

# TENDER SPECIFICATION

**BHEL: PSSR: SCT: 1218**

FOR

Handling at Site Stores / Storage yard,  
Transportation to site of Work, Erection,  
Testing and Commissioning of ESP Electrical  
works for Units I,II & III of 3 x 660 MW  
set

at

## **Sipat Thermal Power Project**

(for M/s NTPC) , Stage- I ,  
Bilaspur District , Chattisgarh State

**PART – I TECHNICAL BID**

BOOK NO :



**BHARAT HEAVY ELECTRICALS LIMITED**

(A Government of India Undertaking)

Power Sector – Southern Region

690, Anna Salai, Nandanam, Chennai – 600 035.

<b>INDEX – SCT 1218- ESP Electrical Works – SIPAT</b>		
<b>SNo</b>	<b>DESCRIPTION</b>	<b>PAGE</b>
<b>1</b>	<b>Covering Letter</b>	<b>1 - 2</b>
<b>2</b>	<b>Special Instructions to Bidders</b>	<b>3 - 5</b>
<b>3</b>	<b>Procedure for Submission of Sealed Bids</b>	<b>6 - 7</b>
<b>4</b>	<b>Tender Notice</b>	<b>8 - 9</b>
<b>5</b>	<b>Certificate for No Deviation</b>	<b>10</b>
<b>6</b>	<b>Offer of the Contractor</b>	<b>11 - 12</b>
<b>7</b>	<b>Project Information</b>	<b>13</b>
<b>8</b>	<b>Section - I -General Conditions of Contract</b>	<b>GCC</b>
<b>9</b>	<b>Section- II - General Conditions of Contract</b>	<b>GCC</b>
<b>10</b>	<b>Section – III – Common Conditions of Contract</b>	<b>14 - 36</b>
<b>11</b>	<b>Section – IV - General Conditions of Contract</b>	<b>GCC</b>
<b>12</b>	<b>Section – V - General Conditions of Contract</b>	<b>GCC</b>
<b>13</b>	<b>Section- VI – Scope of Work and Special conditions</b>	<b>37 - 93</b>
<b>14</b>	<b>Section –VII – Technical Requirements &amp; Guidelines for Installation, Testing, Commissioning of HT /LT Package</b>	<b>94-117</b>
<b>15</b>	<b>BOM</b>	<b>118 - 125</b>
<b>16</b>	<b>Section - VII Appendix</b>	
	<b>Appendix – I - Declaration Sheet</b>	<b>126</b>
	<b>Appendix – II – Certificate of Declaration for confirming Knowledge on site conditions</b>	<b>127</b>
	<b>Appendix –III – Check list</b>	<b>128 – 130</b>
<b>17</b>	<b>PRICE – BID ( Separate Book)</b>	<b>131 - 139</b>

BHARAT HEAVY ELECTRICALS LIMITED  
(A Government of India Undertaking)  
Power Sector, Southern Region  
690, Anna Salai, Nandanam, Chennai – 35

Tender Specification No. BHEL:PSSR:SCT: 1218

Messrs

Date :

Dear Sir,

**SUB:** Handling at Site Stores / Storage yard, Transportation to site of Work, Erection, Testing and Commissioning of Electrical Works for Units I,II & III of 3 x 660 MW set at Sipat Thermal Power Project, (For M/s NTPC ) Stage - I , Bilaspur District, Chattisgarh State.

Please find enclosed one set of non-transferable tender documents containing - **139** - pages along with general conditions of contract Booklet and for the above work.

You are requested to go through the tender documents, GCC Booklet and offer your most competitive rate and submit the tender documents duly filled in as per procedure indicated in the tender specification along with requisite EMD of Rs.2,00,000/- (Rupees Two lakhs only) in the form of Demand Draft drawn in favour of M/s.Bharat Heavy Electrical Limited Chennai - 35. Bids with Deviations from the tender conditions will be rejected.

A SEPARATE LETTER SHALL BE FURNISHED INDICATING THAT THERE ARE NO DEVIATIONS FROM THE TENDER CONDITIONS (As in Page 10.)

The completed quotations shall reach the office of the under signed on or before **27.03.2007** at **15.00** Hrs. The Technical bids, will be opened on the same day at **15.30** hrs. We shall separately intimate the date for opening the price bids only to those parties who are technically qualified. You are requested to depute your authorized representative at the time of opening.

**ANY REVISION OF RATES / PRICES WHATSOEVER AFTER THE TIME AND DATE MENTIONED IN TENDER SPECIFICATION FOR SUBMISSION OF COMPLETED QUOTATIONS SHALL NOT BE ENTERTAINED UNLESS CALLED FOR SPECIFICALLY BY BHEL.**

Kindly acknowledge the receipt of the tender documents and confirm your participation.

Kindly note that BHEL reserves the right to reject any or all tenders without assigning any reason.

Thanking you,

Yours faithfully,  
For and on behalf of  
BHARAT HEAVY ELECTRICALS LIMITED

SENIOR DEPUTY GENERAL MANAGER / CONTRACTS

This Tender document is not transferable.

Place : Chennai -35

Encl: One set of Tender documents.

**BHARAT HEAVY ELECTRICALS LIMITED**  
**(A government of India undertaking)**  
**Power Sector : Southern Region**  
**690, Anna Salai, Nandanam,**  
**Chennai – 600 035.**

**SPECIAL INSTRUCTIONS TO BIDDERS**

The Bidder must submit their bids as requested in a sealed cover prominently super scribing the Tender Specification number, due date and time of submission as mentioned in the **TENDER NOTICE**.

The following information shall be furnished by the Bidder along with their offer (Technical Bid cover)

01. Details of previous experience during the last five years indicating contract value, duration, completion period and present engagement as per G.C.C.
02. Organization structure of the Company as per GCC.
03. Financial status of the firm enclosing balance sheet and profit and loss account for the past 3 years and certificate from the Company's Banker as per G.C.C
04. Turnover of the Company in last 3 financial years pertaining to this scope of work only.
05. Latest Income Tax clearance certificate.
06. BIO DATA of key personnel presently in the Rolls of the company and proposed site organization for carrying out the work including deployment of Engineers and Supervisors.
07. Declaration sheets as per Appendix of Tender Specification.
08. Checklist and Schedule of General particulars as per Appendix in GCC.
09. T & P owned/deployment details as per G.C.C.
10. Technical manpower deployment details as per G.C.C
11. Other relevant details as per GCC and checklist.

12. These terms and conditions will be read and construed along with General Conditions of contract and in case of any conflict or inconsistency between the General conditions and the Terms and conditions of the tender specification, the provisions contained in the Term and conditions (NIT, Rate Schedule, Common conditions, Special Conditions including Appendices) shall prevail.

13. ***THE BIDDERS ARE REQUESTED TO FURNISH THE DOCUMENTS LIKE COPIES OF LOI'S, WORK ORDER'S ETC PERTAINING TO THE EXPERIENCE INDICATED IN QUALIFYING REQUIREMENTS, AS GIVEN BELOW.***

14. **QUALIFICATION REQUIREMENT**

a) The bidders should possess the experience of having executed successfully the LT Electrical works consisting of Cabling, trays, tray supports, switch gears, control panels, transformers, drives, earthing and other related works in power plant in the last seven years. The bidder should possess valid electrical installation license.

b) The bidders should have a minimum average financial turnover of **Rs. 54 Lakhs** per year in the preceding three years ending on 31.03.2006

The bidder must have earned profit in any one of the last three financial years ending on 31.03.2006 and should have positive net worth as on 31.03.2006

Bidder should submit audited balance sheet and profit & loss account of the company for last three years ending on 31.03.2006 in support of above requirement.

c) Notwithstanding the above, BHEL reserves the right to reject any Tender or all the Tenders for the reasons whatsoever beyond our control and the decision of BHEL is final.

d) Approval of the agency by customer

**LD / Penalty shall be leviable as per the applicable clauses of General Conditions of Contract ( GCC )**

15. TENDERERS HAVE TO FURNISH A DECLARATION SHEET INDICATING THAT THERE IS NO DEVIATION FROM TENDER DOCUMENTS (AS IN PAGE 10) TENDERERS MAY FURTHER NOTE THAT THIS DECLARATION IS A PREREQUISITE FOR BHEL TO CONSIDER THEIR BIDS. BIDS SUBMITTED WITHOUT **"NO DEVIATION DECLARATION"** WILL BE REJECTED BY BHEL.

**16. SAFETY PLAN**

Bidder may further note that the submission of safety plan is a prerequisite for BHEL to consider their bids.

**BHARAT HEAVY ELECTRICALS LIMITED**  
**(A Government of India undertaking)**  
**Power Sector : Southern Region**  
**690, Anna Salai, Nandanam, Chennai – 600 035.**

**PROCEDURE FOR SUBMISSION OF SEALED BIDS**

The Tenderers must submit their bids as required in two parts in separate sealed covers prominently super scribed as **Part I "Technical Bid"** and **Part II "Price Bid"** and also indicating on each of the covers the tender specification number and due date and time as mentioned in the Tender Notice.

**Part I (Technical Bid) Cover I**

Excepting Rate Schedule, all other schedules, data sheets and details called for in the specification shall be enclosed, in part I Technical Bid only. All the pages of Technical Bid should be bounded and serially numbered and total number of pages should be indicated in the covering letter. Bidders are requested to submit only relevant copies of previous experience as called in the Qualification Criteria.

**Part II (Price Bid) Cover II**

All indications of price shall be given in this part II Price Bid.

Tenderers are requested to quote their rates, only in the price bid (part II) provided by BHEL. Quoting of rates in any other form / formats will not be entertained.

These two separate cover I & II (Part I and Part II) shall together be enclosed in a third envelope (Cover III) along with requisite EMD as indicated and this sealed cover shall be super scribed and submitted to Senior Deputy General Manager/Contracts at the above mentioned address before the due date as indicated. The Tenderers will be intimated separately in case any clarifications are required.

**NOTE:**

Tenderers are issued with 2 Nos. of Technical Bids, 2 Nos. of Price Bids and 2 Nos. of GCC booklets. Out of which one set of each document shall be retained by them for their future reference. Balance one set shall be submitted along with their offer as per procedure indicated above.

EMD amount for this Tender is **Rs.2,00,000/- (Rupees Two Lakhs only)**. This EMD amount shall be submitted in the form of either pay order or demand draft only drawn in favour of M/s. Bharat Heavy Electricals Limited, Chennai – 35.

EMD amount in the form of Bank Guarantee / fixed deposit receipt or in any other form will not be accepted.

**ANY REVISION OF RATES / PRICES WHATSOEVER AFTER THE TIME AND DATE MENTIONED IN TENDER SPECIFICATION FOR SUBMISSION OF COMPLETED QUOTATIONS SHALL NOT BE ENTERTAINED UNLESS CALLED FOR SPECIFICALLY BY BHEL.**

Sr. Deputy General Manager/Contracts.

**BHARAT HEAVY ELECTRICALS LIMITED**  
**(A Government of India Undertaking)**  
**Power Sector, Southern Region**  
**690, Anna Salai, Nandanam, Chennai – 35**

**TENDER NOTICE**

Sealed Tenders are invited from reputed contractors with sufficient previous experience in the under mentioned similar nature of work:

**Tender Specification No. BHEL:PSSR:SCT: 1218**

<b>Description</b>	<b>EMD</b>
Handling at Site Stores / Storage yard, Transportation to site of Work, Erection, Testing and Commissioning of ESP Electrical Works for Units I , II & III of 3 x 660 MW set at Sipat Thermal Power Project, (For M/s NTPC) Stage I Bilaspur District, Chattisgarh State.	<b>Rs.2,00,000/- (Rupees Two Lakhs only)</b>

Cost of Tender Documents : Rs.1040/-  
(Including all Taxes)

Sale Starts on : 07.03.2007

Sale closes on : 26.03.2007

Due date and Time for Submission : 27.03.2007 15.00 Hrs.

Date and time for opening Of Technical Bids : 27.03.2007 15.30 Hrs.

## **QUALIFICATION REQUIREMENT**

- a) The bidders should possess the experience of having executed successfully the LT Electrical works consisting of Cabling, trays, tray supports, switch gears, control panels, transformers, drives, earthing and other related works in power plant in the last seven years. The bidder should possess valid electrical installation license.
- b) The bidders should have a minimum average financial turn over of **Rs.54 Lakhs** per year in the preceding three years ending on 31.03.2006

The bidder must have earned profit in any one of the last three financial years ending on 31.03.2006 and should have positive net worth as on 31.03.2006

Bidder should submit audited balance sheet and profit & loss account of the company for last three years ending on 31.03.2006 in support of above requirement.

- c) Notwithstanding the above, BHEL reserves the right to reject any Tender or all the Tenders for the reasons whatsoever beyond our control and the decision of BHEL is final.
- d) Approval agency by customer

### **LD / Penalty shall be leviable as per the applicable clauses of General Conditions of Contract ( GCC.)**

Interested parties can get the Tender documents from the office of the Senior Deputy General Manager / Contracts on all working days by remitting the cost of tender documents either by Cash or A/c Payee Demand Draft drawn in favour of M/s. Bharat Heavy Electricals Limited, Chennai – 600 035. Money order, Cheques and Postal Orders will not be accepted.

The Bharat Heavy Electricals Limited takes no responsibility for any delay, loss or non-receipt of tender documents sent by post and also reserves the right to reject any or all the tender without assigning any reason therefor. **TENDER NOT ACCOMPANIED BY THE PRESCRIBED EARNEST MONEY DEPOSIT ARE LIABLE TO BE SUMMARILY REJECTED.**

**SENIOR DEPUTY GENERAL MANAGER/CONTRACTS**

TENDER SPECIFICATION : BHEL:PSSR:SCT: 1218

CERTIFICATE FOR NO DEVIATION

I, \_\_\_\_\_ of

M/s \_\_\_\_\_

*hereby certify that there is no deviation from the Tender conditions either technical or commercial and I am agreeing to all the terms and conditions mentioned in the Tender Specification.*

*SIGNATURE OF THE TENDERER*

## **OFFER OF CONTRACTOR**

Senior Deputy General Manager/Contracts  
Bharat Heavy Electricals Limited,  
Power Sector : Southern Region  
690, Anna Salai,  
Nandanam,  
Chennai – 600 035.

Sir,

I/We hereby offer to carry out the work detailed in Tender Specification No.BHEL:PSSR:SCT:1218 issued by Bharat Heavy Electricals Limited, Power Sector : Southern Region, in accordance with the terms and conditions thereof.

I/We have carefully perused the following documents connected with the above work and agree to abide by the same.

1. Instructions to Tenderer
2. General Conditions of Contract
3. Special conditions of Contract
4. Other Section, Appendices and Schedules

I/We have deposited/forwarded herewith the Earnest Money Deposit/a sum of Rs.2,00,000/- (Rupees Two Lakhs only) vide DD.No. . Dt. which shall be refunded should our offer not be accepted. Should our offer be accepted, I/We further agree to deposit such additional sum which along with the sum of Rs.2,00,000/- (Rupees Two Lakhs only) mentioned above, to make up the Security Deposit for the work as provided for in the Tender Specification within the stipulated time as may be indicated by BHEL, Power Sector : Southern Region, Chennai – 600 035.

I/We further agree to execute all the works referred to in the said documents upon the terms and conditions obtained or referred to therein and as detailed in the appendices annexed thereto.

DATE:

CONTRACTOR:

PLACE:

ADDRESS:

Witness with their address

Signature

Name

Address

## **PROJECT INFORMATION**

### **3 x 660 MW SIPAT – STAGE – I**

1. Owner : National Thermal Power Corporation
2. Project Title : Unit 3 x 660MW Sipat TPP Stage - I
3. Location :
  - Project is located East of Kurung Left Bank Cannel near Rank, Kaudia, and Janji in the Bilaspur Dist. (Chattisgarh)
  - Latitude 22 Deg.05' & 22 Deg 09' North and longitude 82 Deg 16' & 82 Deg 18' East.
  - Approximately 20 KMs from Bilaspur City Via Bilaspur – Sipat State highway
  - Nearest Railway Station is Jairamnagar on Nagpur – Raipur – Howrah BG line about 15 KM from site.
  - Nearest Commercial Airport is Raipur – 140 Km from Site
  - Nearest Major Town – Bilaspur at 20 KM from site.
  - Nearest state Highway – 1 KM from site.

## **SECTION III**

### **COMMON CONDITIONS OF CONTRACT**

#### **3.1 SCOPE OF CONTRACT**

- 3.1.1 The Intent of this specification is to provide erection and commissioning services for execution of projects according to most modern and proven techniques and codes. The omission of specific reference to any method and equipment or material necessary for the proper and efficient services towards installation of the Plant shall not relieve the contractor of the responsibility of providing such services, facilities to complete the project or portion of project awarded to him. The quoted rate shall deem to be inclusive of all such contingencies.
- 3.1.2 The contractor shall carry out the work in accordance with instructions/ drawings/ specification/ standard practices supplied by BHEL from time to time.
- 3.1.3 Provision of all types of labor, Supervisors, Engineers, watch and ward as required tools and tackles as required, consumables as required under various clauses of tender specification for handling transportation, erection, testing and commissioning.
- 3.1.4 Proper out-turn as per BHEL plan and commitment.
- 3.1.5 Completion of work in time.
- 3.1.6 Good quality and accurate workmanship for proper performance of equipment / systems.
- 3.1.7 Preservation of all components at all stages of pre-assembly/erection/testing and commissioning till completion of trial run of unit.

## **3.2 FACILITIES TO BE PROVIDED BY BHEL:**

### **3.2.1 OPEN SPACE:**

Open space for building of temporary office shed / stores shed will be provided free of cost. Contractor has to make his own arrangements for labour colony.

### **3.2.2 ELECTRICITY:**

For construction purpose, electricity will be provided free of charge at one single point. Further distribution shall be arranged by the contractor for the site requirement at his cost.

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

### **3.2.3 WATER:**

For construction and drinking purpose water will be provided at one single point, free of charge, as provided by customer to BHEL. Further distribution shall be arranged by the contractor at his own cost.

### **3.2.4 TOOLS & TACKLES:**

All the Tools & Plants and Instruments required for the complete erection of components shall be arranged by the contractor and quoted rate shall be inclusive of such requirements. The stipulation pertaining to these are detailed in clause 3.6 of Tender specification.

### **3.2.5 CONSUMABLES:**

All consumables, Electrodes including Oxygen / Acetylene, Argon, Gases, Paints etc, shall be arranged by the contractor at their own cost.

### **3.3 FACILITIES TO BE PROVIDED AND DEVELOPED BY THE TENDERER / CONTRACTOR AT HIS COST.**

#### **3.3.1 CIVIL CONSTRUCTION:**

It shall be the responsibility of the contractor to construct his own office shed, stores shed, with all facilities like electricity, water supply, sanitary arrangements in the area allotted to him for the purpose.

#### **3.3.2 WATER DISTRIBUTION:**

Distribution of water for construction purpose and as well as drinking purpose from the single point provided by BHEL to various work-fronts shall be contractor's responsibility and at his cost.

#### **3.3.3 ELECTRICITY DISTRIBUTION:**

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

#### **3.3.4 POSSESSION OF GENERATORS :**

As there are bound to be interruptions in regular power supply, power cut / load shedding in any construction sites, due to inherent power shortage in State on this account, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the tenderer / contractor to provide, maintain the complete installation on the load side of the supply with due regard to safety requirements at site. The contractor shall adjust his working shifts accordingly and deploy additional manpower, if necessary to achieve the target. It shall be the responsibility of the contractor to have at least 2 to 4 Nos diesel operated Generator sets to get urgent and important work to go on without interruptions.

The consumables required to operate the generators are to be provided by the tenderer.

### **3.3.5 LIGHTING FACILITY :**

Adequate lighting facilities such as flood lamps, low volt hand lamps and area lighting shall be arranged by the contractor at the site of construction, contractor's material storage area etc. at his cost.

