement at its own cost.</i>
a	Single point source	Yes		
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
<b>1.3</b>	<b>WATER SUPPLY</b>			
1.3.1	<b>For construction purposes</b>			<i>Agency has to make his own arrangement at its own cost.</i>
a	Making the water available at single point	Yes		
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.2	<b><u>Water supply for bidder's office, stores, canteen etc</u></b>			
a	Making the water available at single point	Yes		
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.3	<b><u>Water supply for Living Purpose</u></b>			
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	
<b>1.4</b>	<b>LIGHTING</b>			

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – III: Facilities in the scope of Contractor/ BHEL**  
**(Scope Matrix)**

Sl. No	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
	<b>PART I</b>			
a	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
<b>1.5</b>	<b>COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER</b>			
a	Telephone, fax, internet, intranet, e-mail etc		Yes	
<b>1.6</b>	<b>COMPRESSED AIR wherever required for the work</b>		Yes	
<b>1.7</b>	<b>Demobilization of all the above facilities</b>		Yes	
<b>1.8</b>	<b>TRANSPORTATION</b>			
a	For site personnel of the bidder		Yes	
b	For bidder's equipment and consumables (T&P, Consumables etc)		Yes	
<b>1.9</b>	<b>ERECTION FACILITIES</b>			
1.9.1	Engineering works for construction:			
a	Providing the erection drawings for all the equipment covered under this scope	<b>Yes</b>		
b	Drawings for construction methods	<b>Yes</b>		<i>In consultation with BHEL</i>
c	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small-bore pipes		<b>Yes</b>	<i>In consultation with BHEL</i>
d	Shipping lists etc for reference and planning the activities	<b>Yes</b>		
e	Preparation of site erection schedules and other input requirements		<b>Yes</b>	<i>In consultation with BHEL</i>

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – III: Facilities in the scope of Contractor/ BHEL**  
**(Scope Matrix)**

Sl. No	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
<b>PART I</b>				
f	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		<b>Yes</b>	<i>In consultation with BHEL</i>
g	Weekly erection schedules based on SI No. e		<b>Yes</b>	<i>In consultation with BHEL</i>
h	Daily erection / work plan based on SI No. g		<b>Yes</b>	<i>In consultation with BHEL</i>
i	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 weeks.		<b>Yes</b>	
j	Preparation of preassembly bay		<b>Yes</b>	
k	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself		<b>Yes</b>	
l	Arranging the materials required for preassembly		<b>Yes</b>	
m	HSE Permits, Approvals, Requirements		<b>Yes</b>	

**2.1 ERECTION CONDITIONS OF CONTRACT**

These provisions shall supplement the conditions specified in other sections of these specifications and contract documents and shall govern the portion of the work to be executed at site. Any erection requirements and procedures not explicitly covered in these documents shall be carried out in accordance with the recommendations of BHEL or as mutually agreed between BHEL and the Bidder prior to the commencement of erection activities.

The Bidder upon signing of the Contract shall, in addition to a Project coordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and coordination of the Works to be performed at Site. Such a person shall function from the Site office of the Bidder during the pendency of Contract.

**2.2 ELECTRICAL SAFETY REGULATIONS**

**2.2.1** In no circumstances will the Contractor interfere with fuses and electrical equipment belonging to the other Contractor or Customer

**2.2.2** Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contractor or Customer, he shall:

- 1) Satisfy BHEL/Customer that the appliance is in good working condition.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL (Scope Matrix)

---

- 2) Inform the BHEL/Customer of the maximum current rating, voltage and phase of the appliances.
- 3) Obtain permission of the BHEL/Customer detailing the socket to which the appliances may be connected. The BHEL/Customer will not grant permission to connect until he is satisfied that the appliance is in good condition and is fitted with a suitable plug.
- 4) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

**2.2.3** No electric cable in use by the other Contractor/ Customer will be disturbed without permission. No weight of any description will be imposed on any such cable and ladder or similar equipment will rest against or be attached to it.

**2.2.4** No repair work shall be carried out on any live equipment. The equipment must be declared safe by the BHEL/Customer and a permit to work issued before any work is carried out.

**2.2.5** The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.

### **2.3 WELDING PROCEDURE**

The welding of all equipment, piping, pressure parts shall be in accordance with qualified welding procedures. The welders must be qualified in accordance with the latest applicable and statutory requirements.

### **2.4 REMOVAL OF MATERIAL**

No material brought to the Site shall be removed from the Site by the Contractor without the prior written approval of the BHEL/Customer.

### **2.5 ACCESS TO SITE AND WORKS ON SITE**

**2.5.1** Suitable access to site and permission to work at the Site shall be accorded to the Contractor by the BHEL/Customer in reasonable time.

**2.5.2** The execution of the Works, no person other than the Contractor or his duly appointed representative, and workmen, shall be allowed to do work on the Site, except by the special permission, in writing by the BHEL/Customer or his representative.

### **2.6 CONTRACTOR'S SITE OFFICE ESTABLISHMENT**

The Contractor shall establish an Office at the Site and keep posted an authorized representative for the purpose of the Contract.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL (Scope Matrix)

---

### **2.7 FACILITIES TO BE PROVIDED BY THE CUSTOMER**

#### **2.7.1 ELECTRICITY**

The Contractor shall be provided with electricity on chargeable basis for the purposes of the Contract, only at two locations in the Customer's Site and at 415V voltage level. The Contractor shall make his own further distribution arrangement. All temporary wiring must comply with local regulations and will be subject to Customer's inspection and approval before connection to supply. The free supply of power will not be provided for the use in the labor and staff colony.

#### **2.7.2 WATER**

Contractor shall make all arrangements himself for the supply of construction water as well as potable water for labor and other personnel at the worksite/colony.

### **2.8 FACILITIES TO BE PROVIDED BY THE CONTRACTOR**

**2.8.1 Contractor's site office Establishment:** The Contractor shall establish a site office at the site and keep posted an authorized representative for the purpose of the contract.

**2.8.2 Contractor shall deploy labor workers whose police verification is carried out.** Contractor has to give under taking for the same while obtaining the gate pass. Contractor has to submit police verification record of his labor /workers to Dy. Commandant, CISF, CSTPS/A.D. Security, CSTPS.

**2.8.3 Contractor shall obtain gate pass with receipt of work order & start the work as per directives of contract operating authority, otherwise action as deemed fit shall be taken against Contractor.**

### **2.9 TOOLS, TACKLES AND SCAFFOLDINGS**

The Contractor shall provide all the construction equipment, tools, tackles and scaffoldings required for pre-assembly, installation, testing, commissioning of the equipment covered under the Contract. He shall submit a list of all such materials to BHEL/Customer before the commencement of pre-assembly at Site. These tools and tackles shall not be removed from the Site without the written permission of the BHEL/Customer. The Contractor shall arrange Dozer, Hydra, Cranes, Trailer, truck, etc. for the purpose of fabrication, dismantling, erection and commissioning, and material management to and from the site.

### **2.10 CLEANLINESS**

**2.10.1** The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of Contract. The Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by the Customer. Materials and stores shall be so managed to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.

**2.10.2** Similarly, the offices and the residential areas of the Contractor's employees and workmen shall be kept clean and neat to the entire satisfaction. Proper sanitary arrangements shall be provided by the Contractor, in the work-areas, office and residential areas of the Contractor.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL (Scope Matrix)

---

### **2.11 SECURITY**

The Contractor shall have total responsibility for all equipment and materials in his custody stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss. All materials of the Contractor shall enter and leave the Site only with the written permission of the BHEL in the prescribed manner.

### **2.12 COMMISSIONING ACTIVITIES**

**2.12.1** Upon completion of pre-commissioning activities/tests, the contractor shall initiate commissioning of equipment/systems. During commissioning the Contractor shall carry out system checking and reliability trials on various parts of the equipment/systems.

**2.12.2** Contractor shall carry out the checks/tests at site, according to instructions of BHEL engineer, to prove to the Customer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified.

**2.12.3** Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the BHEL/Customer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence. Decision of BHEL engineer shall be final and binding on contractor.

**2.12.4** Other tests shall be conducted, if required by the BHEL/Customer, to establish that the plant equipment is in accordance with requirements of the specifications.

**2.12.5** The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipment including all electrical and C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied and

Installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications.

### **2.13 MATERIALS HANDLING AND STORAGE**

**2.13.1** Contractor after issue of material shall be responsible for examining all the shipment and notify the BHEL/Customer immediately of any damage, shortage, discrepancy etc. for the purpose of BHEL/ Customer's information only. However, the Contractor after receipt/issue of material shall be solely responsible for any shortages or damage in transit, handling and / or in storage and erection of the equipment to and from the site.

**2.13.2** All electrical panels, controls gear and such other devices shall be properly dried by heating before they are installed and energized. Exposed parts shall be protected against moisture ingress and corrosion during storage at site after issue to the contractor and periodically inspected.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL

### (Scope Matrix)

---

**2.13.3** The Contractor shall ensure that all the packing materials and protection devices used for the various equipment during transit and storage are removed before the equipment are installed.

**2.13.4** The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.

**2.13.5** After issue all the materials stored in the open or dusty location must be covered with suitable weather-proof and flameproof covering material wherever applicable.

**2.13.6** If the materials belonging to the Contractor are stored in areas other than those earmarked for him, BHEL will have the right to get it moved to the area earmarked for the Contractor at the Contractor's cost.

#### **2.14 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY**

**2.14.1** The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of the BHEL/Customer and the employees of other Contractors and Sub- Contractors and all public and private property including structures, building, other plants and equipment and utilities either above or below the ground.

**2.14.2** The Contractor will ensure provision of necessary safety equipment such as barriers, sign - boards, warning lights and alarms, etc. to provide adequate protection to persons and property.

**2.14.3** The Contractor shall follow and comply with all the Safety Rules, standards, code of practices of MSPGCL and relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time.

#### **2.15 FOUNDATION DRESSING, GROUTING AND DOWELLING**

**2.15.1** The surfaces of foundations shall be dressed to bring the top surface of the foundations to the required level, prior to placement of equipment/equipment bases on the foundations. All the equipment/ equipment bases shall be grouted and finished as per these specifications unless otherwise recommended by the equipment manufacturer. The concrete foundation surfaces shall be properly prepared by chipping, grinding as required to bring the top of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength.

##### **2.15.2 Grout**

The grout shall be high strength grout having a characteristic compressive strength as per standard for equipment.

