

TENDER SPECIFICATION

BHEL:PSSR:SCT: 1307

FOR

**Handling at Site Stores / Storage yard, Transportation,
Erection, Testing and Commissioning of Control &
Instrumentation System for Unit- 1 of 1x500 MW
Unit at Kakatiya Thermal Power Project at Warangal
Dist. AP for APGENCO**

At

**KAKATIYA THERMAL POWER PROJECT
Chelpur Village, Warangal Dist,
Andhra Pradesh.**

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.

INDEX SCT : 1307 - NALCO CPP ELECTRICAL PACKAGE

Sl.No.	Description	Page
1.	Covering Letter	1 - 2
2.	Special instructions to Bidders	3 - 4
3.	Procedure for submission of sealed bids	5
4.	Tender Notice	6 - 7
5.	Certificate for No Deviation	8
6.	Offer of Contractor	9 – 10
7.	Project Information	11 - 12
8.	Section III - Common Conditions of Contract	13 - 30
9.	Section VI - Special Conditions of the Contract	31 - 91
10.	Section – VII - General Technical Requirements and Guidelines for Installation, Testing, Commissioning and Supply	92 - 118
11.	Bill of Materials for Electrical / C&I / Illumination Package	119 - 167
12.	Section – VIII	
	Appendix- Data Sheet	168 – 170
	Appendix-II Declaration Sheet	171
	Appendix-III Certificate of Declaration For Confirming knowledge On site Conditions	172 173 – 175
	Appendix –IV Check List	
13.	Appendix – V Price Bid (Separate Book)	176 – 197
14.	General Conditions of Contract (Separate Book)	73 Pages

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: 1307

Messrs Date:

Dear Sir,

SUB: Handling at Site Stores / Storage yard, Transportation, Erection, Testing and Commissioning of **Control & Instrumentation System** for Unit 1 of 1x 500 MW unit at Kakatiya Thermal Power Project, at Warrangel Dist, AP for APGENCO.

Please find enclosed one set of non-transferable tender Specification documents along with Separate Booklets for general conditions of contract and Rate schedule 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 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 8.)

The completed quotations shall reach the office of the under signed on or before **14.08.2008 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 WHAT SO EVER 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 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

ADDL. GENERAL MANAGER / CONTRACTS

This Tender document is not transferable.

Place : Chennai -35

Encl: One set of Tender documents along with GCC Booklet & Drawings

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 superscribing 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 Seven 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 Criteria

- a) The bidders should possess the experience of having completed successfully DCS based Boiler Controls/TG Controls /Stations C&I systems and other related works like field instruments, Electric & Pneumatic actuators, Impulse piping, Instrument Air Piping, trays and supports, cabling, earthing, etc, for a thermal/Gas based Combined Cycle Project of minimum 100 MW rating in the last seven years.
- b) The bidders should have a minimum average financial turn over of **Rs.87.60** Lakhs per year in the preceding three years ending 2007.

The bidder must have earned profit in any one of the last three financial years ending 31.03.2007 and should have positive net worth as on 31.03.2007

The bidder should submit audited balance sheet and profit and loss account of the company for the last three years ending 31.03.2007 in support of above requirement.

- c) Notwithstanding the above, BHEL reserves the right to reject any Tender or all the Tenders for reasons whatsoever beyond its control and the decision of BHEL is final.
- d) LD / Penalty shall be leviable as per the applicable clauses of GCC.

15. A DECLARATION SHEET INDICATING THAT THERE IS NO DEVIATION IN TENDER DOCUMENTS (AS IN **PAGE 8) IS TO BE FURNISHED. 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.

Part II (Price Bid) Cover II

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

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 Addl. General Manager/Contracts at the above mentioned address before the due date as indicated. The Tenderers will be intimated separately in case clarifications are required.

NOTE:

Tenderers are issued with 2 Nos. of Technical Bids, 2 Nos. of Price Bids and 2 Nos. of GCC booklet., out of which one set of each document shall be retained by them for their 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 demand draft only drawn in favor 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 WHAT SO EVER AFTER THE TIME AND DATE MENTIONED IN TENDER SPECIFICATION FOR SUBMISSION OF COMPLETED QUOTATIONS SHALL NOT BE ENTERTAINED UNLESS CALLED FOR SPECIFICALLY BY BHEL.