### **3.3.6 POWER DISTRIBUTION :**

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

### **3.3.7 CONTRACTOR'S OBLIGATION ON COMPLETION :**

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

## **3.4 GASES :**

3.4.1 All required gases like Oxygen/ Acetylene/ Argon/ Nitrogen required for work shall be supplied by the Contractor at his cost. It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of those gases. Non-availability of gases cannot be considered as reasons for not attaining the required progress of erection.

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

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

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

3.4.5 The contractor shall arrange air / gas manifold ensuring proper distribution and reduction of handling time.

### **3.5 ELECTRODES & FILLER WIRES :**

3.5.1 All required electrodes shall be arranged by contractor, at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement regarding suppliers, type of electrodes on receipt of the electrodes at site it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch No., and date of expiry etc.

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

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

3.5.4 In case of improper arrangement of procurement of above electrodes BHEL reserve the right to procure the same from any source and recover the cost from the contractor's first subsequent bill at market value plus departmental charges of BHEL. Postponement of such recovery is not permissible.

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

### **3.6 TOOLS & TACKLES**

- 3.6.1 All T & P required for the satisfactory execution of work shall be arranged by contractor at his cost as specified in clause 3.2.4.
- 3.6.2 All the T & P arranged by contractor including electrical connections wherein required shall be reliable/proven/tested and necessary test certificate.
- 3.6.3 All instruments, measuring tools etc. are to be calibrated periodically as per the requirement of BHEL and necessary calibration certificates are to be submitted to BHEL before use.
- 3.6.4 All the T & P, lifting tackles including wire ropes, slings shackles and electrically operated equipment shall be got approved by BHEL Engineer before they are actually put on use. Test certificates should be submitted before their usage.
- 3.6.5 For the movement of cranes etc. it may become necessary to lay sleeper bed for obtaining leveled safe approach for usage of equipment. It shall be the contractor's responsibility to lay necessary sleepers. Required sleepers shall be arranged by the contractor at their cost.

### **3.7 SUPERVISORY STAFF AND WORKMEN**

- 3.7.1 The Contractor shall deploy experienced Engineers, Supervisors all the skilled workmen like High Pressure Welders (gas, TIG and arc) Carbon, alloy steel welders, Gas cutters, electricians, Riggers, Serangs, Erectors, carpenters, fitters etc. in addition to other skilled semi-skilled and unskilled workmen required for all the works of handling and transportation from site storage to erection site, transportation, erection, testing and commissioning contemplated under this specification. Only fully trained and competent men with previous experience of the job shall be employed. They shall hold valid certificates wherever necessary.

- 3.7.2 BHEL reserves the right to decide on the suitability of the workers and other personnel who will be employed by the contractor, BHEL reserves right to insist on removal of any employee of the contractor at any time, if they find him unsuitable and the contractor shall forthwith remove him.
- 3.7.3 The supervisory staff employed by the contractor shall be qualified Engineers and experienced in the area of work. They shall ensure proper out-turn of work and discipline on the part of labour put on the job by the contractor and in general see that the works are carried out in safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other contractor's of BHEL's client.
- 3.7.4 The Contractor shall also furnish DAILY & MONTHLY report showing the number of employees engaged in various categories of work and a progress report of work as required by BHEL Engineer.
- 3.7.5 The work shall be executed under the usual conditions existing in major power plant construction and in conjunction with numerous other operations at site. The bidder and his personnel shall co-operate with other personnel contractor coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 3.7.6 The contractor's supervisory staff shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work, good workmanship and aesthetic finish are essential part of this contract. The contractor shall be responsible to ensure that assembly and workmanship conform to the dimensions and tolerances given in the drawings/instructions given by BHEL Engineers from time to time.
- 3.7.7 The contractor shall employ the necessary number of qualified and approved full time electricians at his cost to maintain his temporary electrical installation till the completion of work.
- 3.7.8 It is the responsibility of the bidder to carryout the work for achieving the target set by BHEL and also during erection, commissioning and testing period. The contractor's quoted rate shall include all these contingencies.

- 3.7.9 If the contractor or his workmen or employees shall break, deface, injure or destroy any part of a building, road, kerb, fence, enclosure, water pipes, cables, drains, electric or telephone posts or wires, trees or any other property or to any part of erected components etc. The contractor shall make the same good at his own expense or in default.
- 3.7.10 BHEL may cause the same to be good by other workmen or by other means and deduct the expenses (of which BHEL's decision is final) from any money due to the contractor.

**3.8.0 SCOPE OF MATERIAL HANDLING AND SITE STORAGE AND OTHER RESPONSIBILITIES:**

- 3.8.1 While BHEL will endeavour to store/stack/identify materials properly in their open/closed storage yard/shed it shall be contractor's responsibility to assist BHEL in identifying material well in time for erection, taking delivery of the same in time following the procedure indicated by BHEL and transport the material safely to pre-assembly yard/erection site in time according to programme.
- 3.8.2 The contractor shall identify necessary supervisor/labour for the above work in sufficient quantity as may be needed by BHEL for areas covering their scope.
- 3.8.3 It shall be contractor's responsibility to arrange necessary cranes/tractors, trailer or trucks/slings/tools and tackles/labour including operators and on to transport equipment, move it to erection site/pre-assembly yard and unload the same at pre-assembly yard/ erection site and the quoted rate shall include the same.
- 3.8.4 All equipment so used by contractor shall be of proven quality and safe in operation as approved by the statutory authorities as per the law in force.
- 3.8.5 Any loss/damage to materials issued to contractor shall be made good by him or BHEL will arrange for replacement at cost recovery basis and decision of BHEL shall be final. Any loss/ damage must be intimated to site in-charge of BHEL in writing within 24 hours of the occurrence.

- 3.8.6 All the surplus damaged, unused materials, package materials/containers/special transporting frames, gunny bags etc. supplied by BHEL shall be returned to the BHEL Stores by the contractor immediately.
- 3.8.7 The contractor shall take delivery of the components and equipments and special consumables from the storage area after getting the approval of the BHEL Engineer on standard indent forms to be specified by BHEL. At periodic/intervals of work, complete and detailed account of the equipment so erected and electrodes used shall be submitted to the BHEL Engineer.
- 3.8.8 The contractor shall submit monthly plan for erection and the same will be mutually agreed upon after discussion. The contractor shall arrange for Engineers, Supervisors and labour force and tools and plants and consumables to suit the above plan and execute the work accordingly.
- 3.8.9 The Contractor shall have total responsibility for all equipment and materials in his custody, stores, loose, semi-assembled, assembled or erected by him at site.
- 3.8.10 The contractor shall make suitable security arrangement including employment of security personnel to ensure the protection of all materials/equipments and works from theft, fire, pilferage and any other damage and loss.
- 3.8.11 The contractor shall ensure that the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are installed.
- 3.8.12 All equipments 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 equipments without the specific written permission of the Engineer. The equipments 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 so as to avoid damage for such equipments at site.

- 3.8.13 The work covered under this scope of work is of highly sophisticated nature requiring best quality / proven workmanship engineering and construction management. It should also ensure successful and timely commercial operation of equipment installed. The contractor must have adequate quantity of precision tools, construction aids in possession. Contractor must also have adequate trained qualified and experienced supervisory staff and skilled personnel.
- 3.8.14 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.
- 3.8.15 The contractor shall take all reasonable care to protect the material and work till such time the erected equipment has been taken over by BHEL/their client. Necessary suitable temporary fencing and lighting shall have to be provided by the contractor as a safety measure against accident and damage of property of BHEL. Suitable caution notices shall be displayed where access to any part may be deemed to be unsafe and hazardous.
- 3.8.16 The contractor shall be responsible for taking all safety precautions during the construction and leaving the site safe at all times. When the work is temporarily suspended he shall protect all construction materials, equipments and facilities from causing damage to existing property interfering with the operations of the station when it goes into service. The contractor shall comply with all applicable provisions of the safety regulations clean-up programme and other precautionary measures which the BHEL has in effect at the site.
- 3.8.17 All lifting tackles including wire ropes, slings, shackles etc. used by the contractor shall be got approved by BHEL Engineer at site before they are actually put on the work. It will be the responsibility of the contractor to ensure safe lifting of the equipment taking due precautions to avoid any accidents and damage to other equipments and personnel. All piping shall be adequately supported and protected to prevent damage during handling erection. The history cards for major equipments to be maintained by the contractor.

3.8.18 The contractor shall take delivery of equipment from storage yard/stores/sheds. He shall also make arrangements for verification of equipment maintain records and keep safe custody watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by BHEL's client. The stolen/lost damaged goods shall have to be made good by the contractor at his own cost.

3.8.19 Sometimes it may become necessary for the contractor to handle certain unrequired components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

### **3.9.0 PRESERVATION OF COMPONENTS**

3.9.1 It shall be the responsibility of the contractor to apply touch up painting on all equipment before erection. It shall be contractor's responsibility to arrange for required labour, brush and other consumables like cotton waste, cloth etc. for carrying out preservative painting. The quoted rates shall be inclusive of above work. The required paint and thinner shall be arranged by BHEL at free of cost.

3.9.2 The contractor shall effectively protect the finished work from action of weather and from damage or defacement and shall cover the finished parts, then and there for their protection.

3.9.3 Any failure on the part of contractor to carry out work according to above clauses will entail BHEL to carry out the job from any other party and recover the cost from contractor.

3.9.4 Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. All consumables including painting brush, emery paper, cotton waste, cloth etc. have to be procured by the contractor at his cost. The required preservative paint and Thinner shall be arranged by BHEL free of cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The

decision of the BHEL Engineer is final with regard to frequency of application of paint.

### **3.10.0 DRAWINGS AND DOCUMENTS**

- 3.10.1 The detailed drawing specification available with BHEL Engineers will form part of this tender specification. These documents will be made available to the contractor during execution of work at site.
- 3.10.2 One set of necessary drawings to carry out the erection work will be furnished to the contractor by BHEL on loan which shall be returned to BHEL Engineer at site after completion of work. Contractor's personnel shall take care of these documents given to them.
- 3.10.3 The data furnished in various appendices and the drawings enclosed with this Tender Specification, describes the equipment to be installed, tested and commissioned under this specification briefly. However, the changes in the design and in the quantity may be expected to occur as is usual in any such large scales of work.
- 3.10.4 Should any error or ambiguity be discovered in the specification, or information, the contractor shall forthwith bring the same to the notice of BHEL before commencement of work. BHEL's interpretation in such cases shall be final and binding on the contractor.
- 3.10.5 Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimensions/details without specific approval of BHEL.

### **3.11.0 SITE CLEANLINES AND SAFETY REQUIREMENTS**

- 3.11.1 Contractor shall strictly follow all safety regulations/conditions as per clause 2.15 and its sub clauses of General Conditions of Contract booklet enclosed with this tender.
- 3.11.2 Non-conformity of safety rules and safety appliances will be viewed seriously and the BHEL has right to impose fines on the contractors as under: BHEL Engineer's decision is final and binding in this regard.

<b>SNo</b>	<b>SAFETY MEASURES</b>	<b>Fine ( Rs )</b>
01	Not wearing safety helmet	50/-
02	Not wearing safety belt	100/-
03	Grinding without goggles	50/-
04	Not using 24V supply for internal work	500/-
05	Electrical plugs not used for hand machines	100/-
06	Not slinging properly	200/-
07	Using damaged sling	200/-
08	Lifting cylinders without cage	500/-
09	Not using proper welding cable with lot of joints and not insulated properly	200/-
10	Not removing small scrap from platforms	200/-
11	Gas cutting without taking proper precaution or not using sheet below gas cutting	200/-
12	Not maintaining elec. Winches which are being operated dangerously	500/-
13	Improper earthing of electrical T & Ps	500/-

3.11.3 The contractor should exclusively deploy one Safety Engineer along with a safety supervisor for effective implementation and co-ordination of safe working conditions.

3.11.4 Contractor shall necessarily fill up the safety plan format available in general conditions of contract booklet enclosed with this tender and submit along with their offer.

**3.11.5 CONTRACTOR SHALL DEPLOY A SAFETY OFFICER EXCLUSIVELY TO HANDLE SAFETY REQUIREMENT.**

### **3.12.0 PROGRESS OF WORK**

3.12.1 During the course of erection if the progress is found unsatisfactory or if the target dates fixed from time to time for every milestone are to be advanced or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians etc. employed are not sufficient, BHEL will induct required additional workmen to improve the progress or take over a part of the job and get it done on risk and cost of the contractor and recover from contractor's bill, all charges incurred on this account including all expenses together with BHEL overheads from contractor's bill.

3.12.2 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, material reports, consumables reports and other reports considered necessary by the BHEL Engineer.

The manpower reports shall clearly indicate the manpower deployed category wise daily specifying also the activities in which they are engaged.

3.12.3 The progress reports shall indicate the progress achieved against planned with reasons indicating delays if any and shall give remedial action which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original programme and the slippage do not accumulate and affect the overall programme in a format designed and approved by BHEL site engineer.

3.12.4 The contractor shall arrange for weekly progress review meeting with the "Engineers" at site during which actual progress during the week vis-à-vis scheduled programme shall be discussed for action to be taken for achieving targets. The programme for subsequent work shall also be presented by contractor for discussion. The contractor shall constantly update/revise his work programme to meet the overall requirements and suit the material availability.

3.12.5 The contractor shall arrange for submitting three sets of progress photographs every month to BHEL office the areas to be photographed will be as per the instruction of BHEL Engineer. The quoted rate shall include this contingency.

- 3.12.6 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises, without the Entry Gate Pass these materials will not be allowed to be taken outside.
- 3.12.7 The contractor shall maintain a record in the form as prescribed by BHEL for all operations carried out on each weld and maintain a record indicating the number of welds, the name of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejections, if any, percentage of rejection, etc. and submit copies of the same to BHEL Engineer, as required.

### **3.13.0 SPECIFIC REQUIREMENTS FOR ISO 9001-2000**

#### **IMPORTANT NOTE**

Contractors shall ensure that all their Staff/Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9001 - 2000 Standards.

Contractors shall ensure that the Quality is maintained in all the works connected with this contract at all stages of the requirement of BHEL.

Contractor shall ensure that all Inspection, Measuring and Testing equipment that are used, whether owned by the contractors or used on loan, are calibrated by the authorized agencies and the valid calibration certificate will be available with them for verification by BHEL. A list of such instruments possessed by contractor at site with its calibration status is to be submitted to BHEL Engineer for control.

Contractors shall arrange for the inspection of the works at various stages as required by BHEL. Immediate corrective action shall be taken by the contractors for the non-conformances if any, observed and pointed out by BHEL.

### **3.14.0 INSPECTION / QUALITY ASSURANCE / QUALITY CONTROL STATUTORY INSPECTION**

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

Preparation of quality assurance log sheets and protocols with customer's Engineers, welding logs and other quality control and quality assurance documentation as per BHEL Engineer's Instructions, is within the scope of work / specification.

The protocols between contractor and customer/BHEL shall be made prior to installation for correctness of foundations, materials, procedures, at each stage of Installation, generally as per the requirement of Customer/BHEL. This is necessary to ensure elimination of errors or keeping them within tolerable limits and to avoid accumulation and multiplication of errors.

A Daily log Book should be maintained by every supervisor/Engineer of contractor on the job in Duplicate (One for BHEL and one for Contractor) for detailing and incorporating Alignment/clearance/centering/Leveling Readings and Inspection details of various Electrical and C & I works.

All the Electrical/Technical Measuring and Testing Instruments/Gauges, Feeler Gauges, Highest Gauges Dial Gauges, Micrometers, Levels Spirit Levels, Surface plates, straight Edges, vernier calipers and all measuring instruments shall be provided by the contractor for checking, leveling, Alignment, Centering etc of Erected Equipments at various stages. The Instruments / gauges / Tools etc. provided should be of Brand, Quality and Accuracy, Specified by BHEL Engineer and should have necessary Calibration and other Certificates as per the Requirements BHEL Engineer.

Total Quality is the Watch Ward of the work and standards, Procedures laid down by BHEL. We shall follow all the Instructions as per BHEL Drawings and Quality / Standards. Contractor shall provide for the services of quality Assurance Engineer.

### **3.15.0 STAGE INSPECTION BY FES / QA ENGINEERS :**

Apart from Day-to-Day Inspection by BHEL Engineers Stationed at site and also by Customer's Engineers, Stage Inspection of Equipment under Erection and commissioning at various stages of Erection and commissioning by TEAMS of Engineers from Field Engineering Services of BHEL's Manufacturing units and Quality Assurance Teams from Field Quality Assurance Unit/ Factory Quality Assurance and commissioning Engineers Contract shall arrange all labour, Tools and Tackles, etc. for such stage inspections free of cost.

Any modifications suggested by FES and QA Engineers Team shall be carried out. Claims of Contractor, if any shall be dealt as applicable.

Any minor rectifications of minor repairs of defective work found out during stage Inspection shall be rectified free of cost, by the contractor.

Any major rectification or major repairs of defective work found out during stage inspection verification / checking but not attributable to contractor shall also be carried out. Claims of contractor, if any, shall be dealt as applicable.

### **3.16 STATUTORY INSPECTION**

- 3.16.1 The scope includes getting the approvals from the Statutory Authorities like Boiler inspector and Labour officers. This includes arranging for inspection visits of boiler inspector periodically as per BHEL Engineer's instructions, submitting documents, radiographs, etc. and following up the matter with them.
- 3.16.2 All fees connected with the contractors for testing his welders / men / workers and testing, inspection, calibrating of his instruments and equipments, shall be paid by the contractor. It shall be his responsibility to obtain approval of statutory authorities, wherever applicable, for the conducting of any work which comes under the purview of these authorities. Any cost arising from this shall be the contractor's Account. However, BHEL shall pay all other fees (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES, ETC.) In case these inspections have to be repeated due to default / fault of the contractor and fees have to be paid again, the contractor shall have to bear the charges. These would be deducted from his bills.

## **HSE SPECIFIC REQUIREMENT**

### **OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM**

#### **SUB CONTRACTOR TO ENSURE COMPLIANCE OF THE FOLLOWING HEALTH RELATED POINTS**

01. Sub-contractor to identify nearest hospital for Health check up of his staff and workers and intimate BHEL site office & PSSR HQ.
02. To arrange for occupational health check up / screening of contractor's staff and workers engaged in sub contracting activities. In this, category of workmen such as welders, gas cutters, grinders, radiographers, crane operators are to be given exclusive attention in respect of health screening.
03. Sub-contractor to arrange an ambulance vehicle or emergency vehicle on a continuous basis to meet any emergency situation arising at site work in which his staff and workers are engaged.
04. To provide appropriate facilities for prompt first aid treatment of injuries and illness at work. One first Aider for each sub contractor to be provided. First Aider should undergo training on first aid.
05. To provide filtered drinking water at selected place in a clean container.

#### **SUBCONTRACTOR TO ENSURE COMPLIANCE OF THE FOLLOWING SAFETY RELATED POINTS**

01. Personnel protective equipment (PPES): Required number of following PPES (Confirming to Relevant is Standards ) to be made available to workmen at site and ensured that they are used .
  - ❑ Helmet
  - ❑ Safety goggles
  - ❑ Welding face shields
  - ❑ Safety belts for working at heights
  - ❑ Safety shoes
  - ❑ Ear plugs

- Rubber gloves and mats for low tension (I.T) electrical works
  - Gum boots & aprons
  - Other items as required by BHEL site
02. Sub contractor to liaise with nearest fire station and inform contact telephone number and contact person to meet any emergency.
  03. To provide appropriate fire fighting equipment at designated work place and to provide fire fighting training to selected persons in his group of workmen to meet emergencies.
  04. To provide adequate number of 24 V power supply points to work in a constrained and enclosed space.
  05. All power tapping points / switch boards /power & control cabling should fulfill required electrical safety aspects as per relevant is standard.
  06. ELCH's (Earth leak circuit breakers) at all electrical distribution points to be provided.
  07. Red and white caution tape of proper width ( 1.5 to 2 inch ) to be used for cordoning unsafe area such as open trench, excavated area, etc.
  08. To provide sub-contractors company logo or clothing to all staff and workers for identification including identity cards with photographs approved by BHEL.
  09. High pressure and structural welders to be identified with colour clothing and to display copy of welders certificate with photographs of welder at the work place. They also should be in possession of valid welding procedure.
  10. To display safe handling procedure for all chemicals such as lube oil, grease, sealing compound, kerosene, diesel etc. At stores & respective work place.
  11. Contractor should authorize a person at site to stop work if there is a unsafe work noticed as per his knowledge.
  12. Fitness for use of erected scaffolding to be certified by the contractors approved scaffolder and the certificate should be

displayed on the scaffolding itself. If the scaffolding is unsafe, the same will not be used. the certificate to be updated daily. The scaffolding to be made as per the relevant is standard.