##### **2.15.3 DOWELLING**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL

### (Scope Matrix)

---

All the turbine supervisory sensors and other equipment shall be suitably doweled with tapered machined dowels as per the standards and direction of the BHEL/Customer

#### **2.16 Equipment Installation**

##### **a) General Requirements**

i) The Contractor shall furnish all construction materials, tools and equipment other than that being supplied by BHEL and shall perform all work required for complete installation of all control and instrument equipment furnished under this specification. This clause is to be read in conjunction with relevant clauses, instructions, guidelines etc. mentioned elsewhere in this document.

(ii) Contractor shall prepare Marked-Up drawings incorporating modifications and deviations from original drawings or prepare fresh sketch for actual installation/ connection details if need be, that can be converted to "As-built" drawings.

iii) The Contractor shall coordinate his work with other suppliers/contractors where their instruments and devices are to be installed under specifications.

(iv) Bidder has to work along with other agencies working at same unit, bidder to maintain co-ordination with them.

##### **b) Regulatory Requirements**

All installation procedures shall conform with the accepted good engineering practice and with all applicable governmental laws, regulations and codes.

##### **c) Cleaning**

All equipment shall be cleaned of all sand, dirt and other foreign materials immediately after removal from storage and before the equipment is brought inside the power plant building or to other installation sites. All piping and tubes shall be air blown.

##### **d) Equipment Assembly**

Equipment installed under these specifications shall be assembled if shipped unassembled. The equipment shall be dismantled and reassembled as required to perform the installation and commissioning work described in these specifications.

##### **e) Equipment Setting**

Field mounted instruments and accessories, other than those in local instrument enclosures/racks, shall be bracket or sub panel mounted on the nearest suitable firm steel work or masonry. The brackets, stands, supports and other miscellaneous hardware required for mounting instruments and accessories such as receiver gauge, air set, valve manifold, purge-meter etc. shall be furnished and installed. No field mounted instruments shall be installed such that it depends for support or rigidity on the impulse piping or on electrical connection to it.

Indicating type field mounted instruments shall be installed in such a way that centre of indicating dial shall be about 1600-1800mm from operating floor level or as instructed by BHEL engineer. Non-

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL

### (Scope Matrix)

---

indicating type field instruments shall be installed such that operating handle of manifold block / isolating cock comes within 1600 mm from operating floor level or as instructed by BHEL engineer. All free standing instrumentation cabinets and panels shall be located within the construction tolerances of +/- 3 mm of the location dimensions indicated on the Customer's plant arrangement drawings or as per recommendation/instruction of BHEL engineer.

#### **f) Free-Standing Equipment**

Free-standing Cabinets shall be attached to the floor, concrete equipment bases or supporting steel as indicated on relevant drawings/documents. The cabinets shall be shimmed for proper alignment before bolting them to the floor or welding of base frame as required. Adjacent enclosures shall be shimmed to maintain mutually level appearance before they are attached to floor. Vibration dampening mounts shall be installed between supporting structures and panels when specified.

#### **g) Non-free Standing Equipment :**

Non-free standing local enclosures and cabinets shall be mounted in accessible locations on columns, walls, or stands in locations as indicated on the Customer's Plant Arrangement Drawings or as per instruction of BHEL engineer which shall be final and binding on contractor. Bracket and stands shall be fabricated as required to install the local enclosures and cabinets in a workman like manner

ii) Rough edges and welds on all fabricated supports shall be ground smooth. The supports shall be finished as per painting schedule previously mentioned.

#### **h) Equipment Location :**

(i) All individual items of equipment not located in cabinets or on panels and racks are located approximately according to the floor elevation and the nearest building column designated by the BHEL/Customer.

(ii) Solenoid valves not located in enclosures or mounted on valves shall be mounted in easily accessible protected locations near the components with which they are associated.

(iii) All brackets, stands, supports and other miscellaneous hardware required for mounting devices shall be furnished, other than that being supplied by BHEL and installed.

#### **i) Installation of Field Mounted Instruments and Devices**

All installation work under this specification shall be strictly as per installation drawings or as per instructions of BHEL engineer which shall be final and binding on contractor. In addition to above relevant Portion as specified elsewhere in technical specification may be referred.

#### **j) Piping Connections**

(i) All equipment having piping connections shall be levelled, aligned and wedged in place but shall not be grouted or bolted prior to the initial fitting and alignment of connecting piping. However, all equipment shall be grouted or bolted to its foundation prior to final bolting or welding of the connection piping.

(ii) All flanged joints shall be checked and retightened after approximately 10 days of operation at normal operating temperature.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – III: Facilities in the scope of Contractor/ BHEL (Scope Matrix)

---

### **k) Equipment Checkout**

(i) All equipment shall be cleaned after installation. Equipment subject to pressure differentials shall be checked for leakage.

(ii) After erection, all equipment having moving parts, having electrical apparatus, or subject to pressure differentials shall be trial-operated.

### **l) Defects**

All defects in erection shall be corrected to the satisfaction of the BHEL/ Customer and the Project Manager.

**NOTE: DEFECT LIABILITY PERIOD SHALL BE 12 MONTHS FROM THE DATE OF SYNCHRONIZATION OF UNIT.**

### **m) Equipment Protection**

(i) All equipment to be erected under these specifications shall be protected from damage of any kind from the time of contract award until commissioning of each unit.

(ii) The equipment shall be protected during storage as described herein.

(iii) Equipment shall be protected from weld spatter during construction.

(iv) Suitable guards shall be provided for protection of personnel on all exposed rotating or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy removal and maintenance.

(v) Equipment having glass components such as gauges, or equipment having other easily breakable components, shall be protected during the construction period with plywood enclosures or other suitable means. Broken, stolen, or lost components shall be replaced by the Contractor.

(vi) Machine finished surfaces, polished surfaces, or other bare metal surfaces which are not to be painted, such as machinery shafts and couplings shall be provided temporary protection during storage and constructional periods by a coating of a suitable non-drying, oily type and rust preventive compound.

### **2.17 DEVIATIONS DISPOSITIONING:**

Any deviation to the contract and BHEL/ Customer approved documents shall be properly recorded. All the deviations shall be brought to the knowledge of BHEL representative for suitable disposition.

### **3.1 ARRANGEMENT OF SAFETY ENGINEERS ALONG WITH COMPLIANCE OF ALL HSE REQUIREMENTS: -**

**3.1.1 Two (02) Nos Safety Engineers** are to be deployed by the contractor for complete duration of R&M works in consultation with BHEL Site-In-Charge. Safety Engineer should be qualified from approved institute. Certificate shall be produced at the time of deployment.

**3.1.2 Bidder has to fulfil all HSE related requirement** at site.

**3.1.3 In Addition to BHEL safety conditions in tender, Bidder has to fulfill MSPGCL safety norms at site (KINDLY REFER Annexure-B)**

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – III: Facilities in the scope of Contractor/ BHEL**  
**(Scope Matrix)**

---

**3.2 ARRANGEMENT OF C&I EXPERTS: -**

Two (02) Nos. C&I experienced experts are to be deployed by the contractor for complete duration of R&M works with prior approval of BHEL.

**3.3 ARRANGEMENT OF QUALITY ENGINEERS: -**

**Two (02) Nos Quality Engineers** are to be deployed by the contractor for complete duration of R&M works in consultation with BHEL Site-In-Charge. Quality Engineer should be qualified from approved institute. Certificate shall be produced at the time of deployment.

**3.4 ARRANGEMENT OF OFFICE BOY: -**

Bidder is to provide **One office boy** in each shift for BHEL Office.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – IV: T&Ps and MMEs to be deployed by Contractor

### A: TOOL & PLANTS

**List of major testing & measuring equipment/ tools and tackles to be arranged/ brought by contractor.**

S. No.	Description	UoM	Qty
1	DC power supply 0-250 V, 10 A make "Aplab" or equivalent (variable source)	Nos.	4
2	DC shunt 400 A 75 mV	Nos.	2
3	Dead weight tester rated 400 kg/ cm <sup>2</sup> and with weights and test gauge facility. Make 'Budenberg' or 'Ravika'	Nos.	2
4	Decade resistance box	Sets	4
5	Digital Tong tester AC 5/ 10 and 25/ 60/ 300 A of reputed make	Nos. Each	2
6	Digital Tong tester DC 30/ 60/ 300 A	Nos.	1
7	Earth Resistance Tester	Nos.	1
8	Equipment and consumables for LPI/ MPI test on impulse pipes	Sets	As required
9	Ferrule printing machine	Nos.	2
10	Fire proof tarpaulin		As required
11	Function Generator	Nos.	1
12	Glass thermometer 0-120 °C, 0-200 °C and 0-600 °C	Nos. Each	As required
13	Inclined manometer (+/-) 300 mm water column	Nos.	2
14	Industrial type vacuum cleaner	Nos.	2
15	Insulation Tester Hand Operated 250V/ 500V/ 1000V rated mains/ battery operated	Nos.	2
16	Insulation Tester Hand Operated 250V/ 500V/ 1000V rated mains/ battery operated	Nos. Each	2
17	Manometers (+/-) 500 mm mercury column with hand bulb for lab and small manometer for field purpose.	Nos.	2
18	Muffle furnace – 800 °C with standard temperature gauges	Nos.	As required
19	Multimeters		
	A) Digital, 3 1/ 2 digit Motwane/ HIL/ Fluke or any reputed make	Nos.	4
	B) Digital, 4 1/ 2 digit Motwane/ HIL/ Fluke or any reputed make	Nos.	4
20	Oil temperature bath suitable to calibrate the instruments range 0 – 200 °C with standard temperature gauges and thermostatic control	Nos.	2
21	Portable air compressor with drier and regulator make "Toshniwal/ Khosla" or any reputed make rated for 7 to 10 kg/ cm <sup>2</sup>	Nos.	As required
22	Rheostat	Nos.	2

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

### Chapter – IV: T&Ps and MMEs to be deployed by Contractor

23	RTD/ Pt 100 source	Nos.	2
24	Single Phase Variac 250 V, 8 A	Nos.	2
25	Soldering iron “Soldron” make 25 W	Nos.	2
26	Standard gauges 12” dial size make “Budenberg” or “H Guru” or “Odin” or any reputed make		
	A) -1- 0 kg/ cm <sup>2</sup> pressure gauge(vacuum gauge)	Nos.	2
	B) 0 - 5 or 6 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	C) 0 - 10 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	D) 0 - 25 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	E) 0 - 60 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	F) 0 - 100 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	G) 0 - 250 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	H) 0 - 600 kg/ cm <sup>2</sup> pressure gauge	Nos.	2
	I) 0.2 to 1 kg pressure gauge	Nos.	2
27	Standard milliamps/ millivolts source of reputed make. Range 0 to 60 mA and 0 to 100 mV	Nos.	2
28	Temperature Gun Digital Type	Nos.	1
29	Three Phase Variac 05 A	Nos.	2
30	Vacuum Pump	Nos.	2

**NOTE:**

Instruments shown above are for the regular works only. However, separate sets of tools and instruments are to be arranged and provided to commissioning gang. If contractor fails to arrange the testing instruments as listed above, BHEL site will arrange the instruments at the cost of contractor. Contractor to submit calibration report from recognized agency prior to deployment of it at site and periodical calibration of the same to be arranged by contractor as per procedure of BHEL.