Addl. 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 nature of work and meeting the Qualification Requirements.

Tender Specification No. BHEL:PSSR:SCT: **1307**

Description	EMD
: Handling at Site Stores / Storage yard, Transportation to site of work, Erection, Testing and Commissioning of Control & Instrumentation System for Unit 1 of 1x 500 MW at Kakatiya Thermal Power Project at Warrangel Dist, AP for APGENCO	Rs.2,00,000/- (Rupees Two Lakhs only)

Cost of Tender Documents (Including all Taxes)	:	Rs.1040/-	
Sale Starts on	:	24.07.2008	
Sale closes on	:	13.08.2008	
Due date and Time for Submission	:	14.08.2008	15.00 HRS
Date and time for opening Of Technical Bids	:	14.08.2008	15.30 HRS

QUALIFICATION REQUIREMENT

a) The bidders should possess the experience of having completed successfully DCS based Boiler Controls/TG Controls /Stations C&I systems and other related works like field instruments, Electric & Pneumatic actuators, Impulse piping, Instrument Air Piping, trays and supports, cabling, earthing, etc, for a thermal/Gas based Combined Cycle Project of minimum 100 MW rating in the last seven years.

b) The bidders should have a minimum average financial turn over of Rs.**87.60** Lakhs per year in the preceding three years ending 2007.

The bidder must have earned profit in any one of the last three financial years ending 31.03.2007 and should have positive net worth as on 31.03.2007

The bidder should submit audited balance sheet and profit and loss account of the company for the last three years ending 31.03.2007 in support of above requirement.

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

LD/ Penalty shall be leviable as per the applicable clauses of GCC.

Interested parties can get the Tender documents from the office of the Additional General Manager / Contracts on all working days (except Second and last Saturdays) by remitting the cost of tender documents either by Cash (10.00 AM- 3.30 PM) or A/c Payee Demand Draft (10 AM- 4.30 PM) drawn in favour of M/s. Bharat Heavy Electricals Limited, Chennai - 600 035. Money order, Cheques and Postal Orders will not be accepted.

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 tenders without assigning any reason there for.

ADDL. GENERAL MANAGER/CONTRACTS

TENDER SPECIFICATION : BHEL:PSSR:SCT:1307

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

Addl. 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: 1307 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

1. NAME OF THE PROJECT : KAKATIYA THERMAL POWER PROJECT
2. STATION CAPACITY : 1 x 500 MW (COAL BASED)
3. OWNER : ANDHRA PRADESH POWER GENERATION CORPORATION LIMITED (APGENCO)
4. CONSULTANT : M/s DESEIN
5. SITE LOCATION : CHELPUR VILLAGE, GHANPUR MANDAL, WARANGAL DISTRICT
(½ KM FROM STATE HIGH WAY) AND 10 Km FROM BHOOPALAPALLY)
6. LATTITUDE : 18 23” N
7. LONGITUDE : 79 51” E
8. M S L : 180 M
9. NEAREST HIGHWAY : SH –7 (CONNECTING PARKAL WITH MAHADEVPUR)
10. NEAREST /TOWN CITY : WARANGAL 65 Kms SOUTH WEST
11. NEAREST RAILWAY : 1. UPPAL RLY.STATION ON SCR
45 Kms FROM SITE.
2. WARANGAL RLY.STATION OF SCR
65 kms FROM SITE.
12. NEAREST AIRPORT : 240 Kms. (HYDERABAD)

13. METROLOGICAL Data:

A) TEMPARATURE

i. AVERAGE MAX. TEMEPERATURE : 34.5 DEG. C

ii) AVERAGE MIN.TEMPERATURE : 22.3 DEG. C

iii) HIGHEST MAX. TEMPERATURE : 45.7 DEG. C

iv) LOWEST MINIMUM TEMPERATURE : 9.0 DEG. C

v) TEMPERATURE TO BE CONSIDERED FOR
DESIGN OF ELECTRICAL EQPTS./DEVICE : 50 DEG. C

B) RELATIVE HUMIDITY AVERAGE : 55 %

C) RAINFALL (AVERAGE ANNUAL) : 1005 MM

D) WIND DATA/BASIC SPEED : 47 M / SEC

E) SEISMIC DATA : ZONE II

14. LANGUAGES SPOKEN IN THE REGION : ENGLISH, TELEGU.

15) LANGUAGE FOR COMMUNICATION
WITH SUB-CONTRACTOR/VENDORS : ENGLISH

16) TROPICALISATION : ALL EQPTS. SUPPLIED AGAINST
THIS SPECIFICATION SHALL BE GIVEN
TROPICAL AND FUNGICIDAL
TREATMENT IN VIEW OF
CLIMATIC CONDITIONS PREVAILING
AT SITE.