13. For making platform on the scaffolding , proper thickness and size of the plank of required quality wood to be used. The safe working load of the platform to be displayed on the scaffolding itself. Proper use of platform to be explained to the user.
14. All plant equipment should have inspection report before put in to use.
15. All T&Ps should be of reputed brand and having quality certificates.
16. All IMTEs should have valid calibration certificate from recommended institution / testing lab and these should be in place.
17. All lifting tackle and plant equipment should have safe working load certificate.
18. The right worker should be deployed for right job and the resume of site in charge, supervisors, and key workers to be submitted before commencement of work..
19. Sub-contractor should submit inspection / testing matrix of all T&Ps and to be approved by BHEL.
20. Sub-contractor to display safety slogan, safety board, caution boards wherever required in consultation with BHEL.
21. Sub-contractor to provide gas detectors of reputed make at desired locations.
22. Sub-contractor to conduct emergency mock drills. one drill per 6 month and submit report to BHEL.
23. Safe handling and storing of all equipment with adequate space to be ensured.

24. Sub contractor to deploy safety supervisor till the completion of the project.
25. Sub contractor to comply the safety reporting procedure of BHEL as practiced at present and also additional requirements that may arise out of future improvements in the safety management system. This includes computation of safety indices such as frequency rate, severity rate & incident rate.
26. Sub contractor to identify probable emergency situations such as electric shocks to workmen , caving in of shored earth , fall from height, collapse of scaffolding fire etc., and should have clear action plan to overcome them. Sub contractor to take required guidance from BHEL in this regard.
27. Sub contractor to identify hazardous activities which he may carryout and should train his workmen in those activities with the relevant operation control procedures. Sub contractor to take required guidance from BHEL in this regard.
28. Safe work permit system to be followed while working in confined space / near electric systems.

**SUBCONTRACTOR TO ENSURE COMPLIANCE OF THE FOLLOWING ENVIRONMENT RELATED POINTS**

1. HOUSE KEEPING : Sub contractor to carry out daily house keeping of work areas / stores through a check list prepared in consultation with BHEL.
2. Sub contractor shall adopt pollution prevention / reduce /control approach in all his site activities. this shall include:
  - a. Transporting of oil / chemicals from stores to site safely without causing spillage. in case of any spillage, the area shall be cleaned and the remnant spilled oil disposed off to a safe place, identified for such disposal.
  - b. To use required containers / cans / safety gadgets /appliances for transporting and for usage of oil / chemicals at site.

3. Sub contractor shall arrange for segregation / collection of scraps and dispose off to the identified place meant for scrap collection.
4. Sub contractor to adopt good erection practices / procedures with the objective of reduction of waste generation / rework

### **OTHER HSE REQUIREMENTS TO BE COMPLIED BY SUB CONTRACTOR**

1. Sub contractor to clearly understand and accept the HSE policy of PSSR with a commitment to comply the requirements of the policy.
2. Sub contractors to arrange for daily meeting of their supervisors and work force before they disperse for their daily planned activities where in the relevant health , safety and environment aspects of the job and use of PPES are explained
3. Sub contractor to conduct monthly HSE meeting ( internal ) and submit the report to BHEL.
4. HSE slogans to be displayed in a proper board – hoarding at designated places in consultation with BHEL.
5. Sub contractor to submit a structured programme for training & occupational Health Screening of their work force at site after the Award of LOI.

**SECTION VI**  
**SIPAT 3X 660 MW (UNIT 1,2&3)**  
**ESP LT ELECTRICAL PACKAGE**  
**SCOPE OF WORK AND SPECIAL CONDITIONS**

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**6.1.0 GENERAL**

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

Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting, checking, carrying out statutory tests as required, pre-commissioning, commissioning & post-commissioning activities and maintenance up to the time of efficient highly reliable commercial & trial operation of the unit and handing over to customer or till completion contract period which ever is earlier, along with the supply of all consumables, tools and tackles, testing instruments and all type of manpower etc. The installation and commissioning of all the electrical equipments/items shall conform to the technical requirements specified in else ware in the tender.

1. It is not the intent to specify herein all details of material. Any item related to this work not covered, but necessary to complete the system will be deemed to have been included in the scope of the work.
2. Site testing wherever required shall be carried out for all items/materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.
3. The contractor shall take full responsibility for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation. Testing shall also include any additional tests, which the Engineer feels necessary because of site conditions and also to meet system specification.
4. The work shall be executed under the usual conditions without affecting power plant construction and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the

personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

5. All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
6. Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc will decide the sequence of erection/commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection/commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.
7. All necessary certificates and licenses required to carryout this work are to be arranged by the contractor expeditiously at his cost.
8. During the course of erection, testing and commissioning Electrical work certain rework/modification / rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and / or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously and the same shall be deemed to be part of the scope of work.
9. The contractor shall take delivery of item, materials, from the storage yard/ stores/sheds of BHEL / customer which is within a radius of 5 kms. He shall also make arrangements for, safe custody, watch and ward of equipment after it has been handed over to him till they are fully erected, tested and commissioned till the contract period. The contractor shall note that items/materials shall be transported to erection site / assembly yard etc. by the prescribed route without disturbing and causing damage to other works in the most professional manner. All items, Hardware, etc. shall be stored in appropriate manner as per BHEL's instructions.
10. The contractor shall take delivery of items/materials, and consumables from the stores/ storage area / sheds of BHEL / customer after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer.
11. After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in packed condition to BHEL stores. In

case of any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

12. Contractor shall, transport all materials to site and unload at site / working area, or pre-assembly yard for inspection and checking. All material handling equipment required shall be arranged by the contractor.
13. Contractor shall retain all T&P/Testing instrument/Material handling instrument etc at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge
14. Contractor shall remove all scrap materials periodically generated from his working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor.
15. The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
16. The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge
17. The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances.
18. Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc. in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and

skilled personnel. The manpower deployed by contractor shall match with above scope of works. The contractor shall have valid **ELECTRICAL CONTRACTOR LICENSE** to carry out the Electrical works.

19. All the surplus, damaged, unused materials, package materials, containers, special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor.
20. Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
21. The scope of specification covers the installation, testing and commissioning of the instrument, hardware along with accessories as detailed in Bill of Materials.
22. If any item or equipment not covered but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.

**Note:**

- 1. Bill of Materials (BOM) contains detailed specification of various instruments and items, system-wise and BHEL Unit- wise along with relevant clause for scope of works.**
- 2. The Rate Schedule contains the consolidated list of BOM with brief description of items.**
- 3. Rates are to be filled only in the Rate Schedule.**
- 4. Before filling the Rates in the rate schedule, the bidder shall go through the detailed specification of all items of BOM as well as Scope of Work as specified in relevant Clause of this document.**
- 5. Section VII contains general guidelines for Erection and Commissioning of Electrical systems**

6.1.1 **SOMS (Site Operations Management System) – An Over View**

SOMS is an Online WEB based system covering all aspects of site operations from estimation to contract closing. The modules include:

1. Documentation management System
2. Materials Management System

3. Tools & Plants (T&P), IMTE System
4. Erection / Material Handling and billing System.
5. Performance Monitoring of Contractors, Welders and total no. Of joints
6. Site Deviation / Failure Monitoring System, SARs, CARs.
7. Management Information Report System (MIRS)
8. Customer billing
9. Sub Contractor Billing
10. Integration of Contractor bill payments, Recoveries from Contractor, T&P Hire Charges with existing Financial System already running in BHEL.
11. Local purchase material accounting system.
12. Insurance claim management

### **6.1.2 OBJECTIVE**

- WEB based system for all site related activities to effectively carry out, monitor and analyse activities on line for different sites.
- Lowering inventory cost, timely completion of planned activities and transfer of information without delay.
- Allow monitoring the project effectively.
- Interface with Online Finance System and aid activity based costing.
- Tool for effective Project Monitoring at HQ.
- Cover all site activities presently being done manually
- Create a database for future use
- Eliminate paper based reports
- Provide access to all users on need to know basis. This covers BHEL employees, Customers, Vendors etc.

The broad overview and objectives of SOMS is indicated above, however the tenderer is responsible and execute functions relevant to his scope of erection of ESP Electrical works.

### **6.1.3 ENVIRONMENT**

The system works with following environment:

SERVER:

Operating system – Linux 7.x

Oracle database - 9.i

Oracle application server – 9.ias

Contractor shall provide the following exclusive computer system for SOMS with qualified operator.

<b>S. No.</b>	<b>Features</b>	<b>Minimum Requirements</b>
1	Processor	Intel Pentium 4 2 GHz or above
2	Chipset	Intel 845 or higher Intel Chipset
3	RAM	256 MB DDR SDRAM
4	HDD	40 GB
5	FDD	1.44 MB
6	Optical Drive	48x or above CDD
7	Monitor	15" VGA Colour
8	Keyboard	Minimum 104 keys Windows keyboard
9	Mouse	2 Button Scroll mouse
10	Ethernet	Integrated 10/100 Mbps NIC for LAN
11	Ports	Minimum 1 Parallel, 1 Serial, 2 USB
12	Software	Windows 2000 or XP Professional
13	Accessories	Mousepad & Dustcovers
14	UPS	1 kVA UPS with 1 hr. backup
15	Printer	A4 size Laser Printer - 20 ppm or above (with all consumables, cartridges & stationery)

### **6.2.0 SCOPE OF WORK IN GENERAL**

1. The scope of Electrical Installation and Commissioning works covers mainly the Electrical Works related to Units 1,2 & 3 Electro static precipitator (ESP) systems of 3 x 660 MW TPS
2. The scope of Electrical works are as detailed below:

1. Erection commissioning of various type of LT MCC / ACP, Rectifiers and other control panels.
2. Fabrication and Installation of Flexible cable tray supports for cable trays.
3. Installation of various types of trays with accessories.
4. Installation of above ground earthing grid, equipment earthing of all equipment, cable racks, trays etc.
5. Installation of push button stations for local starting of all motors, Junction Boxes etc.
6. Commissioning of, LT drives, ESP Transformer equipment erected by Mechanical contractor.
7. Laying and termination LT-Power, control and Instrumentation cables
8. Supply and painting of all cable supports and other steel fabricated items
9. Erection and Testing Heating Elements and Thermostats
10. Erection and commission of Ash Level Instruments.
11. Supply of all consumables required for installation as detailed elsewhere in the contract.
12. Installation of other items that have not been specifically indicated, but required for completing installation
13. The scope of work in general covers loading from store, transportation, unloading at site , keeping in safe custody, erection, testing and commissioning along with supply of consumables as detailed in the respective clause, deployment of skilled / unskilled manpower, engineers / supervisors, T & P, Testing instruments and handing over.

### **6.3.0 DETAILED SCOPE OF WORKS**

#### **6.3.1 SCOPE OF LT SWITCHGEARS, POWER DISTRIBUTION BOARDS AND OTHER CONTROL PANELS**

1. The base frames shall normally be supplied along with the boards. These shall be aligned, leveled and grouted in position as per approved drawings. Wherever the base channels are not available, the same shall be fabricated, erected and painted at site. The material for this shall be supplied by BHEL. Base channels shall be grouted on the opening of the floor. All minor concrete chipping and finishing works are deemed to be included in the scope of the job.

If base frame is to be fabricated/ erected, separate rate shall be paid on Tonnage basis. This is applicable for local start/stop push button box also. If any grouting bolts are required for the panel, the same shall be supplied at free of cost.

2. For the panels to be mounted on the trenches, channel supports have to be provided across the cable trenches over which the base frames of the panels shall be mounted. Fabrication and erection of these support structures and separate rate shall be paid on Tonnage basis.
3. The contractor shall set each section of equipment on its foundation or supporting structures and assemble the panels as required. Skilled manpower shall be engaged for installation of panels with parallel, horizontal and vertical alignment.
4. Panels will be delivered in different shipping sections. Necessary interconnection of busbar, inter panel wiring, etc. shall be carried out as part of panel erection.
5. Normally the panels shall be supplied with complete instrument mounting and wiring. However, if necessary, dismantling of the existing components, making minor modifications in the wiring to suit operating conditions, mounting and rewiring of new components shall be carried out without any extra cost. However, if any major wiring modification is involved inside the panel, the same shall be carried out at extra cost. Mounting and wiring of any instruments, meters, relays, push buttons, indicating lamps, contactors etc. if supplied loose for safety in transit, will also be included in the scope of the job.
6. The commissioning of Switchgear shall also involve the trial runs and commissioning of all connected equipment like servomotors and drives etc. The contractor will have to keep his people round the clock, if necessary during the trial runs and promptly take action for any repair, checks and rectification etc. required in the equipment erected by him. (Separate rate shall be paid for commissioning of associated electrical drives as per BOM).
7. The **contractor shall carryout touch up painting for panels wherever required and this includes supply of paints also.**
8. All T&P, Material handling equipment including cranes and Relay Testing/ HV Testing Calibration equipment/ Instruments shall be arranged by contractor.

9. The contractor shall calibrate and commission all switchgear/panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc with well-experienced Engineers/ Technicians.
10. MCC incomer bus shall be connected to PCC of customer. The contractor shall co-ordinate for proper connection at PCC.
11. Contractor shall co-ordinate with other cable-laying agency for proper cable termination.
12. All testing Instruments/ Equipment deployed to site shall be calibrated before putting the same into service. A copy of calibration certificate shall be submitted to BHEL Engineer for his verification and approval.
13. The contractor shall prepare all erection/ commissioning log sheets, protocols/test certificates as per field quality plan, get it signed by the concerned BHEL/ NTPC Engineer and submit the same to BHEL Engineer as per his instruction.
14. The contractor shall maintain the charged and commissioned equipment till the same is taken over by M/s NTPC.
15. If any removal/ Re-fixing of contactors/relays becomes necessary for the completion of the system, the same shall be done by the contractor at free of cost.
16. Any loose supplied items like lamps, lens, contactor, fuse/relays/instruments missed from the custody of the contractor shall be replaced by the contractor at free of cost.
17. Contractor shall put his watch and ward for the equipment under his custody and erected in location against theft and damage by other agencies working on the same area.
18. Rubber mats for switchgear shall be supplied by BHEL, and these shall be laid, wherever required, by the contractor at free of cost.
19. The contractor shall close unused opening at the panel bottom plate with suitable material in consultation with Site Engineer at free of cost.

20. Scope of work shall also cover drilling of bottom gland plates for cable entry as required.
21. Contractor shall prepare all erection/ commissioning log sheets, protocols/test certificates as per field quality plan, get it signed by the concerned BHEL/ NTPC Engineer and submit the same to BHEL Engineer as per his instruction.
22. Contractor shall close unused opening at the panel bottom plate with suitable material in consultation with Site Engineer at free of cost as part of panel erections
23. Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Variations in depth, height or weight of the panel shall not be considered for payment.
24. Any variation in length within  $\pm 20\%$  shall not be considered for payment.
25. If the panels has any variation in length beyond  $\pm 20\%$  as compared to actual length indicated in the BOQ, payment shall be considered proportional to the length of the panel only.

**26. SCOPE OF AVR AND OTHER CONTROL PANELS**

- a. The different types of Microprocessor based panels like PLC/DCS/IOS Panels, control panel etc. related to ESP are covered in the scope of work for erection and commissioning. The scope of work will be generally in line with Electrical MCC panels as detailed under clause. 6.3.1.3 These panels shall be installed in the respective control rooms.
- b. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels.
- c. If panels are supplied with monitor, printers, furniture, controller etc. or any loose items or equipments, the erection of above shall be part of respective panel. No separate rate shall be payable for loose supplied items.
- d. Normally the panels shall be supplied with instruments / modules mounted and wired. No separate payment shall be made for commissioning of any instrument/ cards/ components. If dismantling of the above such

instruments and rewiring are needed at site, the same shall be carried out at no extra cost. If any instruments/ cards/ components supplied as loose items for safe transit, the same shall be mounted and wired at no extra cost. However, if any major installation/modification/wiring are involved, the same may be carried out as extra work. The decision of BHEL engineer shall be final in respect of above extra works.

**Note:- BHEL shall provide vendors supports for proprietary type of microprocessor based instruments, protection relays which requires software loading and programmer etc. However overall responsibility lies with contractor and the contractor shall provide all supports like manpower, standard T&P, Instruments etc for calibration and commissioning of above proprietary type instruments.**

**The contractor shall carry out testing and commissioning works with their own testing equipments and testing teams and should not engage outside agency for testing. Testing shall be done under the supervision of BHEL/NTPC Engineers.**

### **6.3.2 ESP Transformer.**

All ESP transformers will be erected by the mechanical contractor. Testing and commissioning of ESP Transformer alone is covered in Electrical contractor's scope. Scope of Testing and commissioning of ESP Transformers are follows.

1. Dry out of transformers (Oil filtration) till achieving desired BDV, IR Value,
2. Calibration of oil temperature gauges, Checking of breather gauge, Buchholz relay, HV Test etc.
3. Replacing defective components like Temperature gauges, breather glass etc and attending to any defects till handing over of the unit to customer by BHEL
4. All the test equipment shall be arranged by the contractor and testing shall be done under the supervision of BHEL/NTPC Engineers.
5. Arranging suitable capacity of min 1000 litre/hour Silicon oil filtering machines.

### **6.3.3 SCOPE OF JUNCTION BOXES & PUSH BUTTON BOXES:**

1. The unit rate quoted for erection of junction boxes/push button boxes shall include providing necessary supports, drilling of bottom gland plates for cable glands as required, Painting the tag nos. of JB or fixing a separate tag plate as required on the junction boxes/push button boxes, supply of bolts ,nuts (Fasteners),for fixing of JB/PB, minor chipping, supply of grouting bolts and grouting as required for mounting of junction box/push button frames.
2. For fabrication and fixing of supports/Frame , rate shall be paid on tonnage basis.
3. The contractor shall close all unused holes on the gland plates using GROW MAT or any other suitable materials at free of cost.
4. All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.
5. **If any intermediate JBs are required to terminate power cables for drives same shall be installed. Equivalent Unit rate shall be paid for installation of such JBs. Decision of site engineer will be final regarding the equivalent rate.**
6. **Any modification like replacement of terminals, enlarging gland holes etc. that required to accommodate power cables shall be carried out as part of this works.**

### **6.3.4 SCOPE OF LAYING AND TERMINATION OF CABLES :**

1. Cable supplied shall be of LT, 1.1 KV, armoured/ unarmoured, Aluminium/ Copper PVC FRLS insulation, Power, Control and Instrumentation cables of different sizes.
2. Unit rate quoted for cable shall covers laying, termination, drilling of holes on the gland plates of the panels / JBs / PBs or Enlargement of cable entry holes by tapping or any modification required fixing of cable glands, fixing of glands, ferrules and tag plates and dressing.
3. Unit rates quoted for cabling shall also includes supply of clamping/ dressing materials such as Aluminium/GI strips or PVC ties, ferrules, tag plates apart from the work mentioned above. Supply of above material shall conform to the specification detailed in Section VII.
4. The unit rate quoted for cable laying shall also cover the following works.