**HANDLING EQUIPMENTS**

S. No.	Description	UoM	Qty
1	Chain Pulley Blocks 5 or 10 T / Turfer		As required
2	Hydraulic Lifting Machine / Pallet Truck of 4Ton Capacity	Nos.	02
3	Cranes, trucks etc. for transportation and erection of equipment		As required
4	D-shackles		As required
5	Manila ropes		As required
6	Nylon Slings		As required
7	Steel wire ropes		As required
8	Turn buckles		As required

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – IV: T&Ps and MMEs to be deployed by Contractor**

**MAJOR T&Ps**

S. No.	Description	UoM	Qty
1	24V AC Transformer & Hand lamps		As required
2	Cable Rollers		As required
3	Copper tube bender and cutter sizes 6mm, 8mm, 1/ 2", 1/ 4"	Nos. Each	2
4	Crimping tool up to all sizes of Cables under scope of work	Nos. Each	10
5	Die sets for threading up to 2" pipe.	Nos.	4
6	Distribution boards with power cable complete as required		As required
7	Drilling machines 1/ 4", 1/ 2", 3/ 4" & 1"	Nos. Each	2
8	Electrician tool kit	Sets	16
9	Electrode drying ovens		As required
10	Fire extinguishers (Type: as required)	Nos.	5
11	Flood light fittings	Nos.	10
12	Grinding machine	Nos.	10
13	Measuring instruments like Micrometres and Callipers	Sets Each	2
14	Mechanical tool kit for fitters	Sets	10
15	Painting brush		As required
16	Personal computer and accessories, Printer	Sets	1
17	Pipe bending machine – 2" size	Nos.	4
18	Safety belts (Full body Safety Harness) and Safety helmets		As required
19	Spirit level	Nos.	4
20	Tap sets for both BSP and MPT threads up to 1" each	Sets Each	2
21	TIG Welding Set	Nos.	4
22	Welding Generators		As required
23	Welding Transformers		As required

**The following materials/ consumables are to be arranged by the contractor as part of the contractual scope.**

S. No.	Description
1	Welding electrodes for welding AS/ CS/ SS pipe and other welding from BHEL approved vendors only
2	Filler wire for argon welding
3	Argon, oxygen and acetylene gas
4	Provision for temporary scaffoldings.
5	GI "U" clamps with nuts and washers for impulse and GI pipe clamping.
6	Round aluminium tags (30mm dia. x 3mm thick)
7	Teflon tape and insulation tape.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

### Chapter – IV: T&Ps and MMEs to be deployed by Contractor

8	Hold tight/ bitumen tape for GI pipe coupling.
9	Required paints and primer from BHEL approved vendors only.
10	Solder wire (60/ 40)
11	Protocol/ calibration report sheets as per BHEL format.
12	Panel/ JB sealing compound material and Dummy Glands. (for cable entry from bottom/ top of panel).
13	PVC cable tie, aluminium strip and hardware for clamping of cables, copper tube, and temperature gauge capillary.
14	Copper lugs up to 4 sq. mm, PVC sleeve of different size, PVC button & tape
15	Ferrules (PVC) and suitable for ferrule printing.

**NOTE:**

- a) Instruments shown above are for the regular works only. However, separate sets of tools and instruments are to be arranged and provided to commissioning gang. If contractor fails to arrange the testing instruments as listed above, BHEL site will arrange the instruments at the cost of contractor. Contractor to submit calibration report from recognized agency prior to deployment of it at site and periodical calibration of the same to be arranged by contractor as per procedure of BHEL.
- b) The list of instruments/ equipment to be brought by the contractor as shown above is only indicative. Any other instruments/ equipment is required for the execution of the work is to be necessarily arranged by the contractor.
- c) The testing/ calibration instruments which are used to be duly calibrated in the interval prescribed by BHEL Engineers from the reputed agencies decided by BHEL and test certificate to be furnished. Contractor to submit calibration report from recognized agency prior to deployment of same at site and periodical calibration of the same to be arranged by contractor as per procedure of BHEL.
- d) T&P required for civil work shall be in the scope of bidder.
- e) **Other than the aforesaid, one computer, one printer and other necessary peripherals will have to be maintained by the contractor in his site office.**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – V: T&Ps and MMEs to be deployed by BHEL on sharing basis

---

**List of T&P/instruments and consumables that will be made available by BHEL free of hire charges (on sharing basis).**

1	EOT crane in TG hall shall be made available on sharing basis for handling panels	
---	---	--

**Note:-**

**Skilled EOT Crane operators, for round the clock working is in bidder's scope.**

Above T&P will be provided on sharing basis only. Contractor has to plan his activities well in advance and inform BHEL Engineer in charge/ Construction Manager the date of actual use. The decision of BHEL Engineer in-charge/ CM on this will be final and binding.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VI: Time Schedule

---

### 6.0 TIME SCHEDULE AND MOBILIZATION:

#### 6.1.1 INITIAL MOBILIZATION AND TENTATIVE SCHEDULE

Upon receipt of the Fax/Email Letter of Intent (LOI), the Contractor shall coordinate with the Project Manager/Construction Manager regarding initial mobilization. The Contractor shall mobilize to site, establish the site office and necessary infrastructure, and be **ready to commence erection work within seven (07) days** from the date of issue of the LOI or as directed by the BHEL Project Manager/Construction Manager. Resources shall be progressively augmented to align with the project milestones and commissioning schedule.

The Contractor shall thereafter deploy and augment resources in a planned and timely manner to ensure completion of the entire scope of work in accordance with the following tentative schedule:

#### **PRE- SHUT DOWN WORKS: 30 Days PRIOR TO SHUTDOWN DATE.**

The Pre-shutdown duration depends on the shutdown intimation given by Customer. In case of less time available contractor may have to complete the Pre-shutdown works with-in shorter duration. Contractor has to suitably deploy manpower/T&Ps/resources to complete the pre-shutdown activities as specified by Customer.

#### **SHUTDOWN WORKS:**

Completion of Identification, Dismantling, and Erection & Commissioning (up to first synchronization of Unit) of Unified Distributed Digital Control Monitoring & Information System (DDCMIS) for Renovation & Modernization of complete Control & Instrumentation system in SHUTDOWN PERIOD:

**35 DAYS FROM COMPLETE STEAM GENERATION STOPPAGE UP TO FIRST SYNCHRONIZATION OF UNIT.**

#### **TENTATIVE SHUTDOWN SCHEDULE: Aug-2026 To Jan- 2027.**

However, the exact date of the UNIT shutdown shall be intimated to Contractor by BHEL and may vary.

#### 6.1.2 Contract Period

**The Contract period shall be 95 days** from the start of work. Contract period includes the following: -

**Pre-Shutdown activities: 30 days (Tentative)**

**Shut down period: 35 days (from complete steam generation stoppage up to first synchronization of Unit)**

**After completion of work and successful running of DDCMIS system: 30 days**

Pre-Shutdown works, Dismantling, Erection, Testing, Calibration and Commissioning of equipment required for completion of system shall be completed within the time schedule given above.

**NOTE:** The above time schedule is tentative. To achieve this schedule, as well as any intermediate targets set to meet the overall customer/project requirements, the Contractor

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VI: Time Schedule

---

shall arrange, deploy, and augment all necessary resources from time to time, in accordance with the instructions of BHEL.

### 6.2

The contractor should reach site and establish his site office and mobilize to commence the work as per directions of BHEL engineer. The date of starting the work at site shall be fixed in consultation with BHEL's engineer and the same will be recorded in measurement book while entering the first RA bill.

### 6.3

Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the weekly progress and keep up the schedules.

### 6.4

Contractor shall draw the periodic (weekly.) erection programme along with BHEL engineer indicating the work to be achieved and event to be completed. Once the programme is drawn, he shall adhere to the same. Contractor shall plan and erect the materials as it is received at site. The monthly/weekly planned percentage shall take into consideration the material available at site before the start of the month/week and also any material received during the month. Contractor shall mobilise his resources required to achieve the monthly programmes.

### 6.5

In the event that the shutdown is delayed by the Customer after completion of pre-shutdown activities and the contractor has to de-mobilize from site, no demobilization or remobilization charges shall be payable by BHEL.

### 6.6 DEFINITION OF WORK COMPLETION

The contractor's scope of work under these specifications will be deemed to have been completed in all respect, only when all the activities are completed satisfactorily and so certified by BHEL site in charge. The decision of BHEL in this regard shall be final and binding on the contractor.