17)SUPPLY VOLTAGE : 240 V AC FOR LIGHTING

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 Provisions of all types of labour, 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 unit is handed over as specified in detail in clause.

3.2.0 FACILITIES TO BE PROVIDED BY BHEL:

3.2.1 OPEN SPACE

Minimum Open space for building of 1 No temporary office / store shed will be provided free of cost. Contractor has to make his own arrangements for labour colony, including Electricity and water for the labour colony.

3.2.2 ELECTRICITY

For construction purpose and for contractor's office and store sheds electricity **will be provided at one single point free of charges.** Further distribution shall be arranged by the contractor at his own cost including supply of energy meter with calibration certificate.

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

Before connecting any equipment the contractor shall ensure that it is rated for the correct voltage to which it is being connected and the equipment is not likely to cause a fuse blow out.

The contractor shall endeavour to minimize the current consumption as far as possible and avoid wastage.

3.2.3 WATER

For construction purpose, water will be provided at one point free of cost nearer to the project site. Further distribution shall be arranged by the contractor at his own cost. For drinking purpose the contractor has to make his own arrangement at his cost.

3.2.4 TOOL AND TACKLES

All the Tools & Plants and instruments required for the complete erection of components shall be arranged by the contractor.

EOT crane shall be provided by BHEL free of hire charges, on sharing basis, for shifting of Panels. Contractor has to arrange operator at his cost.

3.2.5 CONSUMABLES

All consumables, electrodes including Oxygen/ Acetylene, Argon , Gases, paints etc., shall be arranged by the contractor at his own cost.

3.3.0 FACILITIES TO BE PROVIDED AND DEVELOPED BY THE 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 this purpose.

3.3.2 WATER DISTRIBUTION

Distribution of water for various work fronts from the single point shall be arranged by the contractor at his cost.

3.3.3 ELECTRICITY DISTRIBUTION

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. Any duty, deposit involved in getting the electricity shall be borne by the bidder. As regards contractor's office shed also all such expenditure shall be borne by the contractor. Necessary meters for recording consumption of power for cost calculation purpose and maintenance of the same during execution period shall be contractor's responsibility.

3.3.4 POSSESSION OF GENERATORS

As there are bound to be interruptions in regular power supply power cut/load shedding in any construction site due to inherent power shortage in State, suitable extension of time if found necessary only be given on this account 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.

3.3.5 LIGHTING FACILITIES

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 REQUIREMENT

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, pipelines, cable etc. shall be dismantled and levelled 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 BHEL will undertake such work and the cost of the same will be recovered from the Contractor including overhead charges. The decision of BHEL. Engineer in this regard is final.

3.4.0 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 reason 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.

3.5.0 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 etc. On receipt of the electrodes at site, it shall be subject to inspection and approval of BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry.
- 3.5.2 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.
- 3.5.3 All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each HP elder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at 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.

3.6.0 TOOLS & TACKLES

- 3.6.1 All T & P required for the satisfactory execution of work shall be arranged by contractor at his cost.
- 3.6.2 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.
- 3.6.3 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.
- 3.6.4 All the T & P arranged by contractor including electrical connections wherein required shall be reliable / proven / tested and necessary test certificate to be submitted as per statutory rules of the State / Central Government in force from time to time.
- 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 his cost.

3.7.0 SUPERVISORY STAFF AND WORKMEN

- 3.7.1 The Contractor shall deploy experienced Engineers, Supervisors all the skilled workmen like 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 stores/storage yard to erection site, transportation, erection, testing and commissioning contemplated under this specification. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary.

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.

- 3.7.2 The supervisory staff employed by the contractor shall be qualified (Engineers - Graduates in Engineering and Supervisors - Diploma Holders) 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 BHEL's client.