- a. Modification such as rotating the terminal box through 90° or 180° as required.
  - b. Enlargement of cable entry holes, if necessary, by chipping/tapping or any modification required fixing of cable glands
  - c. Drilling of gland plates of equipment if not done already.
  - d. Reaming and relocating holes at actual point of entry of cable or conduit in terminal boxes, outlet boxes, pull boxes etc. cleaning off the debris/trapped material from conduit/ducts.
5. However any major modification like drilling, tapping etc. are involved in fixing of glands in JBs and Terminal boxes same shall be considered as extra on man hour rate basis as per extra works clause.
  6. Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.
  7. The contractor shall provide Tools/ equipment required for the connections and termination of cable wherever necessary. No separate rate shall be paid for cable terminations. For cable joining, if any, separate rate shall be considered on extra works basis.
  8. If the cables are to be laid on the angles or routed in conduit pipe as per site condition, the unit rate for erection of angles and conduit pipes shall be as per the unit quoted elsewhere in the tender.
  9. Any fabrication required at site for cable support shall be carried out at the rate quoted for fabrication.
  10. The contractor shall carry out cable dressing and clamping for all the cables laid by the contractor. However, if any other agency laid cables of lesser quantity for which no separate trays have been allotted, the contractor shall do clamping along with the cables.
  11. Wherever cable entry holes have not been provided for equipment installed by another agency, the contractor shall co-operate to get the same done.
  12. During testing and commissioning, if the equipment on which the cables are terminated not functioning, it is the responsibility of the contractor to check and establish in coordination

13. with the commissioning agencies that there is no defect in the cabling, The contractor shall promptly depute his supervisor or technicians to assist the commissioning agencies to check the interconnecting cables.
14. Contractor shall carefully plan the cutting schedule for each cable drum in consultation with Engineer such that wastage is minimized and any resultant short lengths can be used where appropriate route lengths are available.
15. Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services any such adjustment shall be done with the approval of Engineer.
16. **The approximate number of termination other than power cable for the purpose of estimation to be considered as follows:**
  1. Looping power cable (2X2.5 Sqmm) the average run length shall be considered as 10 mtrs.
  2. Control cable (1.5 Sqmm) the average run length shall be considered as 250 mtrs.
  3. pair cable (0.5 Sqmm )the average run length shall be considered as 50 mtrs.
17. Irrespective of cable schedule, i.e. whether the laying of cables are covered in Electrical cable schedule or C&I cable schedule, contractor shall lay and terminate the all the cables covered in the BOQ as per directive of site BHEL Engineers
18. **SCOPE OF CABLE TERMINATION**
  1. For all cable terminations, no. separate rate shall be paid except LT power cable.
  2. Separate rate shall be paid for Power cable termination only.
  3. The scope of termination shall also include, termination of cables on various equipment installed by others. The insulating sleeves shall be of fire resistant and be long enough to over pass conductor insulation and shall be properly sized.
  4. The work of testing and reconnecting/rearrangements of leads if required, changing of connectors, shall be carried out without additional cost

5. Contractor shall arrange all type of termination and crimping Tools/ equipments required for the connections/terminations.
6. After cable terminations, the debris shall be removed then & there
7. **Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.**

### **6.3.5 SCOPE OF CABLE TRAYS / CONDUITS/ FLEXIBLE CONDUITS.**

#### **A- CABLE TRAYS**

1. Scope of cable tray works covers erection various sizes of ladder & perforated trays with accessories such as coupler plates/fixing plates, anchor bolts, fasteners etc
2. The scope of erection shall also covers erection all type of trays and its accessories such as coupler plates/fixing plates, anchor bolts, fasteners etc, fabrication of standard tray accessories such as TEES, Reducers, Bends (vertical and Horizontal), cross etc wherever required, and making of offsets by means of cutting standard tray sections and inserting suitable size of trays to match with the existing arrangement.
3. The unit rate for erection of trays shall be on meter basis which includes erection of trays and accessories, fabrication and erection of trays accessories and modification of straight trays .
4. No separate rate shall be paid for any fabrication of trays accessories or any modification on straight trays. ..
5. If tays covers are supplied same shall be erected after completion of cable lying and no separate payment will be made for fixing these covers. GI strip clamps are to be used for fixing the tray covers.
6. Welded Joints of trays shall be painted with red lead and aluminium paint in turn with bitumen as per IS 3043. The unit rate shall also include supply of paints, thinner, other consumables and brush etc.

#### **B- RIGID & FLEXIBLE CONDUITS**

1. Cables shall normally be laid on cable trays. However, in case of shorter routes where trays are not possible, suitable GI pipe/flexible conduits shall be used. Unit rate shall be paid on running meter basis.

2. The scope of works for flexible conduit includes drilling of the holes on the plates, fixing of the end connectors, providing suitable supports and fixing tag marks wherever specified as required by BHEL. The supply of suitable clamps, fasteners and tag plates are in contractor's scope.
3. In the case of flexible conduit laying for fixing end connectors, no separate payment will be made for connectors.

### **6.3.6 SCOPE OF FABRICATION & INSTALLATION OF STEEL MATERIALS**

1. Scope of steel fabrication and installation covers, fabrication and installation of various supports that are required for flexible tray support systems, JB, Control Box/Panel, local push Buttons etc. with angles and channels of different size
2. The fabrication steel materials such as angles, channels, etc shall be supplied as standard lengths.
3. For fabrication, the rate shall be paid on tonnage basis and no separate rate shall be paid for erection of the same. i.e. the rate quoted shall include fabrication and installation. However, for earthing materials the rates shall be paid on meter basis.
4. Fabrication shall be carried out as per schemes in consultation with site engineers. Immediately after fabrication, primer shall be applied to prevent corrosion. The installation shall be carried out only after applying the primer as detailed in painting clause.
5. For fixing frames or supports if any minor grouting is required the same shall be carried out at free of cost. After installation of frames, grouting of the same is in the scope of contractor.
6. Supplies of all cement, sand etc. required for grouting of supports are in the scope of contractor.
7. All the fabricated steel materials shall be painted as per the detailed in the scope of painting clause and no separate rate shall be paid for painting.

### **6.3.7 SCOPE OF FLEXIBLE TRAY SUPPORT SYSTEMS**

1. Erection scope of Flexible GI cable Tray support system(bolting Type), consisting of single/double channels, base plates, cantilever arms and other accessories such as angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc.
2. Two different types of base plates are supplied i.e.Single channel and double channel base plates. Base plates are mostly to be welded and the welded portion is to be cleaned and coated with two coats of zinc rich primer paints, and cold galvanized paint coating or equivalent shall be applied to prevent corrosion.
3. Single channel or double channel are to be bolted to the base plate by fasteners which shall be supplied along with base plate.
4. Wherever necessary, base plate beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded on the racks or beams.
5. Different sizes of cross arms for supporting the cable tray are to be assembled on the channels.
6. Fasteners are supplied with cross arms for fastening the cross arms with the support channels and for fixing the cable trays on the cross arms.
7. Single channel is used for one side cable trays and double channel accommodates trays on both sides.
8. Depending upon the number of tiers of cable trays, suitable lengths of channel is chosen.
9. Unit rate for base plate and cross arms shall be on Nos basis and for channel on running meter basis
10. No separate unit shall be paid for fixing of accessories such as angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc and the rates shall be accommodated in the respective items mentioned in SI.No 9.
11. Channels will be supplied in standard commercial lengths and same shall be cut at site as per requirement. Cutting of channels to be carried out only by power hacksaws and Gas cutting is not allowed
12. Exposed metal portion shall be painted as per specification given in section VI.
13. No separate rate will be paid for cutting & painting.

### **6.3.8 SCOPE OF EARTHING**

1. The scope of earthing covered in this contract is above ground earthing mostly in ESP Area. Customer will provide earthing system comprising of main earthing conductor buried in soil, embedded in concrete in Power house areas. The scope covers Installation of earthing conductors and connecting equipments pertaining to the plant earth grid.
2. The contractor shall carry out earthing for all Electrical equipment which may be erected by the contractor or some other agency. Different type of earthing materials shall be supplied and the contractor shall lay and connect the earthing materials as per site requirement and as detailed in Section VII.
3. Unit rate for earthing material shall be paid on running metre basis
4. Connections to the equipments shall be bolted and the same shall be painted with anti- corrosive paint/ compound. Connection between the equipment earth lead and the grid conductor shall be welded. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint.
5. If the equipment is not available at the time of earthing conductor laying, tap connections from the main earthing conductor shall be brought out up to slab equipment foundation level with at least 200 mm spare length left for further connections to equipment earthing terminals.
6. Wherever possible and as directed by site engineers, localized internal earthing ring shall be formed and connected to the ground earthing through vertical risers.
7. All equipment shall be earthed by two separate and distinct connections. Earthing terminals will be available in all the equipment supplied by BHEL.
8. A continuous earthing conductor shall be installed in all cables trays. When two or more trays supporting power cables run on parallel, continuous earthing conductors shall be provided on one tray only with tap-offs to the control cable trays. All valve and damper motor and rapping motors will be earthed to this conductor.
9. Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/IS code of practice IS 3043-1947 and Indian Electricity Rules, so that the values of the step and contact potentials in case

of faults are kept within safe permissible limits. Parts of all electrical equipment and machinery not intended to be alive shall have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules and apparatus rated 240 V and below may have single earth connections.

### **6.3.9 SCOPE OF PAINTING:**

1. The scope of painting generally covers all steel works carried out by the contractor such as supports, racks, frames, etc. Touch up painting only is generally required for trays, control panels, junction boxes and full painting shall be required only for specific equipments as per the scope of erection.
2. The scope also includes supply of paints, primers, consumables like brushes, emery papers, thinner etc.
3. The painting shall include two coats of Red oxide primer and two coats of final synthetic enamel painting approved by BHEL.
4. No separate rate shall be paid for painting and supply of paints, and other consumables. Painting shall be accommodated in the unit rate quoted for items which calls for painting as per scope of work
5. All damaged painted surfaces shall be cleaned and coated with two (2) coats of primer followed by a finishing coat of approved colour.
6. All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
7. Unless otherwise instructed, final painting shall be carried out in the field, only after mechanical completion and completion of cable laying.
8. Paints shall be arranged from standard reputed suppliers in consultation with BHEL. All painting materials brought to site by contractor for application shall be procured directly from manufacturer as per specifications and shall be accompanied by manufacturer's test certificates.
9. The paint manufacturer's instructions shall be followed as far as practicable at all times. Particular attention shall be paid to Instructions for storage to avoid exposure as well as extremes of temperature, Surface preparation prior to painting, Mixing and thinning, Application of paints and the recommended limit on time intervals between coats.

### **6.3.10 SCOPE OF CALIBRATION:**

1. Contractor shall calibrate all the local instruments, panel mounted instruments like protection relays, transducers, Recorders, Indicators, energy meter etc that will be supplied along with equipments mounted in or in loose
2. Contractor shall calibration records as per the format CP: PEX: FOX enclosed in the tender specification.
3. All testing Instruments/ Equipment deployed for calibration shall be calibrated before taking it into service. A copy of calibration certificate shall be submitted to BHEL Engineer for his verification and approval.
4. All testing instruments shall have calibration certificate issued by recognized/accredited agencies.
5. **BHEL shall provide vendors supports for proprietary type of microprocessor based instruments, protection relays which requires software loading and programmer etc. However overall responsibility lies with contractor and Contractor shall provide all supports like manpower, standard T&P, Instruments for calibration and testing of above proprietary type instruments**
6. **If BHEL is unable provide or arrange vendor support for above mentioned proprietary instruments, contractor shall carry out the calibration through authorized agency, at extra cost. The actual cost of such calibration carried out by out side agency shall be absorbed by BHEL. However if above such calibrator is available with BHEL at site the calibration shall be carried out by the contractor at free of cost.**
7. **The contractor shall carry out calibration with their own calibration and testing equipments and testing teams and should not engage outside agency for calibration and testing. Calibration and Testing shall be done under the supervision of BHEL/NTPC Engineers.**

### **6.3.11 SCOPE OF CIVIL WORKS**

Scope of civil works covers minor civil works required for installation of push button stations, Junction Boxes, etc. including supply of grouting materials like cement, sand etc. More details regarding scope of civil works are given in the respective equipment erection.

### **6.3.12 SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY THE MECHANICAL CONTRACTOR**

#### **A- ALL TYPES OF LT DRIVES.**

- a- Cable identification, checking and meggering.
- b- IR value of motor, measurement of winding resistance etc.
- c- Dry out all the motors if required to improve IR value.
- d- Limit switch setting
- e- Checking direction of rotation of motors and testing and commissioning from local as well as remote.
- f- Attending to any defects till the handing over of the unit to customer by BHEL
- g- Replacing defective components like limit switches

#### **B - HOIST:**

All cabling will be carried out by the vendors. However the scope of works of hoist covers besides works mentioned in SI No-A, the checking of control panels wiring, field wiring like push button, motors, and limit switch etc., fixing of Trailing cables, and making ready for load test by mechanical agency.

### **6.3.13 SCOPE OF ASH LEVEL INDICATOR:**

1. Scope of Ash level indicator consists of erection of transmitters (electronic unit), PTF wires, probes (for high and low level sensing), flexible conduits etc. All PTF cables shall be routed through ¾" GI flexible conduits.
2. The unit rate quoted for each set consists of erection of transmitters (electronic units), fixing of probes, laying and termination of PTF cables through conduits, clamping of flexible conduits etc. The unit rate also covers supply of metallic clamps, lugs etc. Lumpsum rate shall be quoted for each set and no separate payment shall be made against erection of any individual item.
- 3 If any mounting frames are required for insulation of transmitters same shall be carried out on tonnage basis as applicable for other fabrication and erection.

#### **6.3.14 SCOPE OF HEATING ELEMENTS:**

1. Two types of heating elements shall be supplied (panel type and standard heating elements)
2. All heating elements shall be fixed by the mechanical contractor.
3. The panel type heating elements shall be supplied with extension cables and flexible conduits. Unit rate quoted for panel type heating element includes routing the extension cables through flexible conduits, dressing, terminations and checking of the heating elements.
4. Unit rate quoted for thermostat and other standard heating elements covers only checking of elements/thermostat.

#### **6.3.15 SCOPE OF OPACITY MONITORS**

Opacity Monitoring System, OMS, consisting of 1 No. measuring head, 1 No. Local Control Unit, 1 No. Reflector, 1 No. Air Blower with hose, 2 Nos. Fail Safe Shutters, 1 No. Field Termination Box, interconnecting cables, mounting accessories etc. Approximate Weight: 200 kg. The scope works covers shall include installation of all loose items which are not explicitly mentioned, but comes as part of the system, integration of total system and commissioning. No separate rate shall be payable for loose items including furniture. The quantities of loose supplied items are approximate only. No proportional rate will be applicable for any variation in quantity or for any additional items supplied as part of equipments. Unit rate quoted shall be on lumpsum basis.

#### **6.3.16 SCOPE OF PRE-COMMISSIONING/ COMMISSIONING AND POST COMMISSIONING:**

- 1 The scope of commissioning works covers commissioning of all Electrical instruments/equipments/systems covered in the BOQ including loop checking and establishing the operation of instruments/equipments/systems to meet plant commissioning/operation. BHEL will provide vendor supports for special or proprietary type instruments/systems and contractor engineers/supervisors shall associate with the vendors and provide necessary manpower, T&P etc. The contractor shall be responsible for overall commissioning of all the Electrical systems covered in the BOQ.

2 Scope of commissioning starts with the commissioning of various equipment/ instruments/ systems erected by the contractor and making them available, as required, for the various commissioning activities of the main plants. The commissioning activities of the main plant shall be as below:

- a. Trial run of various equipment.
- b. Light up of boiler.
- c. Boiler acid cleaning.
- d. Boiler alkali boil out.
- e. Turbine barring gear.
- f. Steam blowing of piping.
- g. Turbine rolling.
- h. Safety valve floating.
- i. First synchronization of unit.
- j. Heavy oil firing and synchronization.
- k. Coal firing of boiler.
- l. Full load operation of unit.

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

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

3 The pre commissioning activities of the main power plant will start with run of various equipments prior to light up of boiler and commissioning operations shall continue till the unit is handed over to customer. The contractor shall simultaneously start commissioning activities for the equipment erected to match with the various milestone activities of commissioning programme of the project.

- 4 Contractor shall arrange specialized commissioning engineers, supervisors, electricians, and instrument mechanics in each area to be associated with BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted. It shall be specifically noted that above employees of the contractor may have to work round the clock along with BHEL commissioning engineers involving considerable payment of overtime, which forms part of Contractors Scope
- 5 The mobilization of these commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools and tackles with BHEL engineer and arrange for the same.
- 6 If at any time the requisite manpower, consumables, T & P are not arranged by the contractor to meet the schedule, BHEL shall make alternate arrangements and recover the cost with overhead from the running bills of the contractor.
- 7 After erection of various equipment prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers.
- 8 In case any rework/repair/rectification/modification/fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost. If during commissioning, any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.
- 9 During commissioning activities and carrying out various tests, if any of the instruments has to be temporarily erected and commissioned to suit the commissioning activities, the contractor have to carry out the erection of the same. After completion of activities the temporary systems have to be removed and returned to stores and no extra rate shall be paid for this.

- 10 Minimum requirement of Man Power for commissioning works per unit shall be as follows:

<b>Engineer Electrical</b>	3 Nos.
<b>Supervisor</b>	6 Nos.
<b>Technician (C&amp;I/ Elec)</b>	10 Nos.

- 11 The above commissioning group shall be identified at the Pre-commissioning and commissioning time. The above commissioning group shall have the knowledge of various systems referred in the tender and also should have adequate experience. The above manpower for commissioning is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor.
- 12 If the contractor fails to deploy the above Engineer/Supervisor/ Technician at appropriate time of commissioning, no payment shall be made against commissioning activities as per terms of payment.
- 13 All the T&P instruments required for commissioning are to be arranged by the contractor. (However, any special instruments, which are of proprietary nature, shall be arranged by BHEL.)
- 14 It shall be the responsibility of the contractor to arrange and complete all the testing, pre-commissioning and commissioning activities for the particular equipment as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. All the above will be witnessed by the BHEL engineers and reports signed shortly. Contractor shall follow checklist of BHEL and testing & commissioning activities shall be carried out in accordance with the checklist.
- 15 The scope of commissioning shall also cover the commissioning of the equipment/drives erected by the mechanical contractors. (as detailed in the BOQ)

#### **6.4.0 TIME SCHEDULE**

- 1 The contractor shall mobilize his resources and work force within two weeks from the date of telegraphic LOI in such a manner that the entire Eetical work covered in his scope is completed to match the following commissioning programme.
  - Unit 1 shall be started by Apr -07 and completed by Dec-07 with Trial operation completion
  - Unit 2 shall be completed by Aug-08 with trial operation completion
  - Unit 3 shall be completed by Nov-08 with trial operation completion

2. The above time schedule is only indicative. Depending up on the availability of work front, works can be taken up.
3. BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule. Contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.
4. The contractor shall 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 shall be recorded in measurement book while entering the first RA bill.
5. Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the monthly progress and keep up the schedules.
6. Contractor shall draw the monthly erection programme along with BHEL engineer indicating the work to be achieved and events 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 planned percentage shall take into consideration the material available at site before the start of the month and also any material received during the month. Contractor shall mobilize his resources required to achieve the monthly programmes.
7. The work under this scope of contract is deemed to be completed in all respects only when all the items/materials/equipment is erected and trial runs, testing and commissioning the equipment are completed. The decision of BHEL in this respect shall be final and binding with the contractor.

## **CONTRACT PERIOD**

8. The total contract period for completion entire work shall be 20 months from the start of erection activity. The contractor shall complete all the works in the scope of this contract within this period. The date of start of erection work at site shall only be considered as commencement of contract period and shall be certified by BHEL.

### **GRACE PERIOD**

9. Grace period of THREE months beyond the contract period of 20 months is provided for this contract.

### **CONTRACT EXTENSION**

10. If the completion of work as detailed in these specification gets delayed beyond the end of contract period and grace period for the reason not attributable to the contractor then depending on the balance work left out, BHEL at its discretion may extend the contract.
11. A joint programme shall be drawn for the work to be completed during the extended contract period. .
12. During the tenure of contract, if BHEL is not satisfied with the progress of work, BHEL have the right to withdraw any portion of work / balance work and get the same done either directly employing their own personnel or through other agency at the risk & cost of the Contractor. The contractor shall not be entitled for any compensation whatsoever in this regard.