**NOTE: DEFECT LIABILITY PERIOD SHALL BE 12 MONTHS FROM THE DATE OF SYNCHRONIZATION OF UNIT.**

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VII: TERMS OF PAYMENT

The progressive payment for dismantling, erection, testing and commissioning on accepted price of contract value for C&I Package rates will be released as per the break up given hereinafter:

<b><u>TERMS OF PAYMENT FOR C&amp;I</u></b>		
Sl. No.	Activity/Work Description	% of unit rate
<b>A</b>	<b>Main E&amp;C Equipment/Items</b>	
<b>(I)</b>	<b>PRO RATA PAYMENTS (85%)</b>	
1.0	<b>Cable tray and accessories</b>	
1.1	Fabrication and fixing/welding/bolting in position	60%
1.2	Earthing of cable trays	15%
1.3	Tagging of cable trays (painting cable tray numbers on sides)	5%
1.4	Covering of trays where ever envisaged	5%
	<b>Total =</b>	<b>85%</b>
2.0	<b>Cable laying (Power Cables)</b>	
2.1	Laying of cables	45%
2.2	Glanding, Termination and tagging of cables	15%
2.3	Dressing and clamping of cables	10%
2.4	Testing and charging of cables	15%
	<b>Total =</b>	<b>85%</b>
3.0	<b>Cable laying (Control and Signal Cables)</b>	
3.1	Laying of cables	45%
3.2	Glanding, Termination and tagging of cables	15%
3.3	Dressing and clamping of cables	10%
3.4	Shielding of cables	5%
3.5	Testing and charging of cables	10%
	<b>Total =</b>	<b>85%</b>
4.0	<b>Junction box/Push button station (local)</b>	
4.1	Erection including fixing of terminal blocks where ever applicable	75%
4.2	Name plate fixing where ever applicable , Labelling (both inside and outside) and Commissioning of connected equipment	10%
	<b>Total =</b>	<b>85%</b>
5.0	<b>Conduits/impulse pipe/tubes</b>	
5.1	Fabrication, Laying and Erection	50%
5.2	Leak Test/Hydraulic Test (where ever applicable, otherwise clubbed with next activity)	20%
5.3	Dressing, clamping, tagging and painting where ever applicable	8%
5.4	Testing & commissioning of associated equipment/system	7%
	<b>Total =</b>	<b>85%</b>
6.0	<b>Miscellaneous Structural steel including frames for Panels/Racks/Instruments, supports for cable tray/pipes/tubes, Canopies etc</b>	
6.1	Fabrication, Erection, Alignment , Welding/bolting and where ever applicable chipping/grouting/painting	65%

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VII: TERMS OF PAYMENT

6.2	Erection of associated Items/Equipment/Systems as applicable	20%
	<b>Total =</b>	<b>85%</b>
7.0	<b>Panels/Cubicles/Desks/Racks/Enclosures/Monitors/Computers/Computer peripherals/PLCs/UPS/Batteries</b>	
7.1	Erection and alignment	50%
7.2	Fixing of loose items/instruments where ever applicable	5%
7.3	Pre commissioning checks, Charging of panel and Loop testing etc	15%
7.4	System commissioning	15%
		<b>85%</b>
8.0	<b>Flame Scanner</b>	
8.1	Erection and alignment	50%
8.2	Fixing of loose items/instruments where ever applicable	5%
8.3	Pre commissioning checks, and Loop testing etc	15%
8.4	System commissioning	15%
		<b>85%</b>
9.0	<b>Instruments/Devices including Sensors/Cells/Probes etc</b>	
9.1	Removal & refixing/Fixing loose supplied components, including tubing/hose, regulators, etc	30%
9.2	Calibration/Local testing - commissioning readiness	30%
9.3	Local Commissioning & Loop Testing as required	10%
9.4	System Commissioning or Remote Commissioning as required	15%
	<b>Total =</b>	<b>85%</b>
10.0	<b>Miscellaneous items (items not covered under above heads)</b>	
10.1	Erection	50%
10.2	Alignment	10%
10.3	Testing	15%
10.4	Completion	10%
	<b>Total =</b>	<b>85%</b>
11.0	<b>Dismantling</b>	
11.1	Old cable removal and Dismantling of existing DCS Panels from Site.	40%
11.2	Shifting of existing/old Panels from site to Customer's store/designated area.	20%
11.3	Disconnection, Reconnection of existing cables	15%
11.4	Completion	10%
	<b>Total =</b>	<b>85%</b>
12.0	<b>Civil Works</b>	
13.1	Modification in cut-out, making holes, breaking concrete floors etc	50%
13.2	Finishing and restoring to original condition	15%
13.3	Clean-up	10%
13.4	Completion	10%
	<b>Total =</b>	<b>85%</b>

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter – VII: TERMS OF PAYMENT**

---

**(II) STAGE/MILESTONE PAYMENTS (15%)**

Boiler Light Up	1%
Rolling and Synchronisation	1%
Coal Firing	1%
Full Load	1%
Area cleaning, temporary structures cutting/removal and return of scrap	1%
Punch List points/pending points liquidation	2%
Material Reconciliation	1%
Completion of Contractual Obligation	1%
Arrangement of safety engineers along with compliance of all HSE requirements	2%
Arrangement of C&I Experts (Qty-02) (i.e 2% for Each Expert)	4%
<b>Total for Milestone/Stage payments (15%)</b>	<b>15%</b>
<b>OTHERS</b>	
Laboratory Instruments installation and demonstration where ever applicable	100%
PG Test Instruments installation (50%) and removal (50%)	100%

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VIII: TAXES & DUTIES

---

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

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

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VIII: TAXES & DUTIES

reasons not attributable to BHEL, GST amount shall be recoverable from the vendor along with interest levied / leviable on BHEL, as the case may be.

10. Bidder shall upload the Invoices raised on BHEL in GSTR-1 within the prescribed time as given in the GST Act. Bidder shall note that in case of delay in declaring such invoice in your return and GST credit availed by BHEL is denied or reversed subsequently as per GST Law, GST amount paid by BHEL towards such ITC reversal as per GST law shall be recoverable from the bidder along with interest levied / leviable on BHEL.
11. Way Bill: Successful Bidder to arrange for way bill / e-waybill for any transfer of goods for the execution of the contract.

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

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

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

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

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

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – VIII: TAXES & DUTIES

for sale of any goods of the value or aggregate of such value exceeding threshold limit other than export of goods or who is already covered under other provision of section 206C, collect from the buyer, TCS as per applicable rates of the sale consideration exceeding threshold limit subject to following conditions

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

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

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

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

### ANNEXURE-1

#### State wise GSTIN no.s of BHEL

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

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter-IX: Special Inclusions

---

### 9. SPECIFIC INCLUSIONS

#### 9.1 Specific Inclusions for C&I works:

##### 9.1.1. Consumables/ items to be provided by BHEL free of charge

- a) Metallic Cable glands.
- b) Lugs beyond 4 sq. mm size.

##### 9.1.2. Consumables/ items to be arranged by Bidder at his/ her own cost.

- a) Lugs up to 4 sq. mm size.
- b) Paint, primer and consumables.
- c) LT cable straight through jointing Kits.
- d) Cable ferruling printing machine along with ferrule rolls.
- e) Identification tags PVC/ Metals with tying/ fixing material, sleeve and clamps with hardware.  
PVC ties, Ferrule, Buttons and tap for cables at both end & field instruments.
- f) Cable Markers.
- g) Trefoil Clamps.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – X: Annexure-A: Technical details.

### 1. TECHNICAL DETAILS OF CABLING WORKS

Details (wherever required) of items listed in the rate schedule

#### SPECIAL NOTE:

- a) All the items in general are to be erected and commissioned by the contractor, unless specifically mentioned otherwise.
- b) In such cases where systems are described with component quantities lump sum rates are to be quoted. No separate payment will be made for the component items of those systems, although these systems may have certain items for which separate unit rates are also available.
- c) The dimensions and weights mentioned are only approximate. No extra claims will be entertained due to change in dimensions/ weight.
- d) Work includes instrumentation work in main plant area as well as all the off-site/ BOP areas.

#### 10.1 ASSEMBLY OF JUCTION BOXES AND PUSH BUTTON MOUNTING FRAMES:

Galvanized members will be supplied. These are to be assembled as per drawings. Some frames are suitable for one side JB mounting and others are suitable for JB mounting on both sides. Rate quoted should include assembly and installation.

#### 10.2 GENERAL INFORMATION

##### 10.2.1 CONTACT PRESSURE

Following torque are normally recommended for various bolts.

BOLT SIZE	RECOMMENDED TORQUE	TORQUE CAPTY.	SPANNER
M10	0.85 to 1.30 Nm (20-30 ft-lb)	0.85 to 1.3 Nm	
M12	1.30 to 1.70 Nm (30-40 ft-lb)	0.85 to 4.3 Nm	
M16	1.70 to 2.10 Nm (40-50 ft-lb)	0.85 to 4.3 Nm	
M20	2.10 to 2.50 Nm (50-60 ft-lb)	0.85 to 4.3 Nm	

Alternatively tightening the nut till Belleville washer becomes flats. Then unscrew the nut by 1/ 8<sup>th</sup> turn. Exact method and extent of tightening shall be done as per instructions of BHEL site engineer/ as per equipment supplier's recommendation.

Note: - Considering the layout of the bus ducts as mentioned above for interconnection between the transformer and Generator it is not possible to segregate the quantity of structural support materials for individual area, hence the total quantity is mentioned.

Flexible joints, seal off bushings, rubber bellows, CT and their wiring, conduits/ GI pipes breather tapping etc., are accessories and form a part of the system.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter – X: Annexure-A: Technical details.

---

### 10.2.2 Recommendation for Welded Joints (For Enclosure, Box Conductor, Make Up Pieces, Shunt and Flexible Joint etc.)