- 3.7.3 The Contractor shall furnish daily labour report showing by classification the number of employees engaged in various categories of work and a progress report of work as required by BHEL Engineer. The contractor shall also give a summary report at the end of the month and plan of deployment for the consequent month as per the plan of activities as required by BHEL, to meet the overall contract requirement.
- 3.7.4 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 and other contractor's personnel working in site and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 3.7.5 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. Wherever finish or tolerances are not specified in drawings/documents, BHEL Engineers instruction are taken as final.
- 3.7.6 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.
- 3.7.7 It is the responsibility of the bidder to engage his workmen in shifts or on overtime basis during erection, commissioning and testing period for achieving the target set by BHEL . The contractor's quoted rate shall include all these contingencies.
- 3.7.8 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 the erected components etc. The contractor shall make the same good at his own expense or in default, BHEL may cause the same to be made 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 CIVIL WORKS

- 3.8.1 Foundations of all equipments and plants and necessary civil works shall be provided by BHEL. The dimensions of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further top elevation of foundations shall be checked with respect to bench mark etc. All minor adjustments upto 25 mm of foundation level, dressing, chipping of foundation surface enlarging the pockets in foundations and grouting of equipments etc. as may be required for the erection of equipment/plants shall be carried out by the Contractor. All the materials like cement, sand, gravel etc. and cleaning consumables shall also be arranged by the contractor at his cost.

The required special cement like CONBEXTRA-GP2 and SHRINKOMP N 30 etc or its equivalent grade cement for grouting of columns, equipments etc. shall be arranged by the contractor at their cost. The contractor should also arrange required nos. of mixing machines and vibrators at their cost.

- 3.8.2 The contractor shall ensure perfect matching of packer plates with foundation by dressing the foundation and between the packer plates and the base plate of structural column/equipment to the satisfaction of BHEL Engineer. Machining/matching of packer shall be carried out by the Contractor at his own cost.
- 3.8.3 The contractor shall arrange for grouting of foundation bolt holes of equipment and final grouting of equipment as per the drawings / specification or as advised by the Engineer or BHEL after preparing the foundation surface for grouting.
- 3.8.4 Contractor has to carry out the grouting as per the work instructions for grouting available at site.
- 3.8.5 The contractor at his cost shall arrange for grouting of anchor points of T & P issued to him and also grouting of winches or any other supports required for T & Ps. Necessary grout materials are to be arranged by the contractor at his cost.

3.9.0 SCOPE OF MATERIAL HANDLING AND SITE STORAGE AND OTHER RESPONSIBILITIES

- 3.9.1 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 materials 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.
- 3.9.2 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.
- 3.9.3 It shall be contractor's responsibility to arrange necessary cranes/tractors, trailer or trucks/slings/tools and tackles/labour including operators Fuel lubricants etc., for loading from storage yard 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.
- 3.9.4 All equipment so used by contractor shall be of proven quality and safe in operation as approved by BHEL site Engineers from time to time.

- 3.9.5. 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.
- 3.9.6 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 and maintain records.
- 3.9.7 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.
- 3.9.8 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.
- 3.9.9 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.
- 3.9.10 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.
- 3.9.11 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.
- 3.9.12 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.
- 3.9.13 The work covered under this scope of work is of highly sophisticated nature requiring best quality / precision workmanship engineering and construction management. He 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.
- 3.9.14 All the necessary certificates and licenses required to carry out this scope of work are to arranged by the contractor then and there at no extra cost.

- 3.9.15 The contractor shall take all reasonable care to protect the materials and work till such time the erected equipment has been taken over by BHEL/their client. Wherever 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.
- 3.9.16 The contractor shall be responsible for taking all safety precautions during the construction and keeping 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 services. 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.
- 3.9.17 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 and erection. The history cards for major equipments to be maintained by the contractor.
- 3.9.18 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.
- 3.9.19 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.

3.10.0 PRESERVATION OF COMPONENTS

- 3.10.1 It shall be the responsibility of the contractor to apply preservative 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 the contractor at his cost.
- 3.10.2 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.

- 3.10.3 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.
- 3.10.4 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. The required paint and thinner shall be provided by BHEL free of cost. All other consumables like painting brush, emery paper, cotton waste, cloth etc. have to be arranged by the contractor at his 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.