## **6.5.0 OVER RUN CHARGES**

1. In case due to reasons not attributable to the contractor, the work gets delayed and completion time gets extended beyond 20 (twenty) months from the date of commencement of the work, the contractor shall not be entitled for any over run compensation (ORC) for a period of First THREE months after the expiry of 20 months. In case ORC arise the same will apply @ Rs.40,000/- (Rupees Forty thousand only) per month for extension to the completion period beyond 23(20+3) months as stated above duly taking into account the balance work at the end of that period.
2. The period of over run will have to be ascertained before the commencement of grace period

3. During the period of over run targets will be fixed on month to month basis, which have to be adhered. In case of any shortfall due to the reasons attributable to the contractor, ORC amount will be proportionately reduced.
4. The payment of over run charges for extended stay for reasons not attributable to contractor will be subject to achieving the monthly programme of work as mutually agreed upon during the extended stay.

#### **6.6.0 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:**

- 1 For all payment purposes, measurement shall be made on the basis of the execution of drawings/physical measurements. Physical measurements shall be made by the contractor in the presence of the Engineer.
- 2 The measurement for cable, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.
- 3 All the surplus, scrap and serviceable materials, out of the quantity issued to the contractor shall be returned to BHEL in good condition and as directed by the engineer.
- 4 All materials returned to stores should carry an aluminium tag indicating the size and type. More than 5 metres length termed as serviceable material and shall be returned size wise and category wise to the owner's stores/yard. Cable of serviceable length being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum(s) shall be noted and certified by the Engineer-in-charge. This shall be applicable only for the purpose of accounting the cables issued for installation.
- 5 While carrying out material appropriation with contractor, all the above points will be taken into account. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity(ies) will be taken as the net quantity(ies) issued to the contractor. Material appropriation shall be done and allowable scrap quantity calculated as per wastage allowance specified in Section VII. Any scrap/wastage generated by the contractor in excess of the allowable percentage shall be charged at the rates decided by the Engineer whose decision shall be final and binding on the contractor.
- 6 For all site-fabricated steel items such as supports, racks, frames, Canopy etc. physical measurement shall be made and then converted to tonnage. For steel material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.

- 7 Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard proforma prescribed for this purpose by the site in charge.
- 8 The wastage allowances as permissible for various items are indicated in Section VII. Cutting and wastage allowance shall be computed on the lengths and weight of materials actually used, measured and accepted.
- 9 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
a.	Fabrication steel	2
b.	Each size of power cables	1
c.	Each size of control/Inst cables	2
d.	Trays	1

- 10 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.
- 11 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.
- 12 The cable take off from drums shall be planned strategically such that jointing in the run of cables and wastage are avoided. for this purpose the exact route length between various equipment/panels as per the cable schedule shall be measured and the route length recorded before laying of the cables Depending upon the route length the type of cable required for various destinations, the cable drums shall be suitably selected for cable laying. Any jointing which may be approved by the engineer all the cut pieces/bits of cables which are not used/unused shall be returned to the purchaser for accounting towards wastage. The cables damaged by the contractor shall have to be replaced by the contractor at his own cost.

**NOTE:**

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

Non - Salvageable scrap means the lengths of tubes, pipes, multicore cables, cables etc., and they are from cut-pieces of tubes, pipes, multicore cables, cables etc., that cannot be used at all one time or other.

#### **6.7.0 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS**

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

### **6.8.0 TOOLS AND PLANT TO BE ARRANGED BY THE CONTRACTOR**

1. Equipment, vehicles, tools and plants and materials brought to site by the contractor from his resources shall have distinctive identification marks and the contractor shall intimate the description and quantity to BHEL in writing.
2. All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without extra cost necessary enclosures containers and protective materials for proper storage of materials inside, whenever so instructed by the purchaser without any extra cost.
3. No material or equipment or tools etc. shall be taken out of the work-site without the written consent of BHEL.
4. BHEL shall not be responsible for the safety and protection of the materials of the contractor and the contractor shall make his arrangements for proper watch and ward for his materials.
5. Until such time the work is taken over by BHEL, the contractor shall be responsible for proper protection including proper fencing, guarding, lighting, flagging, watching. The contractor shall during the progress of work properly cover up and protect any part of the work liable to damage by exposure to the weather and shall take every reasonable precaution against accident or damage to the work from any cause.

### **6.9.0 STORAGE:**

1. The equipment should be preferably in its original package and should not be unpacked until absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.
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 the packing with forklift truck.
3. Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when decolorisation takes place or degenerated.
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.

5. The storage room and the equipment should be checked at regular intervals to ensure protection from termites, mould growth, condensation of water etc. which can damage the equipment.
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.
7. Packing material shall be retained if the cubicle to be repacked after inspection.
8. Sub-Assemblies
  - a. All sub-assemblies should be kept in a separate place where it is easily accessible.
  - b. Sub-assemblies should have a protective cover in case it is stored without wooden packing/case to prevent accumulation of dust. Silica gel packets should also be kept along with it.
  - c. Sub-assemblies should not be stacked one above the other.
9. Loose items (wherever applicable)

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

### **6.10.0 TERMS OF PAYMENT**

The contractor should submit his monthly on account monthly bill with all the detail required by BHEL on specified date every month covering progress of work in all respects and areas from the 25th of previous calendar month to 24th of the current month.

#### **1. LT SWITCHGEAR**

a.	Receipt, transport to erection site, assembly, checking, calibration, fixing and clamping Adjustment, Alignment, on pro rata basis and protocol signed	75%
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b.	Pre-commissioning tests, checks, and making ready for energisation pro rata basis and protocol signed	13%
c.	Completion of Pending points	2%
d.	Submission of final bills and acceptance	5%
e.	After guarantee period	5%

**2 CABLE LAYING & CABLE TERMINATION**

a.	Laying and tagging on prorata rate basis	75%
b.	After termination and dressing on prorata rate basis	13%
c.	Final bills and acceptance	5%
d.	After guarantee period	5 %
e.	Completion of Pending points	2%

**3 FABRICATION AND INSTALLATION OF STEEL MATERIAL**

a.	After fabrication and applying of primer on prorata basis	50%
b.	After installation on prorata rate basis	38%
c.	Submission of final bills and acceptance	5%
d.	After guarantee period	5 %
e.	Completion of pending points	2%

**4 CABLE TRAYS, TRAY SUPPORTS, RIGID & FLEXIBLE CONDUITS, ABOVE GROUND EARTHING**

a.	After satisfactory completion of work on prorata rate basis	75%
b.	After completing drawing wise on prorata rate basis	13%
c.	On submission of final bills and acceptance	5 %
d.	After guarantee period	5 %
e.	Completion of pending points	2%

**5 ESP TRANSFORMERS**

a.	Oil filtration and satisfactory BDV checking on prorata basis	50%
b.	Pre commissioning checks, tests, calibration on prorata basis	25%
c.	Energisation and commissioning on prorata basis	13 %
d.	On submission of final bills and acceptance	5 %
e.	After guarantee period	5 %

f	Completion of pending points	2%
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**6 OTHER ITEMS WHICH ARE NOT COVERED IN THE ABOVE TERMS OF PAYMENT, THE PAYMENT SHALL BE MADE AS UNDER**

a.	75% of the accepted rate for the respective item of work on prorata basis on satisfactory completion of work.
b.	15% of the accepted rate on commissioning of the system.
c.	5 % on submission and passing of final bills
d.	5% after guarantee period.

5% of guarantee money will be released 12 months from the date of handing over of work to Customer or 6 months from the date of first synchronization, whichever is earlier. However, the above guarantee amount shall be released against submission of bank guarantee for an equivalent amount from a nationalized/scheduled bank in the prescribed Performa of BHEL.

**6.11.0 IMPORTANT CONDITIONS FOR PAYMENT**

It may be noted that the first running bill will be released only on production of the following.

- a. PF Registration No.
- b. Labour License No.
- c. Workmen Insurance Policy No.
- d. Un qualified acceptance for detailed LOI
- e. Initial 50% security deposit
- f. Rs 100 /= ( Rs One hundred only ) stamp paper for preparation of contract agreement

**6.12.0 GUARANTEE**

1. All the works executed by the contractor including supplies are to be guaranteed for a period of 12 months from the date of taking over of the work. The contractor shall be responsible for the quality of workmanship and shall guarantee the work done, shall rectify/replace at free of cost all defects due to faulty supply/erection and commissioning during the guarantee period.

2. In the event of contractor failing to replace/repair the defective supplies/works within the time required BHEL may proceed to undertake the replacement/repairs of such defective supplies/works at the contractor's risk and cost without prejudice to any other points/right.

**6.13.0 MATERIALS/CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR FOR ERECTION AND COMMISSIONING AS PART OF THE SCOPE AT FREE OF COST**

1. Welding electrodes, gas for steel fabrication
2. Provision for Temporary Scaffoldings.
3. "U" Clamps with nuts and washers for GI pipe clamping.
4. Tags- Plates.
5. Insulation tape.
6. Hole tight/Bitumen tape for GI pipe coupling.
7. Paints required for primer coating and final synthetic enamel coating and for protective coating.
8. Solder wire ( Lead ) -(60/40)
9. Protocol/Calibration report sheets as per BHEL Format.
10. Panel Sealing compound material (for cable entry from bottom/Top of Panel).
11. PVC cable tie, Aluminum or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing.(if any cabling works carried out)
12. Ferrules for cables(if any cabling works carried out)
13. Fasteners required for fixing of push button and Junction boxes etc.
14. Chromate for Junction boxes/Push button.

**6.14.0 PRICE ESCALATION**

1. The finally accepted rates for scope of work as defined in this tender are subjected to price escalation provisions as per the following formulae.
  - a.  $P1 = 0.75 \times P0 (F1-F0)/F0$   
Applicable even if F1 is lesser than FO ( price reduction as applicable )
  - b. P1 = Increase in billing amount as per the escalation formulae for the particular month of billing
  - c. P0 = Billing amount calculated on the accepted contract rate

- d. F1 = New All India Consumer Price Index published by Labour Bureau, Simla. Government of India for Industrial workers (Base 2001 - 100) applicable for the month of commencement of work.
  - e. F0 = All India Consumer Price Index published by Labour Bureau, Simla Government of India for Industrial workers (Base 2001- 100) applicable for the months under consideration.
- 2. Price escalation as per above formula will be calculated and paid on the total contract value (excluding payments towards extra works and overrun, if any), on month to month basis. BHEL however reserves the right to freeze escalation for that such of duration of delays, from time to time, which are entirely attributable to the contractor.
  - 3. With the provision of price escalation as per the above clauses no claim/compensation on account of any increase whatsoever, (irrespective of whether escalation are steep/ unanticipated or not compensated by the above escalation provisions in full towards minimum wages, consumables, electrodes gases or any other items/reason) will be payable during the entire period of execution.
  - 4. PVC is restricted to 10% of the contract value .PVC is **not payable** for 10% of the following events:
    - 1. For submission of final bill : 5%
    - 2. For Guarantee period : 5%

#### **6.15.0 ELECTRICAL INSPECTORATE'S APPROVAL:**

- 1. All electrical installation covered in contractors scope which also includes equipments covered in commissioning assistance are to be inspected/approved by the electrical inspector/statutory authority . It will be overall responsibility of the contractor to obtain the statutory clearance .Contractor shall be responsible arrange the following:
  - a. Completion certificate for all the equipment covered in the contract
  - b. Copy of Test results conducted at site for all the equipment including Electric Equipment erected by Mechanical Contractor.
  - c. All other documents as required by statutory authority.

2. Contractor shall carry out the modifications/rectifications if any as suggested by the authority at his cost. However, it is not applicable for equipment erected by Mechanical contractor.
3. Contractor shall also have valid electrical installation license on his company as well as for individuals acceptable to respective state electrical inspectorate requirement. BHEL shall pay other fee if any (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES, ETC). However any expenditure related to documentation shall be borne by contractor.

#### **6.16.0 PROGRESS AND MONITORING OF WORK**

1. It is the responsibility of the contractor to provide all relevant information on a regular basis regarding erection progress, labour availability, equipment deployment, testing, etc.
2. The contractor shall submit daily, weekly and monthly progress reports, manpower reports, material reports, equipment reports etc. as per formats specified by BHEL. The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions by which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan and the slippages do not accumulate and affect the overall programme.
3. The progress reports shall reflect actual progress achieved during the month and shall be submitted to BHEL, so that slippages can be observed and necessary action taken in order to ensure that the situation does not get out of control. The contractor shall update the construction schedule forming part of this contract each month.
4. If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the project schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.
5. In addition a weekly / fortnightly progress meeting will be held at BHEL site office for coordinating job progress and all agreements reached there shall be maintained.
6. Wherever erection sequences are furnished by BHEL, the contractor shall follow the same sequence.

7. The contractor shall submit daily report of the number of men on the job category-wise, showing where men are working, type of work being performed by area or system as required by BHEL

#### **6.17.0 INSPECTION OF WORKS**

1. BHEL/Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer.
2. Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

#### **6.18.0 EXTRA CHARGES FOR MODIFICATION AND RECTIFICATION WORK**

1. BHEL may consider payment for extra works on man day basis for such of those works which require major revamping / rework / rectification / modification which is totally unusual to normal erection or commissioning work which are not due to contractor's faulty erection.
2. The decision of BHEL in this regard shall be final and binding on the contractor. The contractor may submit his work claim bills specifically agreed by BHEL Engineer along with the labour sheet duly certified by BHEL engineer at site. But BHEL also got the option to get those work done through other agencies if they so desire.

3. All the extra work, if any, carried out should be done by a separate gang which should be identified prior to start of work for certification, of man hours. Daily labour sheets should be maintained and should be signed by contractor's representative and BHEL Engineer. Signing of the labour sheets does not necessarily mean the acceptance of extra works. Only those works which are identified as not usual to normal erection and certified so by the Project Manager and accepted by designers/supplier or competent authority only will be considered for payment.
4. The decision of BHEL in this regard shall be final and binding on the contractor.
5. The following man hour rates will be applicable for modification/rectification work.
  - a. Average single manhour rate including overtime if any, supervision, use of tools and tackles and other site expenses and incidentals, including consumables for carrying out any rework revamping as may arise during the course of erection – Rs. 40/- per man hour.
  - b. Average single man hour rate including overtime if any, supervision, use of tools and tackles and other site expenses and incidentals excluding consumables for carrying out any rework/revamping as may arise during the course of erection – Rs. 25/- per man hour.
6. Extra works are broadly defined as below:
7. Design changes which will be intimated the contractor after the start of the work which calls for dismantling of the erected components, rectification, modification, etc.
8. Modification, rectification of erection wrongly erected /fabricated at site as per drawing subject to acceptance by approving authority.
9. Jobs which require major modification, major repair, major reworks etc which will be identified as major and warrant extra, payment, certified as such by the Project Manager and accepted by the designers/competent authority of BHEL.
10. However prior to carryout the repair/rework administrative approval with the estimate to be obtained by Site.
11. The decision of BHEL in this regard shall be final and binding on the contractor.

### **6.19.0 REPORTING DAMAGES AND CARRYING OUT REPAIRS**

1. Checking all components/equipments at siding/site and reporting to transport and/or insurance authorities of any damages/losses will be by BHEL.
2. Contractor shall render all help to BHEL in inspection including handling, re-stacking etc, assessing and preparing estimates for repairs of components damaged during transit, storage and erection, commissioning and preparing estimates for fabrication of materials lost/damaged during transit, storage and erection. Contractor shall help BHEL to furnish all the data required by railways, insurance company or their surveyors.
3. Contractor, shall report to BHEL in writing any damages to equipments/components on receipt, storing, and during drawl of the materials from stores, in transit to site and unloading at place of work and during erection and commissioning. The above report shall be as prescribed by BHEL site management. Any consequential loss arising out of non-compliance of this stipulation will be borne by contractor.

### **6.20.0 SPLITTING OF THE WORK**

1. BHEL also reserves the right to split up work of this tender specification and award the same to more than one contractor on each unit basis or in any other fashion and deemed fit.
2. The terminal points, decided by BHEL is final and binding on the contractor for effecting payment for the work done or distributing and work in case of splitting the work among more than one contract.

### **6.21.0 FORECLOSING THE CONTRACT**

1. BHEL at its discretion may foreclose the contract at any time after the completion of contract period from the date of starting the work at site.
2. In case it is decided to withdraw any portion of work or foreclose the contract, the percentage value of the work withdrawn/left over shall be determined mutually. BHEL engineer's decision in regard to status of an item shall be final and binding on the contractor.
3. The date of completion of work for the purpose of guarantee vide clause 2.3 of General Conditions will be the date on which the contract is foreclosed.

## **6.22.0 TAXES**

1. Notwithstanding the fact that this is only an erection service contract not involving any transfer of materials whatsoever and not attracting any sales tax liability, being labour oriented job work, for the purpose of Sales Tax the contractor has to maintain the complete data relating to the expenditure incurred towards wages etc. in respect of the staff/workers employed for this work as also details of purchase of materials like consumables, spares etc., inter alia indicating the name of the supplier, address and ST Registration No. and ST paid and should furnish to BHEL at the year end.
2. The contractor has to register under local Sales Tax-Law and get assessed. The contractor has to give a certificate each year that the returns and submitted regularly and the turnover on this contract is included in his sales tax return. The sales tax registration number and certificate is to be furnished at site soon after the award of contract. However in case delay is anticipated in obtaining S.T. Regn. No. a copy of application for registration filed with ST Authorities shall be submitted along with first running bill and the ST Regn. No. will be submitted within a reasonable time.
3. The final bill amount would be paid only after submission of proof of inclusion of the turnover of this contract in the ST Returns or ST Clearance certificate. The ST deduction at source will be made from running bills, unless necessary exemption is produced.

### **4. SERVICE TAX**

Service tax as applicable to this contract shall be reimbursed by BHEL at the rate applicable as per Service Tax Act / Rules. You may claim the service tax in your RA bills and the same will be paid by BHEL. You may claim service tax in the first running bill along with copy of service tax registration certificate. Proof of remittance of service tax by you to the service tax authorities, relating to previous RA bill, has to be produced from the second RA bill onwards.

### **TAXES , DUTIES LEVIES**

Refer to clause 2.8.4 of General Conditions of Contract in this regard.

### **New Levies / Taxes**

Incase the Government imposes any new levy / Tax after award of the work, BHEL shall reimburse the same at actuals on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / Tax is applicable to this contract.

### **OTHER STATUTORY REQUIREMENTS**

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

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

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

The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act 1948, copies of Form 6-A(Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act1948 ( If applicable) to BHEL along with the Final Bill.

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

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

### **6.23.0 PROVIDENT FUND & MINIMUM WAGES**

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

### **6.24.0 MOBILIZATION ADVANCE**

No mobilization advance is payable under this tender specifications.

### **6.25.0 MANPOWER REQUIREMENT**

Manpower requirement for Erection and Commissioning shall as follows:

1. There shall be a Resident manager as Site In Charge at site, under whom there shall be 1 erection engineers for each unit .
2. Each area engineer shall be provided with minimum four supervisors and adequate number of Technicians/electricians and other erection staff and T&P etc. The testing Engineers/supervisors/electricians shall be identified separately for each package and the minimum requirement shall be as indicated. Besides, there shall be separate engineers for Planning, Safety and Quality.
3. The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.

4. All instructions from BHEL/Customer will be directed to the contractor through the Site in-Charge and he shall be responsible for all the contractor's activities at site. The contractor shall name his authorized representative prior to or immediately on commencement of operations at site
5. The Site In charge shall be present at site during all normal working hours and his contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.
6. The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed to suffer delay on this account.
7. The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of his duties the contractor shall remove them from site as directed by Site Engineer.
8. The contractor shall ensure that all his supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.
9. The contractor shall ensure that replacement for such persons removed from site are provided immediately and the work is not allowed to suffer delay on that account.

#### **6.26.0 DETAILS TO BE FURNISHED BY THE TENDERERS**

Apart from other details called for in the tender document under the various other provisions, the following details shall be submitted by the tenderers along with their offers. Please also refer the check list.