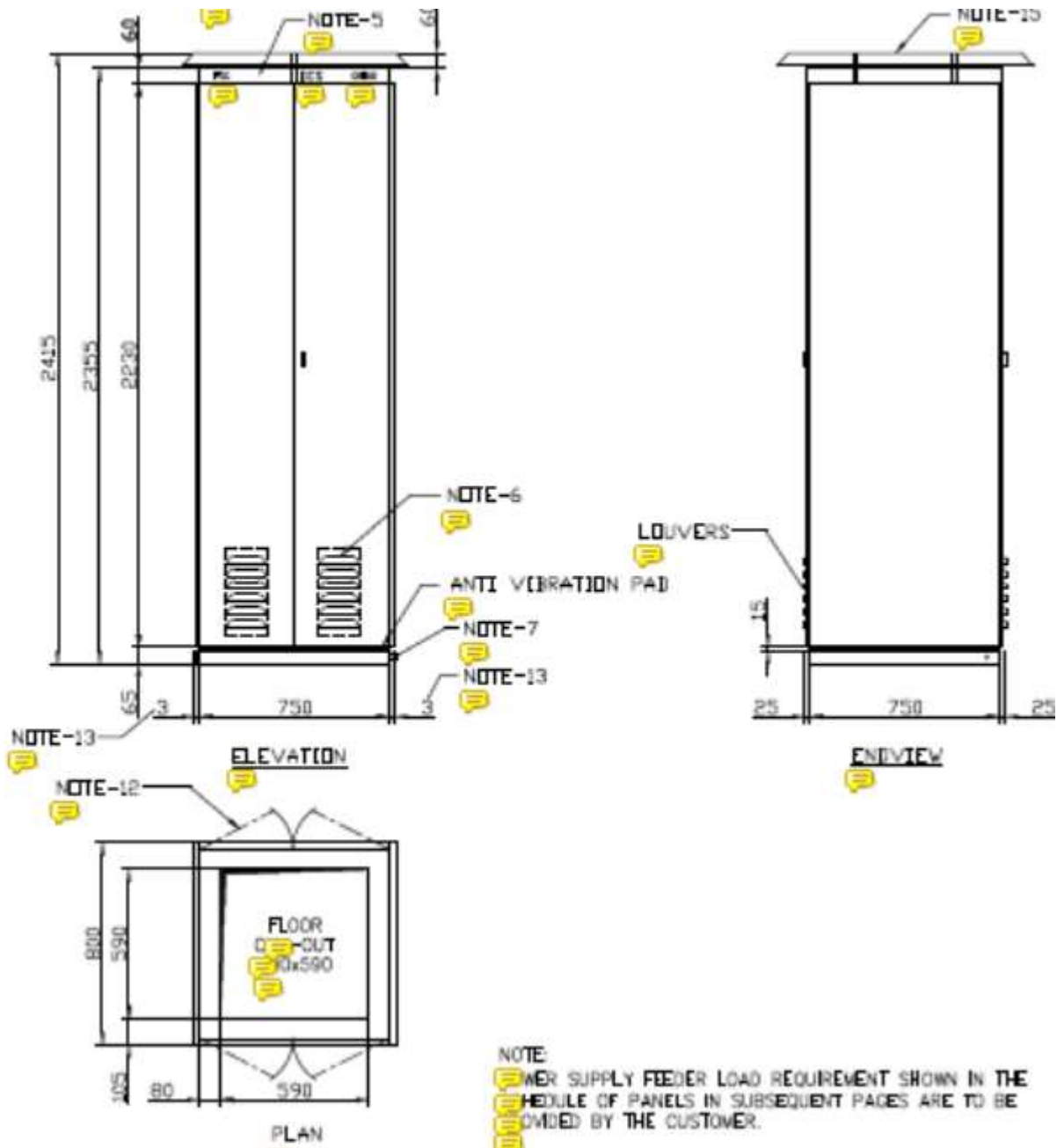
TYPE OF WELDING	MIG/ TIG WELDING
Filler Wire	1.6 mm dia. (NG 21 with 5% silicon)
Angle	10 to 15 degree foreheads.
Cleaning	Degrease and scratch brush.
Current Setting	Depend on thickness.

TECHNICAL CONDITIONS OF CONTRACT (TCC)  
Chapter - X: Annexure-A: Technical details.

Annexure-A

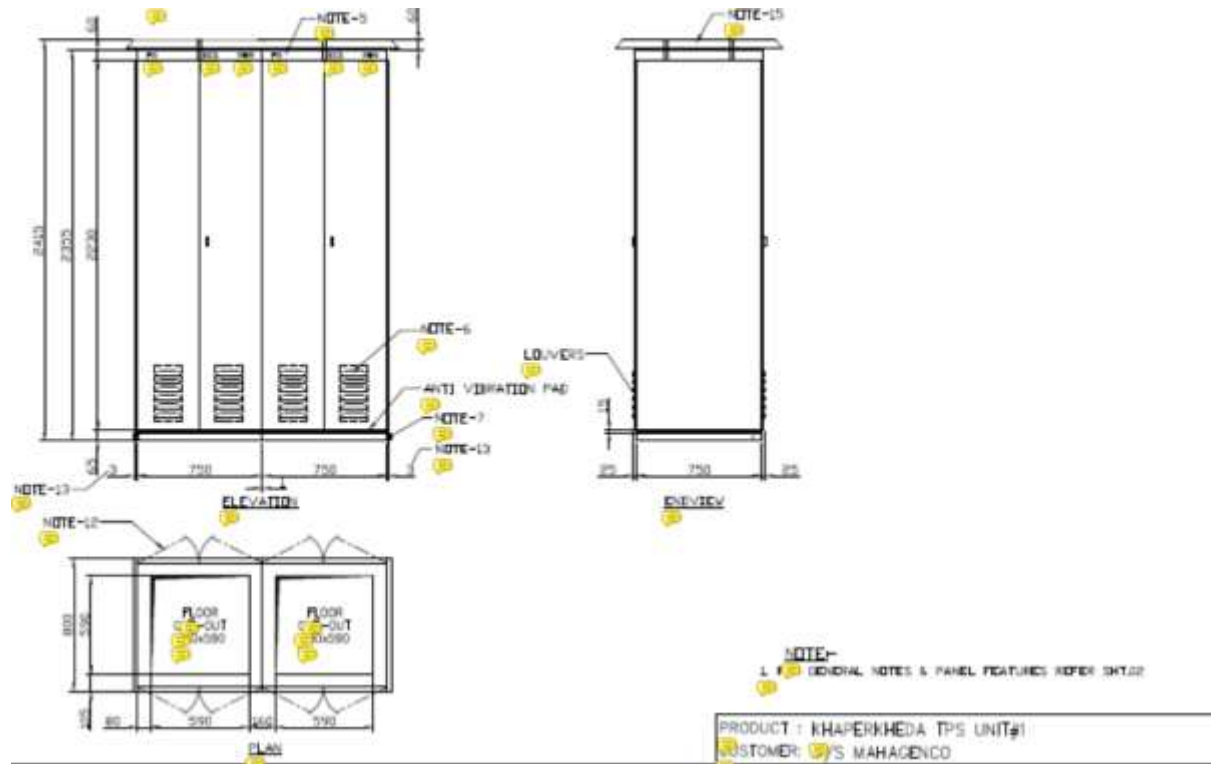
OGA FOR DCS R&M PANELS-SG/TG/BOP (New Panels)

SINGLE CUBICLE



TECHNICAL CONDITIONS OF CONTRACT (TCC)  
Chapter – X: Annexure-A: Technical details.

**SUITE OF TWO CUBICLE**



**SUITE OF THREE CUBICLE**



# TECHNICAL CONDITIONS OF CONTRACT (TCC)

## Chapter-XI: Weightages/ Factor

---

### SCHEDULE OF ITEMS QUANTITIES AND FACTOR FOR DEPRIVING ITEM RATE FROM THE ACCEPTED LUMP SUM PRICE.

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

<b>CONTENTS</b>	
<b>Description</b>	<b>Remarks</b>
<b>Part A:</b> Instructions to the Bidders	Instructions
<b>PART B:</b> % weightage for amount of individual items of Schedule of quantity	Refer Latest Chapter-XI: Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump sum Price

#### **Part A: Instructions to the Bidders**

11.1 Any other entry elsewhere in the offer of the bidder shall be treated as Null and Void.

11.2 BHEL has fixed the Factors of individual items of Schedule of Quantity w.r.t. the total lump sum price (as quoted by the bidder). These item wise factors are available in Chapter-XI of Volume I TCC. Also schedule of items & Quantities are also available in Chapter-XI of Volume I TCC.

11.3 Based on the pre-fixed factors and the quoted total lump sum price, individual item rates shall be derived by BHEL by multiplying the respective factors with total lump sum price.

11.4 Item rates thus derived shall be rounded off to zero decimal places. Rounding off may lead to minor variation in the total lump sum price. This will be adjusted by BHEL by very minor adjustment of the derived item rates. This will be done to arrive at the exact quoted/ accepted Lump sum price given by the bidder.

11.5 For only the convenience of bidders, BHEL has issued an excel sheet with all requisite formulae as detailed above. However, this excel sheet shall not form part of contract document.

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

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter-XI : Bill of Quantities and % Weightage of Individual Items**

Sch no.	Description of Work	UOM	QTY	Percentage of Total lump sum Price Quoted by the bidder
1	<b>UPGRADATION/R&amp;M OF UNIFIED DISTRIBUTED CONTROL SYSTEM (DCS) OF UNIT#1 OF MAHAGENCO KHAPERKHEDA TPS 210 MW.</b>	LS	01	100%
<b>TOTAL Lump-sum value to be quoted by the bidder in VOL II Price Bid</b>			<b>100%</b>	

Sl No.	Description of Items	UOM	Qty	Factor
<b>1</b>	<b>Cable Tray &amp; Accessories</b>			
1.1	Galvanised Perforated type cable tray, W=150mm/100mm	M	800	0.008628154
1.2	Galvanised Perforated type cable tray, W=50mm	M	1200	0.007348613
1.3	Galvanised Ladder type cable tray, W=150mm	M	500	0.007901848
<b>2</b>	<b>Cable laying (Power Cables, Instrument Cables etc.)</b>			
2.1	FLAME SCANNER CABLE - P/O SHIELDED- 2P X 1.31 sqmm P/O Flame Scanner Shielded Cable	M	3500	0.009906426
2.2	Instrumentation Cable: 2P x0.5 sq mm armoured / unarmoured- Individual & Overall shielded (I& OA)	M	7000	0.017451120
2.3	Instrumentation Cable: 4P x0.5 sq mm armoured / unarmoured- Overall Shielded (OA) or Individual & Overall shielded (I& OA)	M	9000	0.022856422
2.4	Instrumentation Cable: 8P x0.5 sq mm armoured / unarmoured- Overall Shielded (OA) or Individual & Overall shielded (I& OA)	M	2500	0.008798261
2.5	Instrumentation Cable: 12P x0.5 sq mm armoured / unarmoured	M	1500	0.006884031
2.6	Instrumentation Cable: 16P x0.5 sq mm armoured / unarmoured	M	4000	0.023388623

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter-XI : Bill of Quantities and % Weightage of Individual Items**

2.7	LT POWER CABLES: 1C X35 SQ MM	M	2600	0.010093473
2.8	Control Cable: 2C x1.5 sq mm/2Cx2.5 sq mm armoured / unarmoured	M	2000	0.005042501
2.9	Control Cable: 5C x1.5 sq mm/5Cx2.5 sq mm/4Cx1 sqmm armoured / unarmoured	M	1500	0.003551067
2.10	Control Cable: 12C x2.5 sq mm armoured / unarmoured	M	500	0.001852823
2.11	Network UTP Cables in flexible GI pipes(special termination using UTP connectors involved)	M	8000	0.029645164
2.12	Single Mode/Multi Mode Optic Fiber Cable-Laying, Terminaion & Testing etc of Optical Fiber Cables on cable trays, conduits etc. with minor civil works.	M	5000	0.021436277
2.13	PTFE Cable-10PRx0.6 SQMM COPPER SHLD	M	1000	0.004589354
2.14	Co-Axial Cable for IRIG-B Signal Communication	M	1000	0.004287255
<b>3</b>	<b>VOID</b>			
<b>4</b>	<b>Junction box/Push button station (local)</b>			
4.1	Junction boxes upto 48 way	Nos	50	0.010503917
<b>5</b>	<b>Conduits/impulse pipe/tubes</b>			
5.1	PIPE D21.3 X 4.78-IMPULSE PIPE	M	25	0.001392052
5.2	PIPE D33.4 X 6.35-IMPULSE PIPE	M	15	0.000835231
<b>6</b>	<b>Miscellaneous Structural steel including frames for Panels/Racks/Instruments, supports for cable tray/pipes/tubes, Canopies etc</b>			
6.1	<b>Supply</b> of Channel, angles, flats (list is given below)	Kgs		
6.1.a	MS Channel as per IS 2062 Gr.A Size: 100 x 50 x 5 mm web Thickness	Kgs	4000	0.039752754
6.1.b	MS Plate 10mm thick as per IS 2062E250	Kgs	1500	0.015074566