1. HQ Organization chart

2. Site Organization Chart Covering various function
3. Month wise Manpower deployment plan
4. T&P deployment plan
5. Erection Schedule.
6. Field Quality Plan
7. A copy of Electrical license

Tenderers shall go through very carefully all the provisions under section VI and shall submit manpower deployment plan as per appendix VI A. The list of T&P and instruments that are available with him for mobilization for the work, as specified in Appendix VI B, shall also be submitted by the contractor along with his offer. Tenderers shall indicate the present location and submit a schedule of tools and plants for this site to meet the schedules of erection and commissioning.

#### **6.27.0 DOCUMENTATION**

1. The following information shall be furnished within two weeks of award of contract for purchaser's approval :
  - a. Final field quality plan
  - b. Bar chart covering planned activities at site
  - c. Detailed organization chart
2. The following information shall be furnished after testing and inspection :
  - a. Test certificates of various tests conducted at site.
  - b. As built drawings: After successful completion, testing and commissioning of installation work, the above listed Purchaser's drawings/documents shall be updated in line with the actual work carried out and as built drawings/documents shall be submitted by the contractor as agreed for the project.

## **6.28.0 TOOLS AND PLANT TO BE ARRANGED BY THE CONTRACTOR**

1. Equipment, vehicles, tools and plants and materials brought to site by the contractor from his resources shall have distinctive identification marks and the description and quantity shall be intimated to BHEL in writing by the contractor.
2. All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without extra cost necessary enclosures containers and protective materials for proper storage of materials inside, whenever so instructed by the purchaser without any extra cost.
3. No material or equipment or tools etc. shall be taken out of the work-site without the written consent of BHEL.
4. BHEL shall not be responsible for the safety and protection of the materials of the contractor and the contractor shall make his arrangements for proper watch and ward for his materials. Until such time the work is taken over by BHEL, the contractor shall be responsible for proper protection including proper fencing, guarding, lighting, flagging, watching. The contractor shall during the progress of work properly cover up and protect any part of the work liable to damage by exposure to the weather and shall take every reasonable precaution against accident or damage to the work from any cause

## **6.29.0 EQUIPMENT FOR TESTING & COMMISSIONING:**

The following testing equipment/T&P shall be brought to site by contractor in sufficient number to carryout the job simultaneously in more than one area.

- a) Insulation tester :
  - i) Motorised megger - 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohms
  - ii) Hand operated megger - 0.5 KV/1.0 KV/2.5 KV, 200 - 100 M ohm
- b) Earth resistance tester 0 to 1, 10, 100 ohms
- d) Torque wrench
- e) Voltmeter ac 0 - 125 - 250 - 625 V ac
- f) Ammeter ac 0 - 2A - 10A ac.
- g) Wattmeter - ac/dc - 0 - 125 - 250 V 0-5-10A.

- h) Multimeter - analogue : acV 2.5V - 2500V, ac A - 100 mA - 10 A  
dc V 25.V - 2500V, dc A - 50mA - 10A  
Resistance - 0 - 200 M ohms  
digital : voltages ac & dc - 100mv - 1000 V  
current 10-mA - 10A Resistance - 0-20 M ohms
- i) Variac - 1 phase - 5A, 15A 3 phase - 10A, 20A.
- j) Secondary injection kit - 0-5A.
- k) HV Test kit - 50 KV AC 400kVA.
- l) Wheat stone bridge - 0.05 m ohm - 100 ohm.
- m) Oscilloscope
- n) Air compressor.
- o) Silicon oil filtering machine of 1000 LPH capacity.
- p) Phase sequence meter - 110V - 450V - 25 to 65Hz.
- q) Frequency meter - 0 - 115 - 230 - 4500 - 45 - 601/s.
- r) Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A.
- s) Tachometer etc.
- t) mA Source
- u) Temperature oil bath
- v) Ferrules printer
- w) Micro ohm meter for contact resistance measurement of circuit breakers
- x) Event recorder for measurement of closing and opening times at micro second accuracy.

### 6.30.0 ACCURACY REQUIREMENT OF TESTING INSTRUMENTS

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY
1	Power Pack	0 to 50V DC, 3A	$\pm 2\%$
2	Analog Multimeter	Voltage 2.5 to 2500V AC	$\pm 1.0\%$
		Current 100 mA to 10A AC	$\pm 2.0\%$
		Current 250 micro A to 1A DC	$\pm 1.5\%$

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY
		Resistance upto 100 ohms	$\pm 3.0\%$
		Voltage 2.5V to 2500V DC	$\pm 1\%$
3	Digital Multimeter	Voltage 200mV to 1000 V DC	$\pm 1\%$ + 1 digit
		Philips Voltage 200mV to 1000 V AC	$\pm 1\%$ + 1 digit
		Hcl Current 200mA to 20 A AC	$\pm 0.8\%$ + 1 digit
		Philips Current 20 mA to 20 A AC	$\pm 0.8\%$ + 1 digit
		Resistance (Hcl) 2120 200* to 200M*	$\pm 0.5\%$ + 1 digit
		Resistance (Hcl) 2105 200* to 200M*	$\pm 0.25\%$ + 1 digit
		Hcl Voltage 200mA to 750 V	$\pm 0.8\%$ + 1 digit
		Philips Current 20 mA to 20 A DC	$\pm 0.5\%$ + 1 digit
		Hcl Current 200 mA to 010 A AC	$\pm 1\%$ + 1 digit
4	Vibration Measuring Equipments	Velocity upto 50 mm/sec.	$\pm 0.5\%$ mm/sec
		Displacement upto 300 microns	$\pm 2$ microns
5	Secondary Injection Kit	Upto 5A	$\pm 0.5\text{mA}$
6	Motor operated Megger	Upto 200 Ohms	$\pm 5\%$ at Centre scale
7	Tongue tester	0/300/600A AC	$\pm 5\%$
		0 to 300A DC	$\pm 5\%$
8	Tachometer (Hand held)	0 to 4000 rpm	$\pm 5\%$
9	Phase Sequence Meter		N/A
10	Three Phase Variac	15 A Capacity	N/A
11	Feeler gauges	300 mm long and 100 mm long	$\pm 2$ microns
12	Dial gauges	Q	$\pm 0.01$ mm

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY
13	Hand operated Megger 500 V / 1000V	Upto 200 M Ohms	$\pm 5\%$ at Centre Scale $\pm 10\%$ at end of Scale
14	Motorised Megger 2.5 KV	Upto 200 M Ohms	$\pm 5\%$ at Centre Scale $\pm 10\%$ at end of Scale
15	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	$\pm 5\%$ at Centre Scale range
16	AC tongue Tester	0 to 300A AC	$\pm 3\%$
17	DC Tongue Tester	0 to 300A DC	$\pm 5\%$
18	High Voltage test Kit	Upto 50 KV AC	$\pm 10\%$
		Upto 70 KV DC	$\pm 10\%$
19	Tacho Generator (Mech)	0 to 4000 rpm	$\pm 0.25\%$
20	DC Ammeter	0 to 300 A	$\pm 10\%$
21	DC Voltmeter	0 to 500 V	$\pm 10\%$

**Note for Contractors' Instruments**

- a. The contractor shall arrange all the above. T&P, equipment and instruments as indicated except testing instruments which are proprietary in nature.
- b. The contractor at his cost shall arrange all cranes and truck/tractor, trailers required for material handling purpose and also cranes required for erection. If contractor requires any equipments other than what is mentioned as free issues from BHEL same can be hired from BHEL on chargeable basis subject to availability.
- c. Any other tools and plants instruments and equipment required in addition to the above for the successful completion of this job will have to be arranged by the contractor at his cost.
- d. Necessary accessories for the above shall also be provided by the contractor.

- e. The above instruments/equipment will be sent for testing and calibration wherever from time to time and maintained by contractor as required by BHEL.
- f. All testing instruments shall have calibration certificate issued by recognized/accredited agencies.
- g. List of such agencies and periodicity of calibration required for different instruments will be furnished by BHEL at site.
- h. Contractor shall maintain calibration records as per the format CP:FE:FOZ enclosed in the Tender Specification and produce them whenever called for by BHEL Engineers.
- i. Contractors shall arrange experienced/qualified persons for using these calibration instruments at laboratory and also at work spot.
- j. Wherever frequent calibration is required, contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments.

**6.31.0 TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS AS APPLICABLE.**

**1. CABLE LUGS:**

a)	Type:	Solderless crimping type
b)	Material	Copper / Aluminium
c)	Whether tinning required (For copper cable lugs)	Yes.
d)	Thickness of tinning:	10 microns
e)	Applicable Standard for LT Cables	IS:8309

**2. FERRULES:**

a)	Colour of ferrules:	Yellow/White
b)	Colour of engraving	Black

3. **TAGS:**

a)	Material :	Al/Fiberglass/ Stainless Steel
b)	Markings:	Engraving/Embossing/Printing

**APPENDIX - VI A**

**MONTHWISE MANPOWER DEPLOYMENT ( NUMBER TO BE INDICATED  
CATEGORYWISE IN EACH MONTH ) BY THE CONTRACTOR**

S.NO	CATEGORY	MONTHS
		1 2 3 4 5 6 7 8 AND SO ON .....
01	Resident Manager	
02	Engineers	
03	Supervisors	
	a. Mechanical	
	b. Electrical	
	c. Industrial Relations/ Safety	
04	Riggers	
05	Fitters	
06	Structure Welders	
07	Electricians	
08	Store Keeper	
09	Semi skilled and unskilled workers	
10	Watchman/Security	

## NOTE

01. Minimum Number of persons to be indicated month wise.
02. Above deployment plan will be discussed with BHEL Site Engineer and necessary changes will have to be made by the contractor as per discussion. If required, any additional deployment during execution of the work will have to be arranged by the contractor for meeting various schedules/targets set by BHEL without any additional compensation.
03. Resident Engineer and Engineers should have a minimum qualification of Engineering Degree or Diploma in Engineering with 15 years of experience in Thermal Power Station.
04. Supervisor should have a minimum qualification of Diploma in Engineering or a graduate with 10 to 15 years of experience in Thermal Power Station.
05. Electrician/Technicians should have experience in Thermal Power Stations.



## NOTE

01. The list of Tools and other plants to be deployed for this project may be indicated by the tenderers separately.
  
02. Above deployment plan will be discussed with the site engineer and necessary changes will have to be made by the contractor as per discussions. If required, an additional deployment during execution of work will have to be made by the contractor for meeting various schedules/targets set by BHEL without any additional compensation.

**BHEL PS:SR**

**Format No.**

<b>CP:</b>
<b>FEX</b>

**CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS**

Name of Site :

Name of Sub-contractor :

SI.N o.	NAME OF INSTRUMENT	INSTRUMENT REGN. NO.	DATE OF		PERIODICITY OF CALIBRATION	CALIBRATION DETAILS
			ENTRY	EXIT		
						DATE OF CAL. CAL. AGENCY NEXT DUE DATE DATE OF CAL. CAL. AGENCY NEXT DUE DATE DATE OF CAL. CAL. AGENCY NEXT DUE DATE

SIGN OF SITE CIC

**SECTION VII**  
**SIPAT UNITS 1, 2 & 3 (3 X 660 MW)**  
**TECHNICAL REQUIREMENTS AND GUIDELINES FOR INSTALLATION,**  
**TESTING, COMMISSIONING AND SUPPLY ITEMS**  
**OF ESP ELECTRICAL PACKAGES**

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**7.1.0 INSTALLATION, TESTING & COMMISSIONING IN GENERAL:**

The stages of completion of various works shall be as follows:

Completion

- Equipment shall be considered to be completely erected when the following activities have been completed.
- Moving of all equipment to the respective foundations.
- Fixing of anchor bolts or tack welding as required.
- Leveling and alignment of equipment.
- Assembling of all accessories such as relays, CTs, PTs, meters, instruments etc. as described in the job specification.
- Cable laying, termination with continuity check.
- Applying of finishing coat of paint.

All the equipment shall be tested at site to know their condition and to prove suitability for required performance. The site tests and acceptance tests to be performed by contractor are detailed below.

The contractor shall be responsible for satisfactory working of complete integrated system and guaranteed performance.

## **7.2.0 SITE TESTS AND CHECKS**

### **a) General**

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

The test indicated in following pages shall be conducted after installation. All tools, accessories and required instruments shall have to be arranged by contractor. Any other test which is considered necessary by the manufacturer of the equipment, contractor or mentioned in commissioning manual has to be conducted at site.

In addition to tests on individual equipment some tests/checks are to be conducted/observed from overall system point of view. Such checks are highlighted under miscellaneous tests but these shall not be limited to as indicated and shall be finalized with consultation of client before charging of the system.

The contractor shall be responsible for satisfactory working of complete integrated system and guaranteed performance.

All checks and tests shall be conducted in the presence of client's representative and test results shall be submitted in six copies to client and one copy to Electrical Inspector. Test results shall be filled in proper proforma.

After clearance from Electrical Inspector system/equipment shall be charged in step by step method.

Based on the test results clear cut observation shall be indicated by testing engineer with regard to suitability for charging of the equipment or reasons for not charging are to be brought by the contractor.

### **b) Trial Run Test**

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

### **c) Acceptance Test**

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

#### **7.3.0 TRANSFORMERS (AS APPLICABLE FOR ESP TRANSFORMERS)**

##### **7.3.1 OIL FILLING**

The following procedure is recommended.

- (i) Close and blank the valve to isolate the conservator from main tank. Fill the oil in transformer under vacuum up to Buchholz level as per instructions given else where.
- (ii) After filling the oil in transformer and breaking the vacuum, oil can be filled in the conservator either through reactor or by drain valve.
- (iii) Remove the inspection cover (ii) provided on the side of the conservator and check the air cell assuring that it is inflated. The air must remain in fully inflated condition during oil filling operation. If the air cell is found deflated fit the inspection cover and inflate the air cell with dry air/nitrogen gas to 0.035 kg/sq.cm max . A gauge may be put by removing plug . After filling close these connections.
- (iv) Remove air release plugs provided on top of the conservator.
- (v) Slowly pump the oil through main reactor/drain valve . Temporarily stop filling operation when oil starts coming from opening after ensuring that no air bubbles come out through these air release holes. Fit the two air release plugs.
- (vi) Continue oil filling till oil start coming from air release plug stop oil after ensuring that no air bubbles come out. Fit the plug .
- vii) Now release the air pressure held inside the air cell from point and continue oil filling until magnetic oil gauge indicates 35 deg. C level.

(viii) Remove oil pump and connect air cell to breather from point . Also remove pressure gauge and put plug .

(ix) The system is now properly filled. Air release plugs are fitted in normal operation.

### **7.3.2 EQUIPMENT FOR OIL-FILLING UNDER VACUUM**

(i) High-vacuum 2 storage oil filtration plant provided with thermostat-controlled oil heaters and vacuum-proof hoses with dependent vacuum pumping system for tank evacuation. Capacity:6000 lph

(ii) Oil-storage tanks provided with silica-gel breathers and inlet/outlet valves for oil circulation. Recommended capacity 20KL

(iii) Vacuum gauges provided in filtration plant.

(iv) Equipment for measurement of electric strength (BDV) of oil - 100 kv set.

(v) Equipment for moisture content of oil.

vi) Equipment for measurement of Resistivity and Tan delta at 90 C.

vii) Transparent vacuum-proof tubes for checking of oil-level during oil filling.

ix) Valves, fitting, gaskets etc.

(x) Dry nitrogen cylinders.

### **7.3.3 COMMISSIONING**

Testing after Assembly of the ESP Transformer

After the transformer/has been assembled at site, it shall be tested in order to check that it has not been damaged during transport and assembly to such an extent that its future operation will be at risk. Regarding the performance of the test, refer to the testing method as per standards. The results of the test shall be documented.

## **COMMISSIONING CHECKS**

### **SL NO      DESCRIPTION**

1. Breather Silica gel (Blue when dry)
2. Oil in the Breather housing cup.
3. All valves for their correct opening and closing sequence, if applicable.
4. Oil level in conservator tank.
5. Release air, wherever necessary.
6. Cooling accessories (Pump motors, Fan motors etc.) for direction and O/L setting.
7. Buchholz, oil level indicator, pressure gauges, thermometer, Temp. indicators etc. , if applicable.
8. Neutral earthing.
9. Earth Resistance of Electrodes.
10. Check oil leakage for 24 hrs.
11. Calibration of OTI/WTI with hot oil.
12. IR of core to earth.
13. Die electric strength of oil PPM & Chemical analysis, specific gravity test
14. IR tests on windings to earth and between winding
15. Continuity test

### **INSULATION RESISTANCE TEST**

Sl.No      Description      Date Time in Hrs Megger (not IR Value Temp

Remarks less than 500 V)

## 1. Main Winding

- a) HV/E                      Not less
- b) LV/E                      than 1000 V
- c) HV/LV                    megger

Note :-

(1) Special care should always be taken while meggering the transformer winding to ensure that there is no leakage in the leads.

### **Oil Characteristics.**

Take necessary precaution (regarding rinsing the bottle, cleaning hand, air bubble etc) while withdrawing the samples, Each sample should be free of air bubbles and should not be tested when it is hot. The sample should satisfy IS:1866.

1. Tank Top Sample Bottom Sample
2. Cooling system Top Sample Bottom Sample
3. OLTC Divertor (each phase)

### **Tests on CT**

- 1.. Ratio
2. Polarity
3. Magnetising current
4. IR Value

### **Potential Transformer Tests**

1. IR test of primary winding by HV megger between windings
2. IR test of secondary winding by LV megger between winding and winding to earth

3. Checking of voltage ratio
4. Verification of terminal markings and polarity
5. Checking of oil level if applicable
6. Checking of continuity and IR values for cables from PT to M
7. Checking tightness of earthing connection.
8. Checking of insulator for cracks
9. Checking output on charging of the system with connected meter

### **7.5.0 LT SWITCHGEAR PANELS**

#### **1. Erection**

- 1.1 The base frames will be supplied normally along with the boards. These will have to be aligned, levelled and grouted in position as per approved drawings. Wherever the base channels are not available, the same will have to be fabricated and painted at site. Base frames shall be grouted on the openings which shall be made on the floor during the time of casting. All necessary concrete chipping and finishing works are to be completed.
- 1.2 All the panels/board shall be placed on its foundation or supporting structures and shall be assembled as required. All panels should be installed with parallel, horizontal and vertical alignment by skilled craftsmen
- 1.3 All the boards will be delivered in sections. Necessary interconnection of busbar, bolting of panels, left out panel/interpanel wiring, etc. will have to be done after assembling the panel.

#### **2. Checks during erection**

1. Layout of foundation channels.
2. Floor level covered by the panel with respect to main floor level.
3. Location and serial no. of panels.

4. Positioning of panels.
5. Verticality of switchgear panels within the limit specified.
6. Freeness of Breaker Truck and modules in housing and its manual operation.
7. Earthing of panels and breaker truck to station earth.
8. Lugs for termination of LT cables.
9. Mounting and fixing arrangements of Bus bars.
10. Tightening of Busbar jointing bolts as specified.
11. Clearance between :
  - i. Phase to Phase
  - ii. Phase to earth
12. Minimum clearance for :
  - i. Breaker, Truck and moduls withdrawal
  - ii. Distance required for maintenance work
13. Check the operation of :
  - i. Remote control
  - ii. Various required - closing / tripping / alarm / indications / interlocks
14. Installation position of insts and relays  
Operation of relays and meters by secondary injection.
15. AC/DC supplies for panel  
Final relay settings as per customer requirements.
16. Tightness of terminal connections for HT & LT connections.
17. Opening operation of breaker, manually and electrically.
18. Working of ammeters and voltmeters for their entire range and other panel mounted insts like recorder, indicator etc.

### **3 LT Switchgear tests**

1. IR test
2. Measurement of contact resistance for LT breakers
3. Test to prove inter changeability of similar parts (including breaker module
4. Testing of relays as per supplier's commissioning manual.
5. Testing and calibration of all meters.
6. Operation of all relays by secondary injection method.
7. Testing of CT polarities and CT ratio by primary injection test.
8. Measurement of kneepoint voltage and secondary resistance for CTs used for differential protection
9. IR and voltage ratio test for PTs
10. Functional test of all circuit components for each panel / feeder
11. Test to prove closing/tripping operation at minimum and maximum specified voltage in test and service position
12. Check for drawout test and service position of breakers for all feeders
13. Check for covering of all openings in the panel - check for continuity and operation of aux. contacts of breaker.