BHEL-PSWR

Technical Conditions of Contract –Volume I A (Part I: Contract Specific Details)

E-Tender Spec No: **BHE/PW/PUR/KPD-C&I-R&M/3250**

Page **79** of **82**

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter-XI : Bill of Quantities and % Weightage of Individual Items**

6.2	<b>Fabrication</b> of Channel, angles, flats (list is given below) Approximate Measurements.	Kgs	5000	0.009775846
7	<b>Panels/Cubicles/Desks/Racks/Enclosures/Monitors/Computers/Computer peripherals/PLCs/UPS/Batteries</b>			
7.1	Suite of One: Cubicle (Dimensions - L X B X H: 800 X 750 X 2415 mm) -Approximate weight = 400 Kg.	No	16	0.061363841
7.2	Suite of Two: Cubicle (Dimensions - L X B X H: 800 X 1500 X 2415 mm) -Approximate weight = 800 Kg.	No	14	0.106528593
7.3	Suite of Three: Cubicle (Dimensions - L X B X H: 1200 X 2250 X 2415 mm or 800 X 2250 X 2415 mm) -Approximate weight = 2400 Kg.	No	6	0.059505925
7.4	<b>Void</b>			
7.5	<b>Void</b>			
7.6	<b>Void</b>			
7.7	TSS-Turbvisory System-Main turbine-TSI	Set	1	0.015523100
7.8	Void			
7.9	Operator Desk/Plant Control Desk	Sections	8	0.034617341
7.10	Computer Furniture (Approximate qty: Computer Table-07 nos, Printer Table-05 nos, Chairs-15 ns)	Set	1	0.011627791
7.11	<b>HMI</b>			
7.11.1	Operator Work Station along with accessories	NO	8	0.002902730
7.11.2	maxLINK Workstation	NO	1	0.000521923
7.11.3	Shift-In-Charge Workstation/PCR I/C Workstation	NO	1	0.000512058
7.11.4	Void	NO		
7.11.5	Engineering Workstation (EWS)	NO	2	0.001024116

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter-XI : Bill of Quantities and % Weightage of Individual Items**

7.11.6	MAX Storian Workstation (max HIST)	NO	2	0.001024116
7.11.7	A4 Colour Laser Printer	NO	2	0.000303541
7.11.8	A4 B/W Laser Printer	NO	2	0.000303541
7.11.9	Void	NO		
7.11.1 0	Large Video Display-LVS	NO	3	0.009294657
<b>7.12</b>	<b>Void</b>			
<b>8</b>	<b>FLAME SCANNER</b>			
8.1	FLAME SCANNER HEAD ASSY.	NO	20	0.002283468
8.2	BHELSCAN AMPLIFIER MODULE	NO	5	0.000731113
8.3	Miniature Junction Box	NO	20	0.002539913
<b>9</b>	<b>Instruments/Devices including Sensors/Cells/Probes etc</b>			
9.1	Pressure / DP / Flow (DP type) / Level -Transmitters with Manifolds	Nos	12	0.005548423
9.2	Electronic Level Transmitter (with amplifier, etc), Capacitance or conductivity type / Guided Wave Radar(GWR) transmitter	Nos	8	0.003999793
9.3	Position feedback transmitters for HPCV & IPCV.	Nos	10	0.004623686
9.4	Thermocouple / RTDs with thermowell (all types) along with converters wherever applicable	Nos	30	0.003682734
9.5	Limit Switches	Nos	15	0.000978672
9.6	Transducers	Nos	15	0.006935529
9.7	Load Transducers		5	0.002311843
<b>10</b>	<b>Miscellaneous items (items not covered under above heads)</b>			
10.1	Electronic Earth Pit	Set	1	0.007709008
10.2	Upgradation of Turbine Governor Control System- replace existing plunger coil type EHC & its feedback unit with proportional directional control valves and feedback unit	NO	1	0.005797047

**TECHNICAL CONDITIONS OF CONTRACT (TCC)**  
**Chapter-XI : Bill of Quantities and % Weightage of Individual Items**

10.3	Upgradation of LP-Bypass Governor Control System- replace existing plunger coil type EHC & its feedback unit with proportional directional control valve and feedback unit	NO	1	0.005797047
10.4	MOUNTING OF SPEED SENSOR	NO	4	0.001350526
10.5	SOLENOID VALVE FOR VACUUM PUMP	NO	6	0.009431990
10.6	CONDUCTIVITY MEASURING INSTRUMENT (Flow transmitter+ Conductivity sensor)	NO	2	0.002215778
<b>11</b>	<b>DISMANTLING</b>			
11.1	Dismantling, loading and handling of existing DCS Panels from Site to Customer's store	NO	68	0.147902068
11.2	Dismantling, loading and handling of operator desk from Site to Customer's store	SET	9	0.053288839
11.3	Disconnection and Reconnection of existing cables connections	NO	28000	0.118383022
11.4	Dismantling of Instruments/Transmitters/Thermocouples & RTDs including thermowells (all types) (As per volume of work)	NO	40	0.003083549
11.5	Dismantling of existing old / unusable cable trays (As per volume of work)	M	500	0.004625351
<b>12</b>	Civil works like modification in cut out for panels, making approach through walls, breaking of concrete floors to suite DCS Panels erection, breaking of concrete in Cable Gallery area for cable lifting etc. wherever required. Finishing of concrete work after completion of work (As per volume of work with cutting of concrete slab).	LOT	1	0.030731551

**ANNEXURE-B**  
**General terms & conditions (works)**

1. Registration of the contract: Contractor will have to register the contract under Labour Contract Act, 1971 and any other sets as may be applicable from time to time and certificate that effect should be submitted from the concerned authority and also adhere to the relevant formalities as per the statutory laws and rules framed there from time to time.

2. Labour License: The contractor will have to submit the Labour License from the Labour Commissioner before starting the work. If he fails to do so the contract will be cancelled at risk and cost of the contractor.

3. Safety: The contractor should provide all the safety equipment viz. safety helmets, hand gloves, safety belts, shoes, masks, ladders etc. required for the work to these workers. If any accident occurs due to non-supply of these equipment or careless handling of equipment, the same shall be to the contractor's risk and cost. The contractor must maintain first aid be the same closet.

4. The contractor will have to keep ready two buckets of water while carrying out the welding work. One bucket is to be used for quenching in case of any fire. Last bit of electrodes should be dropped in the second bucket to ensure red-hot electrode bit not cause any fire.

5. Insurance: The contractor should take group insurance policy if their labours deployed for the work under the workmen compensation scheme of LIC.

6. Laws and regulation: (I) The relevant Labour laws govern this contract and regulations and the amendments made therein from time to time such as: A) Workmen's Compensation Act. B) Factory Act. C) Minimum Wages Act. D) Contract Labour Regulation & Abolition Act. E) Industrial Dispute Act. F) Provident Fund & Misc. Provision Act.

II) It shall be responsibility of the contractor to abide by the conditions of consent granted by MPCB/ CPCB and Environmental Regulations in force from time to time. Following Acts are applicable:

A) The water (Prevention & Control of pollution) Act 1974, amended upto date.

B) The Air (Prevention & Control of Pollution) Act 1981. amended up to date

C) The Environment Protection Act. 1986.

D) Hazardous wastes (Management & Handling) Rules 1989.

BHEL will not responsible in any way either legal or financial for the accident to the contractor's labour at the time of working and the same shall be the risk & cost of the contractor Compensation as applicable in this regard shall be paid by the contractor to his labour as per workmen's Compensation Act.

III) The contractor should be aware of significant / non-significant environment aspects of CSTPS and should comply to special terms & conditions relevant to work order.

7. Payment to his worker. The contractor will have to pay minimum wages to his workers as per the prevailing rates as specified by commissioner of Labour at that time.

8. Security Rules & Regulation: The power station is a prohibited area. The contractor should observe all the Security Rules and Regulations and should obtain the entry permit for him and his workers from the Security Officer. For Security Gate-Pass, the contractor in his letterhead will request BHEL/MSPGCL's authority to issue Gate-Passes against the names, permanent address and age of his workman.

#### 9. Contractor's Responsibility:

A) It is the responsibility of the contractor to maintain the discipline of his workers and himself and any hindrance / misbehavior towards the BHEL/MSPGCL staff will be viewed very seriously and the contract will be terminated without entertaining any financial claim from the contractor in this regard.

B) In case there is any damage to the BHEL/ MSPGCL property or to any other contractor's property or to the BHEL/ MSPGCL employee or to any other contractor's persons due to careless working of the contractor's labour, the cost of the same will be recovered from the contractor.

#### 10. Penalty:

A) Continuous operation & maintenance of the plant is the essence of the contractor. If the contractor fails to give the services at a particular day, penalty at 1.5 times the accepted rate for the day will be recovered from the bill taking such lapse seriously.

11. Keeping of the Plant Clean: It is the responsibility of the contractor to keep the building; plant equipment, machinery and surrounding are neat clean.

12. The contractor should make the arrangement for camping his labours /workers at his own cost.

13. The contractor should keep attendance register of his staff & labour working under him up to date & submit to the BHEL/MSPGCL's officers whenever required.

14. Contractor has to obtain the identity card for his workers, without identity card he may not permit to work. Any delay due to this shall be his account.

15. Safety terms and conditions enclosed is also the part of this contract.

16. Contractor shall provide all protective equipment to his staff labour.

17. Scrap generated during works shall be MSPGCL's property. Such scrap shall be stacked properly at the designated place & as per instructions of Engineer in charge.

#### **Safety terms & condition**

1. The contractor shall provide all applicable PPEs to its workers & subcontractor workers viz. industrial safety shoes, industrial safety helmets, industrial safety hand gloves, safety harness, dust mask, goggles, welding screen /helmet etc. at its own cost. All PPEs shall be of the quality as per applicable BIS standard or ISO standard. Contractor shall ensure its proper usage at work place.

2. The contract shall be governed by all applicable acts, rules, regulation and internal standing instructions and SOPs, such as:

- a. The Factories Act, 1948, (FA)
- b. The Maharashtra Factories Rules, 1963, (MFR)
- c. CEA Safety Regulations, 2011, (CEASR)
- d. Workmen's Compensation Act, 1932, (WCA)

- e. Minimum Wages Act, (MWA)
- f. Contract Labour Regulate & Abolition Act, (CLRAA)
- g. The Maharashtra BOCW Rules, 2007, (BOCWR)
- h. The Environment Protection Rules, 1986, amendment 2010, (EPR)
- i The Hazardous Waste (Management & Handling ) Rules, 2008, amendment 2010, (HWMHR)
- j. The Water (Prevention & Control of Pollution) Rules, 1975, (WPCPR)
- k. The Central Motor Vehicles Act, 1988, (CMVA)
- l. The Central Motor Vehicles Rules, 1989, (CMVR)
- m. The Petroleum Act, 1934, (PA)
- n. The Petroleum Rules, 2002, (PR)
- o. The Explosives Act, 1884, (EA)
- p. The Explosives Rules, 1983, (ER)
- q The static and Mobile Pressure Vessels (Unfired) Rule, 1981, (SMPVR)
- r The Gas Cylinders Rules, 2004 (GCR)
- s The Public Liability Issuance Act, 1991, (PLIA)
- t The Public Liability Insurance Rules, 1991, (PLIR)
- u The Environment Protection Act, 1986, (EPA)
- v. The Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996, (CAR)

3. The contractor shall maintain proper attendance record at its site office.

4. The contractor shall ensure proper gate pass for its workers & supervisors before starting the work & shall ensure all its persons are carrying it.

5. Any portable light/ hand lamp shall be of 24 V.

6. Every portable hand tools to be used with plugs, to avoid electric shock while at work, proper earthing should be checked both at supply end and tool end, if required, before commencement of work. Colour code of the three wire system should be: RED for Live, GREY /BLACK for Neutral and GREEN for Earthing. All portable tool should have its healthiness certificate from a competent person.

7. All portable supply board shall have three wire systems, MCB or ELCB. The supply shall be taken from a regular plug socket arranged by MSPGCL authorized persons only.

8. All hazardous area should be covered or cordoned off to restrict movement.

9. Transportation of any gas cylinder & its storage shall be in capped condition. Filled cylinder transportation should be in up-right position.

10. All Mobile Crane /Hydra should have its „REVERSE HORN" functioning. No Mobile Crane /Hydra should be operated without Attendant. The Driver should carry valid Driving License as applicable.

11. Contractor shall ensure the issue of permit & isolation done - before starting any work.

12. All work shall be supervised by designated competent supervisor.

13. All Lifting Tools and Tackles shall have valid Test Certificate, issued by Competent Person. A copy of that certificate to be submitted to the Controlling Section and the Safety Office, before commencement of work.

14. The contractor employing two hundred employees or more, including contract workers, shall have a safety

coordinator in order to ensure the implementation of safety requirements of the contract and a contractor with lesser number of employees, including contract workers, shall nominate one of his employees to act as safety coordinator, who shall liaise with the Safety Officer on matters relating to safety and his name shall be displayed on the notice board at a prominent place at the work site.

15. The contractor shall depute one of his regular employees as a representative of the local safety committee & shall make him available during all of that committee activity.

16. The contractor shall ensure the training/awareness program is participated by all its workers & supervisors, arranged by the concerned Controlling Authority, relates to work associated hazards at its site and keep a record of that program & attendance.

17. The contractor shall be responsible for non-compliance of the safety measures, implications, injuries and legal implications & compensation arising one of such situations or incidents.

18. In case of any accident, the contractor shall immediately submit a statement of the same to the owner and safety officer, containing the details of the accident, any injuries or casualties, extent of property damage and remedial action taken to prevent recurrence and in addition, the contractor shall submit a monthly statement of the accidents to the Factory Manager at the end of each month.

19. The contractor shall always keep First Aid box ready at site.

20. In case of injury, arrangement for shifting of the person for medical treatment is to be made immediately by the contractor. Any medical injury /illness / fitness certificate shall be recommended by MSPGCL Medical Officers.

21. The contractor shall ensure removal of all scraps & debris generated out of his work, its disposal at designated place. The area shall be kept clean everyday & scrap removal shall be complete before cancelling the permit

22. Safety of its own staff is contractor's sole responsibility. If any BHEL/MSPGCL Officer / Supervisor find:

a. Violation of any Statutory Act, Rule or Regulation applicable:

1) Working at height or confined space:

1.1 10000/- on the first occasion,

1.2 Stoppage of work in the next occasion.

2) Other areas:

1.1 5000/- on the first occasion, 1.2 10000/- on the second occasion, 1.3 Stoppage of work in the next occasion.

b. Any of the safety norms /directives violated the contractor shall be penalized for 3000/- on the first occasion, 5000/- on the second occasion & 10000/- on the third occasion. For violation further, the contractor's activity can be stopped for a period to be decided by the competent authority.

**Work Specific Safety Terms & Conditions**  
**For Working at Height (above three meters from the working floor)**

1. Working at Height permit (FF98258) shall be taken in addition to Regular permit (FF9825 /9826).
2. All scaffolding shall be prepared with proper base, rigid & good quality maternal & couplers. Working platform should be made of good quality plank, property tied with structure. Toe guard shall be provided.
3. Ladder should be property mounted at its landing, firm footing. It should be mounted close to an in inclination of 4:1. Top three rungs of the ladder shall be above the landing.
4. No ladder shall be extended by tying with another ladder; unless it is designed for.
5. All persons working in the scope of Work at Height" will have to use safety harness. The safety harness will be property anchored at a suitable place, to avoid free fall.
6. Safety nets and life lines are to be provided as and when require.
7. All persons working with safety harness should be property trained by a competent person, appointed by contractor.
8. Duck ladder, Crawling Boards to be provided by the contractor for its workers, working at steep or fragile roof or as and when necessary.
9. Tool bags should be used by the workmen working at height.
10. All scaffoldings / Platforms erected inside the Boiler /ESP /AMP shall be certified by a competent person for its healthiness
11. All workers should be given specific instructions by the supervisor about his responsibility & hazard & risk associated with his works.
12. A minimum penalty of Rs.10000/ shall be imposed on the contractor for any sort of Unsafe Act during work.

**Working in confined space**

1. Working in Confined Space permit (FF98254) shall be taken in addition to Regular permit (FF9825 /9826).
2. All workers working in any confined space e.g. Vat, Pit, Tank, Chamber, inside bunker or sewage chamber, pipelines, condenser etc. shall be healthy & fit to work in such a condition.
3. All workers shall be property trained to understand their responsibilities & hazard & risk associated with his works.
4. Before entering any confined space, it should be during property & checked for presence of any toxic or flammable fumes or gases, inside should be free from any dust or mist. Oxygen content should be checked for in between 19-21%.in case of lesser "Self Contained Breathing Apparatus shall be used by the entrants.
5. Person working inside a confined space shall use all necessary PPEs, which include Safety Harness.

6. Attention & assistance shall always be provided to person working inside for early emergency response and speedy evacuation.
7. Any openings created at the floor level or near to any pathway shall be cordoned & glow sign /indication lamp to be mounted for easy detection.

#### **Welding /cutting and other hot work**

1. Any welding m/c shall require its healthiness certificate from a competent person; the certificate shall be made available on demand.
2. No cut cable shall be used with joint.
3. Earthing to be mounted on work, not any structure.
4. Supply connection to be made by the concern BHEL/MAHAGENCO staff only.
5. AI gas cutting torch shall be fitted with NRVS at both gas inlet.
6. All regulators shall have proper Pressure gauges, Flashback Arrestors units.
7. No Domestic LPG cylinder shall be used for any industrial purpose.
8. While welding /cutting work, all necessary precautions to be taken by the contractor to avoid fire hazard.
9. Transportation of all gas cylinders shall be done in a Trolley only, in chained condition and its upright position.

#### **Transportation of Hazardous Chemicals and materials**

1. Documents relating to the vehicle to be carried in the vehicle, as per the material transported:
  - a. Applicable license for transport of Specific Products,
  - b. License to transport petroleum class A & B in bulk. [PR Form XI, Article 2 of the First Schedule)
  - c. License to transport compressed gas. [SMPVR Form IV, Rules 49 & 50]
  - d. License to transport explosives. [ER Form 25 & 26 Rule 155]
2. Loading/Unloading to be done at approved places. (PR Form XI (5) & Rule 76; ER 81 Form 25 (12))
3. Additional conditions, if any. [PR-Form XT)
4. Vehicle to be fitted with Techograph [CMVR-129(2)]
5. Spark Arrestor to be fitted at the exhaust of the engine. [OMVR-129A, PR-70)
6. Vehicle to carry Portable Fire Extinguisher of 9 kg. [OMVR-129(1 (N), PR-72, SMVPR-41, ER-86)
7. Vehicle to carry Safety Kt. [CMVR-129(1)(i), Item No: 5 of circular issued by CCOE of Performa (Certificate of safety) issued 43]

8. Transport of Cylinders. [Schedule VI w/r 20 of GOR]
9. No parking shall be done on a public road or congested area or within 9 m of fire source. (PR-74)
10. The driver or operator of a vehicle carrying or containing Hazardous goods shall not stop unnecessarily or for a longer period than is reasonably required, stops at places where the public safety would be endangered shall be avoided. [SMPVR Form IV (9), ER 81 (6)]
11. No passengers or any other article to be carried. [SMPVR Form IV (11), PR Form XI (11), ER Form 25 (7) w/r 155]
12. Display EIP containing prescribed information of specified dimensions in a format at prescribed places on a vehicle carrying Hazardous goods. [CMVR-134]
13. The vehicle should have Hazard Class Labels. [OMVR-130, 134, 137]
14. The vehicle should carry Road worthiness and Periodic examinations report. (SMPVR-44(2))
15. Vehicle should carry Certificate of Fitness and annual renewal. (CMVR-62)
16. Driver should be qualified and trained. (3-day training and 1-day refresher training) [CMVR-9, CMVA Sec-14(2)]
17. Driver should carry the relevant Tremcard.
18. In case of death or injury to any person (other than a workman) or damage to any property owing to an accident involving a Hazardous goods, the owner is liable to give relief as specified in the Schedule of the PLIA. [PLIA-3(1)]

## ANNEXURE-C

### **1.00.0 FUNCTIONAL GUARANTEES (Bidder shall provide complete assistance in conductance and completion of following tests)**

The term "Performance Guarantees" wherever appears in this section shall have the same meaning and shall be synonymous to "Functional Guarantees" Similarly the term "Performance Tests" wherever appears in this section shall have the same meaning and shall be synonymous to "Guarantee Test(S)".