#### **7.6.0 GUIDELINES FOR CABLE LAYING**

- 1** In the plant building, substations, switchgear rooms, control rooms etc. Power and control cables shall generally be laid on cable trays installed in concrete trenches, tunnels, cable basements, cable vaults, cable shafts or along building and structures as the case may be.
- 2** In case of multicore cables of diameter upto 20 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of more than 300 mm.

- 3 Power & control cables installed along buildings and structures, ceilings, walls, etc. which are required to be protected against mechanical damage shall be taken in G.I. conduits.
- 4 GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends
- 5 In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy duty PVC pipes shall be provided.
- 6 Entry of cables through trenches/tunnels into buildings shall be by means of one of the methods indicated in drawing as applicable for different buildings.
- 7 Cables laid exposed in racks/trays and routed through trenches/tunnels/basements etc. to individual drive/control devices etc. shall be taken in embedded surface exposed rigid GI conduits and or flexible conduits unless directly terminated to the equipment in the panels located, above trenches, tunnels or basement.
- 8 All cables routed along walls or in equipment rooms shall be protected by means of laying them through GI pipes or by providing sheet metal covers upto a height of 2000 mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be of enclosed type.
- 9 Tray covers shall not be provided for the cable trays within trenches, tunnels and basements. Non-perforated type sheet steel covers shall be provided for the trays in the areas susceptible to accumulation of coal dust/atmospheric abuses etc.
- 10 Cable trays shall be supported on ISA 50x50x6mm MS/Gi brackets. Brackets shall be welded to steel plate inserts in the trenches/tunnels or supporting channel angle/inserts in other areas.
- 11 Wherever direct heat radiation exists, heat isolating barriers (subject to customers approval), for cabling system shall be adopted.
- 12 For 415V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded/exposed GI conduits or rigid PVC pipes as applicable.

- 13 If required, a few number of cables in exceptional areas may be directly buried into the earth.
- 14 Wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth as decided by Engineers.
- 15 At certain places where hazardous fumes/gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.
- 16 In corrosive atmosphere, PVC conduits shall be used for cables.
- 17 Single core cables, when pulled individually shall be taken through PVC pipes only.
- 18 Laying and installation of power, control and special cables shall generally conform to IS : 1255
- 19 The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
- 20 In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks/trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. Only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.
- 21 Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.
- 22 Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of cable. The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS 1255.
- 23 All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Tags shall be fixed at both ends of cables (both inside & outside of panel) both sides of floor/wall crossings, every 25m spacing for straight runs or as specified by Engineer for easy identification of cable.

- 24 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.
- 25 Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material.
- 26 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacing not less than one cable diameter of bigger diameter cable.
- 27 All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanised MS saddles/aluminium strips/nylon cable ties. Cables above 35mm diameter shall be clamped individually.
- 28 Control cables shall be laid touching each other and wherever required may be taken in two layers. All control cables shall be clamped with a common clamp/tie.
- 29 Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formation:
- 30 HT cables shall be laid in the top tier(s)
- 31 LT power cables to be laid in the tray(s) below the HT cable trays.
- 32 LT control cables to be laid in the Tray(s) next below to the LT power cable (trays)
- 33 Special control cables including screened control cables to be laid in the bottom most tray(s).
- 34 For vertical formations, the trays closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed. However, where there is no clear distinction of bottom/top trays, the order convenient for linking the horizontal and vertical formations shall be followed.
- 35 When it may not be possible to accommodate the cables as per the criteria indicated in the two clauses indicated above, the following rules shall override the criteria. However, prior approval of the Engineer will be required. In hierarchical order:

- 36 Control cables are mixed up with the special control cables with clear minimum gap of 100 mm between them.
- 37 LT power cables are mixed up with control cable with clear minimum gap of 150 mm between them.
- 38 LT power cables are mixed up with HT power cables with clear minimum gap of 200 mm between them.
- 39 LT power cables are mixed up with special control cables with clear minimum gap of 200 mm between them.
- 40 In case of duplicate feeders to essential loads, the respective cables shall be laid through separate raceways. Alternatively, such cables shall be laid on the opposite sides of a trench/tunnel/basement.
- 41 For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanised.
- 42 For laying cables along concrete walls, ceilings etc. The cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using raw plus and MS flat spacers of minimum 6 mm thickness.
- 43 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic scoop or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.
- 44 No single core cable shall pass through a GI conduit or duct except DC single core cables. AC single core cables shall pass through GT conduits/pipes in trefoil formation only.
- 45 In case of a 3 phase, 4 wire system, more than one single phase circuit, unless originating from the same phase shall not be taken in the same GI conduit.
- 46 Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The

sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for consideration by BHEL.

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

#### 48 SUPPORT SPACINGS & CLAMPINGS

Support spacing and clamping suitably provided and as required

#### 49 LAYING OF CABLES DIRECTLY BURIED IN GROUND

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

#### 50 SUPPORT SPACINGS & CLAMPINGS

Trefoil Clamps:	
i. Horizontal run spacing :	1000 mm (max)
ii. Vertical run spacing :	1000 mm (max)
iii Axial spacing between adjacent trefoils	Double the diameter of larger cable or 150 mm Whichever is less

#### **Other Clamps**

##### **A. Power Cables:**

##### **Above 35mm OD**

i)Horizontal runs :Individually clamped at 3000 mm Interval (max)

ii)Vertical runs : Individually clamped 3000mm intervals (max).

##### **Upto 35mm OD**

i)Horizontal runs: Collectively clamped at 3000 mm intervals (max)

ii)Vertical runs :Collectively clamped at 2000 mm interval (max)

##### **B. Control Cables:**

i)Horizontal runs :Collectively clamped at 3000 mm interval (max)

ii)Vertical runs : Collectively clamped at 3000 mm interval (max)

##### **C. Spacing for cables supported along structure/ceiling**

##### **Clamping Spacing:**

i) In horizontal runs : 750mm (max)

- ii) In vertical runs : 750mm (max)
- Spacing between cables : 30 mm (min)

**Note:**

- a. Supports shall also be provided at each bend.
- b. For any change in above spacing, prior approval of Engineer will be taken

## 51 CABLE TERMINATION AND JOINTING

1. When the equipment are provided with undrilled gland plates for cable/conduit entry into the equipment, drilling and cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site and drawings shall be prepared and take engineer's approval before drilling holes. Cutting shall not be allowed.
2. Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the contractor. Looping of cores/wires at terminals as shown in interconnection diagrams is to be done.
3. All cable entries in the equipment shall be sealed after glanding the cables..
4. Adequate length of cables shall be pulled inside the switch boards, control panels, terminal boxes etc. as per near termination of each core/conductor.
5. Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals.
6. End sealing/termination of cables shall be done by means specified on the specification for terminations. The system shall be suitable for types of cable specified and complete with stress relief system.
7. Termination and jointing of aluminium/copper conductor power cables shall be done by means of compression method using compression type aluminium/tinned copper lugs.
8. Copper conductor control cables shall be terminated directly into screwed

type terminals provided in the equipment. Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.

9. Cable joints shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit, subject to BHEL's approval of Engineer shall be taken for deciding location of joint.
10. Termination and jointing shall generally conform to the requirements of IS : 1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.

## 52 TESTING OF CABLES:

- 1 The contractor shall submit to the Engineer a checklist for testing and commissioning and the activities shall be carried out in accordance with the checklist.
- 2 Testing and electrical measurement of cable installations shall conform to IS : 1255
- 3 Prior to installation, cables shall be tested for :
  - a) Continuity of conductors
  - b) Insulation resistance between conductors & earth
  - c) Insulation resistance between conductors.
- 4 After installation cables shall be tested for :
  - a) Insulation resistance between conductors & iron
  - b) Insulation resistance between conductors & earth
  - c) Conductor resistance
  - e) Capacitance between conductors & earth (for cables above 7C.1.3KV grade)
  - f) DC high voltage test (for LT power cables of higher sizes interconnecting PCCs & MCC)

- g) Absence of cross phasing
- h) Firmness of terminations.

### **7.7.0 TESTS FOR THE EQUIPMENT ERECTED BY MECHANICAL CONTRACTOR**

The tests to be carried out on the equipment at which are normally being erected by Mechanical contractor.

#### **A) AC Motors**

1. IR test of stator and rotor windings.
2. Heating of both windings upto the permissible temp.
3. Checking/testing of associated switchboard, cables, relays/meter interlockings as mentioned in relevant chapters are completed.
4. Tightness of cable connection.
5. Winding resistance measurement of stator and rotor.
6. Checking continuity of winding.
7. Checking tightness of earth connections.
8. Checking space heaters and carryout heating of winding (if required)
9. Checking direction of rotation in decoupled condition during kick start
10. Measurement of no load current for all phases
11. Measurement of temperature of body during no load and load conditions.
12. Check for tripping of motor from local/remote switches and from.
13. Checking of vibration (if required).
14. Checking of noise level (if required)

15. Measurement of stator and bearing temperatures during load running (if applicable) for every half an hour interval till saturation comes.
16. Checking operation of speed switch (if there)
17. Checking of polarisation index of stator winding, R10/R1 by motorised megger (The value should not be less than 2.0) R60/10 absorption coefficient shall not be less than 1.5.
18. Dielectric test.

#### **B ) DC Motors**

1. IR measurement and heating the winding as per heating curve.
2. Check for earth connection
3. Winding resistance for field and armature.
4. Check running of drive at minimum and maximum specified.
5. Check auto start of drive on failure of AC supply (if applicable)
6. Check operation of overload relay.
7. Measure vibration.
8. Check temperature rise on body of drive after required period of continuous running.
9. Measure load currents and no load currents (if possible)
10. Check direction of rotation.
11. Check continuity of winding.
12. Measurement of RPM.

#### **7.8.0 PAINTING**

The surface shall be free from rust, foreign adhering matters, grease etc. Two coats of rust preventing red-oxide primer and final painting of two coats as per the colour decided by the site engineer. (More details please refer Section VI scope of works). After cleaning the surface is painted with one coat of Red oxide zinc chromate primer conforming to IS 2074

and allowed to dry completely. The primer coated surface is painted with two coat of final painting of desired colour which shall be selected from IS-5.

The contractor shall paint steel fabrications at site with two (2) coats of primer followed by two (2) final coats of epoxy paint of shade 631 of IS:5 as detailed in section VI.

### **7.9.0 CODES AND STANDARDS**

7.9.1 All equipment and materials shall be designed, manufactures and tested in accordance with the latest applicable Indian Standards (IS) except where modified and/or supplimented by this specification.

7.9.2 Equipment and materials conforming to any other standard which ensures equal or better quality may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

IS           The electrical installation shall meet the requirement of Indian Electricity Rules as amended upto dates, relevant IS codes of Practice and Indian Electricity Act. In addition, other rules or regulations applicable to the work shall be followed. In case of any discrepancy, the more restrictive rule shall be binding. A list of applicable standards is given below for reference.

IS 3043     Code of practice for earthing

IS 3072     Installation and maintenance of switchgear

IS 5133     Box for enclosure of electrical equipment

IS 5216     Guide for safety procedure and practice in electrical work

IS 13947    Degree of protection provided by enclosures for low voltage switchgear and control gear.

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

IS 800 Code of practice for use of structural steel

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

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

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

#### **7.10.0 TECHNICAL REQUIREMENT FOR ITEMS SUPPLIED BY THE CONTRACTOR.**

##### **1. GENERAL**

Equipment and material supplied shall comply with description, rating, type and size as detailed in this specification, drawings and annexures.

Equipment and materials furnished shall be complete and operative in add details.

All the accessories, fittings, supports, anchor bolts etc., which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished.

All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable.

Samples of all items shall be made available for purchaser's approval prior to supply of item to site.

## **2 FERRULES**

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

## **3 TAGS**

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

## **4 FIRE STOP CABLE SEALING SYSTEM (AS APPLICABLE)**

Fire stop cable sealing system shall have two (2) hours fire protection rating suitable for sealing both vertical & horizontal cable penetrations. The sealing compound in conjunction with mineral wool shall form effective fire seals. The sealing compound shall have special property to allow for short circuit conditions. **GPG fire stop sealing compo** or equivalent sealing compound shall be used.

### **7.11.0 GUIDELINES FOR ERECTION OF GI PIPES , SUPPORTS AND ACCESSORIES**

- 7.11.1 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.
- 7.11.2 For equipment and devices having GI conduit entry arrangement other than standard GI conduit adopter, adopters shall be provided as required to enable the GI conduit to be properly terminated, between conduit end and motor T.B.
- 7.11.3 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.
- 7.11.4 The entire GI conduit system shall be firmly fastened in position. All boxes and fittings shall generally be secured independently from the GI pipes entering them.
- 7.11.5 Bends of GI pipes/conduits shall be made without causing damage to the pipes/conduits.
- 7.11.6 Occupancy of conduits shall not be greater than 40%.
- 7.11.7 The adopter for coupling rigid GI pipe/conduits and flexible conduit shall be of aluminium or galvanised steel.
- 7.11.8 Transportation and storage of cable drums  
Transportation and storage of cable drums shall generally conform to the requirements of IS : 1255
- 7.11.9 All the cables shall be supplied to the contractor free of cost from BHEL/Customer's store/storage area. Transportation of cables from storage area to the work site shall be the responsibility of the contractor.
- 7.11.10 The cable drums shall be transported on wheels to the place of work.

Note : **The test specified above for all the electrical equipment are not exhaustive. Any other pre-commissioning and field tests not**

**included in the above list but necessary as per relevant standards, Electricity rules, code of practice and instructed by the manufacturer of the equipment shall also have to be carried if deemed necessary shall be carried out as per requirement either at free of cost or at additional cost. Decision of Engineer in charge will be the final regarding additional cost for testing. The contractor shall take the full responsibility of testing, commissioning, trial run and successful operation of the equipment under overall guidance of BHEL engineer**

## DATA SHEET

### SPECIFIC TECHNICAL REQUIREMENTS

#### SUPPLY ITEMS

1. **Ferrules** : As per Section VI
2. **Tag**
  - a. **Material** : Aluminium/Fiber/Stainless Steel
  - b. **Markings** : Engraving/Embossing/Printing
  - c. **Size** : As required.
3. **Cable lugs** : Copper/Aluminium (crimping type)
4. **Wastage Allowance:**
  - support installation : 1% by weight

**SIPAT : 3 X 660 MW (UNIT 1, 2 & 3) ESP ELECTRICAL WORKS**

**DETAILED BILL OF MATERIALS WITH RELEVANT CLAUSE REFERENCE**

***Bill of Materials (BOM) contains detailed specification of various Equipments and items supplied by various BHEL Unit-wise. Scope of work specific for each item is indicated in the last column of BOM. In addition to these clauses, other common clauses like painting, calibration, Civil Work etc. (under 6.3.0) related to the work also to be referred.***

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.1.0	<b>ESP CONTROL PANELS</b>					6.3.1
B.1.1	Auxiliary Control Panel Size : 13000 x 1700 x 2450 mm Approximate Weight : 11000 kg / panel	6 Nos	6 Nos	6 Nos	18 Nos	6.3.1
B.1.2	Electronic Control Panel with BAPCON controller Size : 700 x 650 x 2,000 mm Approximate Weight : 300 kg / panel	108 Nos	108 Nos	108 Nos	324 Nos	6.3.1
B.1.3	IOS panel with stand alone PC with monitor, printers and other accessories etc. Size : 1000 x 500 x 2,050 mm Approximate Weight: 200 kg / panel	1 No	1 No	1 No	3 Nos	6.3.1

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.1.4	Rapper Control Panel- with 2 Nos Rapcon controllers Size : 1000 x 500 x 2,050 mm Approximate Weight : 200 kg / Panel	12 Nos	12 Nos	12 Nos	36 Nos	6.3.1
B.1.5	Statcon Panel- with Statcon controllers Size : 1000 x 500 x 2,050 mm Approximate Weight : 200 kg / Panel	6 Nos	6 Nos	6 Nos	18 Nos	6.3.1
B.2.0	<b>HEATING ELEMENTS</b>					6.3.14
B.2.1	Testing and Termination and dressing of Heating Elements for Hopper (Panel Type)	108 sets*	108 sets*	108 sets*	324 sets*	6.3.14
B.2.2	Testing Heating elements for support insulator heater	432 Nos	432 Nos	432 Nos	1296 Nos	6.3.14
B.2.3	Testing Heating elements for shaft insulator heater	108 Nos	108 Nos	108 Nos	324 Nos	6.3.14
B.2.4	Testing Thermostats for hopper heaters.	108 Nos	108 Nos	108 Nos	324 Nos	6.3.14
B.2.5	Testing Thermostat for support insulators	12 Nos	12 Nos	12 Nos	36 Nos	6.3.14

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.3.0	<b>JUNCTION BOXES/ LOCAL START STOP PUSH BUTTONS</b>					6.3.3
B.3.1	Local Start Stop Push Buttons (for Rapping Motors)	228 Nos	228 Nos	228 Nos	684 Nos	6.3.3
B.3.2	Junction Boxes for hopper heaters Size: 600 x 278 x 515 mm; Approximate wt: 15kg / JB	108 Nos	108 Nos	108 Nos	324 Nos	6.3.3
B.3.3	Junction Boxes for support insulator heaters,& shaft insulator heaters. Size: 450 x 150 x 300 mm; Approximate wt : 15kg / JB	36 Nos	36 Nos	36 Nos	108 Nos	6.3.3
B.3.4	Junction Boxes for start stop PB ,hopper thermostat, ALI & Opacity Monitor. Size: 250 x 150 x 400 mm; Approximate wt : 12 kg / JB	66 Nos	66 Nos	66 Nos	198Nos	6.3.3
B.4.0	<b>LT POWER CABLES ( Unarmoured )</b>					6.3.4
B.4.1	2 C X 120 sq. mm, Al	49500 Mtr	49500 Mtr	49500 Mtr	148500 Mtr	6.3.4
B.4.2	3 C X 16 sq. mm, Al	2550 Mtr	2550 Mtr	2550 Mtr	7650 Mtr	6.3.4
B.4.3	3 C X 25 sq. mm, Al	21000 Mtr	21000 Mtr	21000 Mtr	63000 Mtr	6.3.4

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.4.4	3 C X 70 sq. mm, Al	3600 Mtr	3600 Mtr	3600 Mtr	10800 Mtr	6.3.4
B.4.5	3 C X 2.5 sq.mm, Copper	46800 Mtr	46800 Mtr	46800 Mtr	140400 Mtr	6.3.4
B.4.6	2 C X 2.5 sq. mm, Copper	14250 Mtr	14250 Mtr	14250 Mtr	42750 Mtr	6.3.4
B.5.0	<b>LT CONTROL CABLES( Unarmoured )</b>					6.3.4
B.5.1	3 C X 1.5 sq.mm, Cu	27000 Mtr	27000 Mtr	27000 Mtr	81000 Mtr	6.3.4
B.5.2	10C X 1.5 sq.mm, Cu	2625 Mtr	2625 Mtr	2625 Mtr	7875 Mtr	6.3.4
B.5.3	12 C X 1.5 sq.mm, Cu	34800 Mtr	34800 Mtr	34800 Mtr	104400 Mtr	6.3.4
B.5.4	14 C X 1.5 sq.mm, Cu	14400 Mtr	14400 Mtr	14400 Mtr	43200 Mtr	6.3.4
B.5.5	LT screened copper, Unarmoured cable 4C x 1.5 sqmm.	57900 Mtr	57900 Mtr	57900 Mtr	173700 Mtr	6.3.4
B.6.0	<b>TERMINATION OF POWER CABLES</b>					6.3.4.18
B.6.1	2 C X 120 sq. mm, Al	864 Nos	864 Nos	864 Nos	2592 Nos	6.3.4.18
B.6.2	3 C X 2. 5 sq.mm, Copper	492 Nos	492 Nos	492 Nos	1476 Nos	6.3.4.18
B.6.3	3C x 16 sqmm, Al	216 Nos	216 Nos	216 Nos	648 Nos	6.3.4.18
B.6.4	3C x 25 sqmm, Al	360 Nos	360 Nos	360 Nos	1080 Nos	6.3.4.18
B.6.5	3C x 70sqmm, Al	36 Nos	36 Nos	36 Nos	108 Nos	6.3.4.18