#### **1.01.0 GENERAL REQUIREMENTS (applicable to BHEL, Bidder shall provide complete assistance in conductance of tests)**

- a) BHEL shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in these specifications.
- b) The guaranteed performance parameters furnished by the Bidder in his offer, shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.
- c) The Contractor shall demonstrate all the guarantees covered herein during functional guarantee / acceptance test. The various tests which are to be carried out during performance guarantee/acceptance test are listed in this Sub-section. The Contractor shall conduct the guarantee tests at site in presence of BHEL/Customer.

In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the BHEL.

### **1.02.0 DDCMIS SYSTEM GUARENTEE REQUIREMENTS**

The Bidder shall assist for conductance of test- for parameters/capabilities to be demonstrated for various systems/ equipment shall include but not be limited to the following:

#### **1.02.01 Performance Requirement of the Closed Loop Control System:**

- a) The closed loop Control System shall provide automatic control of the plant for full applicable operating range of the unit. The closed loop Control System shall permit the performance of the dynamic load tests (ramp test, steady state test & step tests) while maintaining safe furnace conditions, major process parameters and without endangering other equipment. All tests will be performed with the system in automatic mode:
  - i) Drop 30 percent of maximum load capability from approximately full load at a rate of 10 percent per minute.
  - ii) Drop load from full rated output to the lowest runback limit, at a rate corresponding to the fastest run back rate

## ANNEXURE-C

During transient conditions causing deviation of process variables, the control system furnished under the specification shall not permit deviations, which exceed those permitted by the manufacturers of the controlled process equipment, for load changes as indicated above, the exact parameters to be monitored for this test shall be decided during detail engineering. The control loops shall perform to return the controlled variable to the set point in a stable manner without cycling in the shortest possible time and without any loop interactions or cycling of generation when generation matches unit load demand.

- b) The Bidder shall also guarantee that the control system provided by him will be responsive and stable and will maintain the deviation of controlled variables from set point within the limits specified so that the equipment being controlled will operate as specified over the range required. The controls shall operate automatically, with no assistance from the operator. The controller shall successfully demonstrate the performance of Closed Loop Control Systems before acceptance and taking over of this system by the Owner. However, limitation / constraints of main equipment of Owner shall be considered.
- c) The control system including furnace draft & firing rate control shall also comply with all relevant requirements of NFPA code no. 85 'Standard for Prevention of Furnace Explosions in Pulverize Fired Utility Stations' and other applicable codes regarding safety
- d) All runback conditions listed below shall be proved by the Contractor without any oil support.
  - i) FD/ID/PA fan trip ii) BFP/CEP/BCW trip
  - iii) One mill and two mill trip iv) Turbine trip v) GCB open vi) Any other condition decided during detailed engineering.

### **Note:**

- a) Sufficient time shall be allowed as setting period between conducting the tests.
- b) Plant operating condition, i.e. main equipment status, availability of auxiliaries, operational and equipment constraints, which can influence the test, shall also be recorded.
- c) Control system shall be running in the CMC mode i.e. Boiler master, fuel flow, air flow, feed water and turbine load control shall be in automatic mode Load set point, maximum and minimum load set point, rate of raise/lower of load shall be set through the Operator Work Stations and Large Video Screen.
- d) FGMO/RGMO trials as per statutory / CERC requirement at that time shall be proved by the Contractor.

The parametric tests shall also be conducted under **worst case loading conditions A, B and C** as defined below :

- a) For control system
  - CPU loading, Cycle time/controller reaction time

## **ANNEXURE-C**

- b) For HMI  
CPU Loading, Spare Duty Cycle, Spare Memory Capacity
- c) Spare duty cycle for system bus
- d) Various display response time
- e) Display update time

### **A. WORST CASE LOADING CONDITIONS FOR CONTROL SYSTEM**

The worst case loading conditions shall include the following tasks.

- i) All process inputs coming to Control System including SOE/annunciation inputs are being scanned, acquired, conditioned and processed.
- ii) All closed loop controls are in operation during a disturbed (non-steady) state of the process
- iii) All open loop controls of DDCMIS are in operation during a disturbed (nonsteady) state.
- iv) All data being transferred between control system, system bus and HMI.
- v) Three (3) alarms are being generated per second from each of the functional groups of Control System.
- vi) Twelve control commands from HMI are being executed in one minute.
- vii) All processors (including hot standby) health being monitored.
- viii) All standby processors status being updated.

### **B. HMI WORST CASE LOADING CONDITIONS**

The worst case loading conditions shall include the following tasks.

- i) Continuous data transfer between System Bus & HMI.
- ii) All calculations including performance calculations being performed at the specified rates.
- iii) Alarms being reported at the rate of three (3) alarms per second for each of the Control System functional groups
- iv) Two control operator commands for control/information within a base period of one minute from each OWS & each LVS.
- v) Data collection for all logs/reports in progress.
- vi) All printers connected to HMI are in operation at rated speed.
- vii) HMI processors and all peripherals health being monitored.
- viii) Data collection for trend function and historical data storage in progress.
- ix) Four alarm acknowledgements within a base period of one minute from each OWS & LVS.
- x) Calculations for long term storage of data being performed.

## **ANNEXURE-C**

- xi) SOE printing in progress.
- xii) Data transfer with other DDCMIS sub-systems, all PLCs and SG/TG C&I Systems in progress for controls (commands) as well as for information.

### **C. THE WORST CASE LOADING CONDITIONS FOR SYSTEM BUS**

The worst case loading condition shall mean continuous data transfer between the distributed modules (Control System/HMI), at their individual worst case loading conditions.

**For the parametric test under above mentioned worst case loading conditions, the following requirements shall be met:**

**a) Processor Spare Duty Cycle (Free time)**

- i) Under worst case loading of HMI and system bus each HMI processor shall have 40% free time when measured over any two second period and 50% free time when measured over anyone minute period.
- ii) Under worst case loading conditions of control system, control system processor shall have 20% free time when measured over any one minute period.

**b) System Bus Spare Duty Cycle (Free Time).**

The Bidder shall furnish all necessary data to fully satisfy the BHEL/Customer that the processor spare duty cycle figures quoted by the Bidder are realistic and based on configuration and computation capability of the offered system and these shall be actually achieved in the fully implemented system as commissioned at project site.

The system bus shall have min. 50% free time during the worst case loading conditions of control system, HMI and the system Bus, measured over any 2 seconds interval.

**c) Response Time i) Display**

The time from mouse click or last button pressed to the commencement of the requested display under the worst case loading conditions shall not be worse than the following:

All control related displays 1 sec Point Details Display (single point) 1-2 sec. Bar chart display (20 points, current data) 2-3 sec. Operator guide/plant start-up guide message display 1-2 sec. (Full screen of alphanumeric information and a maximum of ten numbers of dynamic data items)

Plant mimic display of fair complexity with a 2-3sec.minimum of 120 numbers of dynamic data items e.g., values, macros, line segment, etc. Group review display (current values of twenty points) 2-3 sec. X-Y plot display (2 X-Y plots and a single display 3-4 sec. requiring both historical as well as current data)

## ANNEXURE-C

X-T plot display (Trend of 6 analog points and a 3-4 sec. Single display requiring both historical as well as current data)

Plant Summary display (e.g., bad point summary, 3-4 sec. Limit check removed point summary. Assume the Whole data base search is required and the Summary display contains ten points only). **ii) Command**

The response time for screen update, after the execution of the control command, from the time the command is issued (for example command to start a motor to the time the screen is updated) shall be within two seconds (excluding the drive actuation time).

### **d) Display update rates**

All displays shall be updated at least every two seconds.

### **1.02.02 Sequence of event**

The sequence of event in operating with 1 m sec. resolution as per technical specifications.

### **1.02.03 Availability Tests**

BHEL shall guarantee system availability for a continuous period of 180 days. The bidder shall depute the required number of personnel to assist in conductance of availability test.

An availability guarantee test shall be conducted to assure this level of availability. If the accrued down time exceeds 0.3 percent of 180 days, during availability test run, a new 180 days test run shall start at the time when the system becomes available again. Loss of availability (unavailable system) shall be defined as the loss of the system's guaranteed accuracy and repeat ability or of any system function, except however, that the loss of a function for not more than five percent of the points shall not be considered loss of availability. Loss of a function for more than five percent of the points shall be treated as partial unavailability and the corresponding outage time shall be weighted with respect to the function and the percentage of the points for which the function is unavailable. Loss of each function shall have one weighing factor and unavailability of each equipment, peripheral device or process I/O card etc. shall have another weighing factor. The guaranteed accuracy and repeat ability and system parametric requirements specified in clauses on system parametric requirements shall be maintained for the entire 180 days run without any manual recalibration or any other changes made to the DDCMIS.

Downtime shall start upon loss of a system function and shall end upon full restoration of the affected system function. A minimum of one hour's down time shall be charged for each loss of availability in determining system availability.

If availability is lost due to reasons not attributed to the Contractor / Contractor's system or due to force majeure, then downtime shall not accrue & interrupted test resulting from the same shall be extended by an amount of time equal to the length of interruptions.

Loss of each of the following functions shall be treated as full system unavailability (i.e. factor of 1) and the downtime shall accrue individually for each of the following function:

- a) Interruption of control command communication between HMI and controllers for a period more than three seconds for any drive (i.e. Unavailability of information in HMI for

## **ANNEXURE-C**

carrying out the control command shall also be treated as interruption of control commands).

- b) Permanent data loss in history functionality for a period more than three seconds for more than five percent of the history database.
- c) Delay in reporting of alarms in **HMI** for more than five percent of the alarms for more than three seconds.

If loss of function as described at (a) to (c) above is attributed to server changeover, due to system feature, then unavailability due to the above loss of function shall accrue even if the function is not specifically attempted by Owner during the server changeover period.

The performance & guarantee test for C&I system shall constitute verification of the parameter as mentioned above & shall be earned out as per agreed procedure.

**NOTE: - The Bidder shall provide complete assistance in conductance and completion of Closed Loop Control System Test, Availability Test, and PG Test.**