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.7.0	<b>INSTRUMENTS</b>					
B.7.1	<b>Opacity Monitoring System</b> , consisting of 1 No. measuring head, 1 No. Local Control Unit, 1 No. Reflector, 1 No. Air Blower with hose, 2 Nos. Fail Safe Shutters, 1 No. Field Termination Box, interconnecting cables, mounting accessories etc. Approximate Weight: 150 kg	6 Sets*	6 Sets*	6 Sets*	18 Sets*	6.3.15
B.7.2	Ash level indicator ( High & Low ), each sets consisting of average length 12 mtrs of 3/4" GI metallic flexible conduit and 12 mtrs length PTFE wire with probes/ Sensors Size of ALI: 900 x 100 x 100 mm; Approximate Weight : 15 kg / ALI	216 Sets*	216 Sets*	216 Sets*	648 Sets*	6.3.13

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.8.0	<p><b>FLEXIBLE CABLE TRAY SUPPORTS AND ACCESSORIES</b></p> <p>Flexible GI cable support system, consisting of single/double channels, base plates, cantilever arms as per BOQ given below. The base plate shall be bolted with anchor fasteners for floor mounting and in all other places base plate shall be welded.</p> <p>Necessary 90 deg. Angle fittings, flat plate fittings, clamps for single &amp; double channels, fasteners etc. will be supplied for fixing trays and cantilever arms and for this no separate erection charges will be paid. Rates shall be accommodated in support channel and cantilever arm erection. Support channels will be supplied in standard running lengths, and shall be cut at site depending on requirement, and exposed metal portion shall be painted as per specification given in section VI. Payment for erection will be made on per metre basis. No separate rate will be paid for cutting &amp; painting.</p>					6.3.7
B.8.1	Base plate for double support channel	465 Nos	465 Nos	465 Nos	1395 Nos	6.3.7
B.8.2	Base plate for single support channel	2400 Nos	2400 Nos	2400 Nos	7200 Nos	6.3.7

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B.8.3	Double channel support	600Mtr	600Mtr	600Mtr	1800 Mtr	6.3.7
B.8.4	Single channel support	2205Mtr	2205Mtr	2205Mtr	6615 Mtr	6.3.7
B.8.5	Cantilever arm of length 650 mm	1725 Nos	1725 Nos	1725 Nos	5175 Nos	6.3.7
B.8.6	Cantilever arm of length 500 mm.	675 Nos	675 Nos	675 Nos	2025 Nos	6.3.7
B.8.7	Cantilever arm of length 200 mm.	1980 Nos	1980 Nos	1980 Nos	5940 Nos	6.3.7
B.9.0	<b>GALVANISED CABLE TRAYS complete with accessories like coupler plates ,fastners, clamps etc</b>					6.3.5
B.9.1	Ladder type 600 mm wide 120mm height	2663Mtr	2663Mtr	2663Mtr	7989 Mtr	6.3.5
B.9.2	Ladder type 450 mm wide 120mm height	863Mtr	863Mtr	863Mtr	2589 Mtr	6.3.5
B.9.3	Ladder type 150 mm wide 120mm height	4763Mtr	4763Mtr	4763Mtr	14289 Mtr	6.3.5
B.9.4	Perforated Type, 600 mm wide 120mm height	525 Mtr	525Mtr	525Mtr	1575 Mtr	6.3.5
B.9.5	Perforated Type, 150 mm wide 120mm height	788Mtr	788Mtr	788Mtr	2364 Mtr	6.3.5
B.10.0	<b>EARTHING MATERIALS</b>					6.3.8
B.10.1	GI Flat 50 x 6 mm	4500Mtr	4500Mtr	4500Mtr	13500 Mtr	6.3.8
B.10.2	GI Flat 30 x 5 mm	7500Mtr	7500Mtr	7500Mtr	22500 Mtr	6.3.8
B.10.3	GI wire 8 SWG 4.06 mm dia	1000 Kg	1000 Kg	1000 Kg	3000 Kg	6.3.8

BOM Ref No	Description	Quantity			Total Qty	Clause Ref No
		3 x 660 MW				
B.	<b>BHEL - RANIPET SCOPE</b>	Unit 1	Unit 2	Unit 3		
B10.4	<b>STRUCTURAL STEEL for support consisting of ISMC, ISA of different sizes</b>	12.0 MT	12.0 MT	12.0 MT	36.0 MT	6.3.6
B.11.0	<b>COMMISSIONING of the following erected by Mechanical Contractor</b>					6.3.12
B.11.1	<p><b>ESP Transformer</b></p> <p>Commissioning of High voltage rectifier transformer</p> <ul style="list-style-type: none"> <li>- 95 kV, 800mA,</li> <li>- 70kV, 1200mA</li> </ul> <p>The scope of work includes oil filtration, sample testing for dielectric strength, PPM etc., calibration of WTI, Bucholz relay etc.</p> <p>Approximate Oil Quantity per transformer: 500 litres</p> <p><i>Lump sum rate to be quoted including Final painting</i></p>	24 Nos 84 Nos	24 Nos 84 Nos	24 Nos 84 Nos	324 Nos	6.3.2
B.11.2	LT Drives	228 Nos	228 Nos	228 Nos	684 Nos	6.3.12
B.11.3	Electrically operated Hoist 3T (EOT)	6 Nos	6 Nos	6 Nos	18 Nos	6.3.12

**Note : \* Lumpsum Rate to be quoted**

**SECTION VII**  
**APPENDIX – I**  
**DECLARATION SHEET**

I, \_\_\_\_\_ hereby  
certify that, all the information and data furnished by me with regard  
to this Tender Specification No.BHEL:PSSR:SCT:1218 are true and  
complete to the best of my knowledge. I have gone through the  
specifications, conditions, stipulations in detail and agree to comply  
with the requirements and intent specifications.

I further certify that I am duly authorized representative of the under  
mentioned tenderer and a valid power of Attorney to this effect is  
also enclosed.

TENDERER'S NAME & ADDRESS

AUTHORISED REPRESENTATIVE'S  
SIGNATURE WITH NAME & ADDRESS

**SECTION VII**

**APPENDIX – II**

**TENDER SPECIFICATION NO BHEL:PSSR:SCT:1218**

**CERTIFICATE OF DECLARATION FOR CONFIRMING  
KNOWLEDGE ON SITE CONDITIONS**

We,

hereby declare and confirm that we have visited the project site under subject, namely and acquired full knowledge and information about the site conditions. We further confirm that the above information is true and correct and we will not raise any claim of any nature due to lack of knowledge of site conditions.

TENDERER'S NAME AND ADDRESS

Place:

Date :

SIGNATURE OF AUTHORISED  
REPRESENTATIVE WITH NAME & ADDRESS:

OFFICE SEAL

**BHARAT HEAVY ELECTRICALS LIMITED**  
(A Government of India Undertaking)  
Power Sector: Southern Region  
690, Anna Salai, Nandanam, Chennai – 600 035.

**SECTION VII**  
**APPENDIX - III**  
**CHECK LIST**

**TENDER SPECTFICATION NO, BHEL: PSSR : SCT : 1218**

Tenderers are required to fill in the following details:

- |    |  |   |        |
|----|--|---|--------|
| 1. | a) Name of the Tenderer with address   | : | YES/NO |
|    | b) Telegraphic/Telex address   | : | YES/NO |
|    | c) Phone (Office/Residence)  | : | YES/NO |
|    | d) Management Structure of firm (Pvt. Ltd./Public Ltd./Partnership/Sole Proprietorship) Documentary proof For the same enclosed) | : | YES/NO |
| 2. | Whether EMD submitted as per Tender specifications terms and Conditions  | : | YES/NO |
| 3. | Validity of offer (offer shall be kept open for acceptance for minimum six months)   | : | YES/NO |
| 4. | Whether tenderer visited the erection site and acquainted with the site conditions before quoting                                | : | YES/NO |

SIGNATURE OF THE TENDERER

5. Whether the following details are furnished : YES/NO
- a) Previous Experience : YES/NO
  - b) Present assignments : YES/NO
  - c) organization chart of the company : YES/NO
  - d) Company financial statue : YES/NO
  - e) Incase of company, proof of Registration of the company : YES/NO
  - f) Memorandum & Articles of Association of company/copy of Partnership deed : YES/NO
  - g) Profit & Loss account for the Last 3 years : YES/NO
  - h) Audited Balance sheet for the Last 3 years : YES/NO
  - i) Income Tax clearance certificate (latest) : YES/NO
  - j) Solvency Certificate from a Nationalised Bank : YES/NO
  - k) Power of Attorney of the person Signing the tender duly attested By a Notary Public : YES/NO
  - l) Manpower organization chart With deployment plan at site For posting of Engineers/super Visitors and workers/labourers For satisfactory completion of Work under this specification : YES/NO

SIGNATURE OF THE TENDERER

6. Whether the Tenderer is conversant with local labour laws & conditions : YES/NO
7. Whether the tenderer is aware of all safety rules and codes : YES/NO
8. Whether the Declaration sheet (as per appendix enclosed) : YES/NO
9. Time required for mobilization of site organization and start of work : YES/NO
10. Whether list of tools and Plants available with the contractor and proposed to be deployed for this work enclosed : YES/NO
11. Whether all the Pages are read understood and signed. : YES/NO
12. Deviations, if any Pointed out :
13. Whether PF exemption No. is allotted by RPFC of your area if so, indicate number : YES/NO

SIGNATURE OF THE TENDERER

# TENDER SPECIFICATION

**BHEL:PSSR:SCT: 1218**

FOR

Handling at Site Stores / Storage yard,  
Transportation to site of Work, Erection,  
Testing and Commissioning of ESP Electrical  
works for Units I,II & III of 3 x 660 MW  
set

at

## **Sipat Thermal Power Project**

(for M/s NTPC) , Stage- I ,  
Bilaspur District , Chattisgarh State

**PART – I PRICE - BID**

BOOK NO :



**BHARAT HEAVY ELECTRICALS LIMITED**

(A Government of India Undertaking)

Power Sector – Southern Region

690, Anna Salai, Nandanam, Chennai – 600 035.

**BHARAT HEAVY ELECTRICALS LIMITED**  
**(A Government of India Undertaking)**  
Power Sector, Southern Region  
690, Anna Salai, Nandanam, Chennai – 35

**TENDER SPECIFICATION NO:BHEL:PSSR:SCT:1218**

**NAME OF WORK**

Handling at Site Stores / Storage yard,  
Transportation to site of Work, Erection,  
Testing and Commissioning of Electrical  
Works for Units I,II & III of 3 x 660 MW  
set at Sipat Thermal Power Project, (For M/s  
NTPC ) Stage - I , Bilaspur District,  
Chattisgarh State

(PRICE BID)

PART II

Issued to  
M/s.

For and on behalf of  
BHARAT HEAVY ELECTRICALS LIMITED

Senior Deputy General Manager/Contracts

(This tender document is not transferable)

Place: Chennai-600 035.  
Date:

**SIPAT : 3 X 660 MW (UNIT 1, 2 & 3) ESP**

**RATE SCHEDULE FOR LT ELECTRICAL WORKS**

**Before filling the Rates, the bidder shall go through the detailed specification of all the items given in the detailed Bill of Materials (BOM) as well as Scope of Work specified in Section VI**

SI No	BOM Ref No:	Description	Total Qty 660 MW Unit 1,2&3	Unit Rate	Total Rate
		<b>LOW VOLTAGE SWITCH GEAR/ CONTROL PANELS</b>			
1.	B.1.1	Auxiliary Control Panel	18 Nos		
2.	B.1.2	Electronic Control Panel with BAPCON controller	324 Nos		
3.	B.1.3	IOS panel with stand alone PC with monitor, printers and other accessories etc.	3 Nos		
4.	B.1.4	Rapper Control Panel- with 2 Nos Rapcon controllers	36 Nos		
5.	B.1.5	Station Panel- with Statcon controllers	18 Nos		
		<b>INSTRUMENTS</b>			
6.	B.7.1	Opacity Monitoring System	18 Sets*		
7.	B.7.2	Ash level indicator ( HIGH & LOW )	648 Sets*		
		<b>LT POWER CABLES (unarmoured)</b>			
8.	B.4.6	2 C X 2.5 sq. mm, Copper	42750 Mtr		

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

SI No	BOM Ref No:	Description	Total Qty 660 MW Unit 1,2&3	Unit Rate	Total Rate
9.	B.4.5	3C x 2.5 sqmm, Cu	140400 Mtrs		
10.	B.4.1	2 C X 120 sq. mm, Al	148500 Mtr		
11.	B.4.2	3 C X 16 sq. mm, Al	7650 Mtr		
12.	B.4.3	3 C X 25 sq. mm, Al	63000 Mtr		
13.	B.4.4	3 C X 70 sq. mm, Al	10800 Mtr		
		<b>LT CONTROL CABLES(unarmoured)</b>			
14.	B.5.1	3 C X 1.5 sq.mm, Cu	81000 Mtr		
15.	B.5.5	4C x 1.5 sqmm.	173700 Mtr		
16.	B.5.2	10C X 1.5 sq.mm, Cu	7875 Mtr		
17.	B.5.3	12 C X 1.5 sq.mm, Cu	104400 Mtr		
18.	B.5.4,	14 C X 1.5 sq.mm, Cu	43200 Mtr		
		<b>TERMINATION OF POWER CABLES</b>			
19.	B.6.2	3C x 2.5 sqmm, Cu	1476 Nos		
20.	B.6.4	3C x 25 sqmm, Al	1080 Nos		
21.	B.6.3	3C x 16 sqmm, Al	648 Nos		
22.	B.6.5	3C x 70sqm, Al	108 Nos		
23.	B.6.1	2 C X 120 sq. mm, Al	2592 Nos		

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

SI No	BOM Ref No:	Description	Total Qty 660 MW Unit 1,2&3	Unit Rate	Total Rate
		<b>GALVANISED CABLE TRAYS complete with coupler plates, fastners</b>			
24.	B.9.11	Ladder type 600 mm wide 120mm height	7989Mtr		
25.	B.9.2	Ladder type 450 mm wide 120mm height	2589Mtr		
26.	B.9.3	Ladder type 150 mm wide 120mm height	14289Mtr		
27.	B.9.4	Perforated Type, 600 mm wide	1575 Mtr		
28.	B.9.5	Perforated Type, 150 mm wide	2364Mtr		
		<b>FLEXIBLE CABLE TRAY SUPPORTS &amp; ACCESSORIES</b>			
29.	B.8.1	Base plate for double support	1395 Nos		
30.	B.8.2	Base plate for single support channel	7200 Nos		
31.	B.8.3	Double channel support	1800Mtr		
32.	B.8.4	Single channel support	6615Mtr		
33.	B.8.5	CANTILEVER ARM of length 650 mm	5175 Nos		
34.	B.8.6	CANTILEVER ARM of length 500 mm.	2025 Nos		
35.	B.8.7	CANTILEVER ARM of length 200 mm.	5940 Nos		
		<b>HEATING ELEMENTS</b>			
36.	B.2.1	Testing and Termination and dressing of Heating Elements for Hopper (Panel Type)	324 sets*		
37.	B.2.2	Testing Heating elements for support insulator	1296 Nos		

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

SI No	BOM Ref No:	Description	Total Qty 660 MW Unit 1,2&3	Unit Rate	Total Rate
38.	B.2.3	Testing Heating elements for shaft insulator h	324 Nos		
39.	B.2.4	Testing Thermostats for hopper heaters.	324 Nos		
40.	B.2.5	Testing Thermostat for support insulators	36 Nos		
		<b>JUNCTION BOXES/ LOCAL START STOP PBS/ SWITCH BOXES/ MARSHALLING BOXES</b>			
41.	B.3.1	Local Start Stop Push Buttons	684 Nos		
42.	B.3.2	Junction Boxes for hopper heaters	324 Nos		
43.	B.3.3	Junction Boxes for support insulator heaters,& shaft insulator heaters.	108 Nos		
44.	B.3.4	Junction Boxes for start stop PB ,hopper thermostat, ALI .	198 Nos		
		<b>EARTHING MATERIALS</b>			
45.	B.10.1	GI Flat 50 x 6 mm	13500Mtr		
46.	B.10.2	GI Flat 30 x 5 mm	22500Mtr		
47.	B.10.3	GI wire 8 SWG	3000 Kg		
48.	B10.4	<b>STRUCTURAL STEEL for support</b>	36.0 MT		

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

SI No	BOM Ref No:	Description	Total Qty 660 MW Unit 1,2&3	Unit Rate	Total Rate
		<b>COMMISSIONING of the following erected by Mechanical Contractor</b>			
49.	B.11.2	LT Motors	684 Nos		
50.	B.11.3	Hoists	18 Nos		
51.	B.11.1	ESP Transformer	324 Nos		

Total Contract Value \_\_\_\_\_  
(Rupees \_\_\_\_\_)

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

SI No	Description	Qty	Unit Rate
	<b>OPTIONAL RATE</b>		
	<b>Supply of Cable Glands: Double Compression type, Nickel Plated, Weatherproof, Brass Cables glands, conforming to IS12943:1990. of following sizes</b>		
52.	Upto 12 sq mm	Per No.	
53.	12.1 – 16.5 sq mm	Per No.	
54.	16.6 – 18 sq mm	Per No.	
55.	18.1 – 20 sqmm	Per No	
56.	20.1 – 23 sq mm	Per No.	
57.	23.1 – 26 sq mm	Per No.	
58.	26.1 – 30 sq mm	Per No.	
59.	30.1 – 33 sq mm	Per No.	
60.	33.1 – 37 sq mm	Per No.	
61.	37.1 – 41 sq mm	Per No.	
62.	41.1 – 46 sq mm	Per No.	
63.	46.1 – 52 sq mm	Per No.	
64.	52.1 – 60 sq mm	Per No.	
65.	60.1 – 67 sq mm	Per No.	
66.	67.1 – 72 sq mm	Per No.	
67.	72.1 – 78 sq mm	Per No.	
68.	78.1 – 84 sq mm	Per No.	
69.	84.1 – 94 sq mm	Per No.	

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

<b>SI No</b>	<b>Description</b>	<b>Qty</b>	<b>Unit Rate</b>
70.	94.1 – 105 sq mm	Per No	
	<b>SUPPLY OF CABLE LUGS</b>		
	Tinned Copper <b>Crimping</b> Type Ring Type Aluminum Lugs for Power and Control Cables of following sizes		
71.	0.5 sq.mm	200 Nos.	
72.	1.5 sq mm	100 Nos.	
73.	2.5 sq mm	100 Nos.	
74.	16 sq. mm	100 Nos.	
75.	25 sq. mm	100 Nos.	
76.	70 sq. mm	Per No.	
77.	120 sq. mm	Per No.	

\* LUMPSUM RATE TO BE QUOTED

Signature of Tenderer

## **NOTE TO RATE SCHEDULE**

1. The quantities indicated in the Rate Schedule are only approximate and are liable for variation. Payment shall be made to the actual quantity erected at the unit rate quoted / accepted.
2. Dimension and weight indicated in the Rate Schedule are only approximate and given for guidance of the contractor.
3. Rates include complete installation, testing, commissioning and trial operation of equipments laying and dressing of cables, termination of cables etc.
4. Where the provisional / optional rates / values are asked for, the successful contractor who has been awarded the work shall have to match their provisional / optional rates for all categories of work, with the lowest provisional / optional rates/value quoted by other qualified bidders. Only those rate/values will be paid for these works. However **BHEL RESERVES ITS RIGHT TO TREAT THESE PROVISIONAL WORKS AS OPTIONAL AND GET IT DONE THROUGH OTHERS ALSO AS PER OUR DISCRETION.** The above condition shall be binding on the contractor.
5. Tenderers are requested to quote their rates, only in the price bid (part II) provided by BHEL. Quoting of rates in any other form/formats will not be entertained.

**SIGNATURE OF THE TENDERER**