3.11.0 DRAWINGS AND DOCUMENTS

- 3.11.1 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.
- 3.11.2 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.
- 3.11.3 The data furnished in various appendices 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.
- 3.11.4 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.
- 3.11.5 Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimensions/details without specific approval of BHEL.

3.12.0 SITE CLEANLINESS AND SAFETY REQUIREMENTS

- 3.12.1 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, including specification of Health, Safety and Environment (HSE) management of customer / consultant.

3.12.2 Non-conformity of safety rules and safety appliances will be viewed seriously and the BHEL has right to impose fines on the contractor as under:

SNo	Safety	Fine (Rs)
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/-

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

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

3.13.0 PROGRESS OF WORK

3.13.1 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.

3.13.2 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.

3.13.3 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.

3.13.4 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.

3.13.5 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.

3.13.6 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.

3.13.7 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.

SPECIFIC REQUIREMENTS FOR ISO 9001 - 2000

3.14.0 IMPORTANT NOTE

Contractors shall ensure that all their Staff/Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9002 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 contractor 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 contractor for the non-conformances if any, observed and pointed out by BHEL.

3.15.0 INSPECTION / QUALITY ASSURANCE / QUALITY CONTROL STATUTORY INSPECTION

- 3.15.1 Various Inspection / quality control / quality assurance procedures/methods at various stages of erection and commissioning will be as per BHEL / Customer quality control procedure/codes/IBR and other statutory provisions and as per BHEL Engineer's instructions.
- 3.15.2 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.
- 3.15.3 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.
- 3.15.4 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.
- 3.15.5 Approval Given by Customer/BHEL for welding, results tests etc. shall also be recorded in the log book.
- 3.15.6 All the Electrical/Technical Measuring and Testing Instruments / Gauges, Feeler Gauges, Height 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, Levelling, 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 of BHEL Engineer.

- 3.15.7 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.

3.16.0 STAGE INSPECTION BY FES / QA ENGINEERS

- 3.16.1 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. Contractor shall arrange all labour, Tools and Tackles, etc. for such stage inspections free of cost.
- 3.16.2 Any modifications suggested by FES and QA Engineers Team shall be carried out. Claims of Contractor, if any shall be dealt as applicable.
- 3.16.3 Any minor rectifications of minor repairs of defective work found out during stage Inspection shall be rectified free of cost, by the contractor.
- 3.16.4 Any major Rectification or Major Repair / Major Rework 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.

3.17.0 STATUTORY INSPECTION

The scope includes getting the Approvals from the statutory authorities (Like Electrical Inspector and Labour Officers). This includes Arranging for Inspection Visits of Inspector Periodically as per BHEL Engineer's Instructions, Submitting Documents, Radiographs, Etc. and following up the matter with them.

All fees connected with the contractors for Testing his Welders/Men / Works and Testing, Inspection, calibrating his instruments and equipments, shall be paid by the contractor. It shall be contractor's 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 contractor's Account.

However, BHEL shall pay all other Fees (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES, ETC.) In case these Inspection 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.

3.18 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.

SUB CONTRACTOR 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 fulfil required electrical safety aspects as per relevant BIS 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 authorise 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.

SUB CONTRACTOR 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 HCE 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.

KAKATIYA TPP (1 X 500MW)

SECTION VI

CONTROLS & INSTRUMENTATION PACKAGE

SCOPE OF WORK AND SPECIAL CONDITIONS

6.1.0 GENERAL

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

Identification of equipments at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard/ stores and calibration, erection, aligning, fastening, supporting, cleaning, checking, testing, commissioning, troubleshooting and carrying out statutory tests as required, trial operation, up to the time of completion of commissioning activities and commercial operation of the unit and handing over to customer or till completion of contract period whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.

- 6.1.1 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.
- 6.1.2 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.
- 6.1.3 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.
- 6.1.4 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.
- 6.1.5 The contractor shall co-ordinate and provide assistance for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation. Testing shall also include any additional tests, which the Engineer feels necessary because of site conditions and also to meet system specification.

- 6.1.6 During the course of erection, testing and commissioning C&I 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 work, as covered for extra work referred elsewhere in the contract.
- 6.1.7 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.
- 6.1.8 All necessary certificates and licenses required to carryout this work are to be arranged by the contractor expeditiously at his cost.
- 6.1.9 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.
- 6.1.10 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.
- 6.1.11 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.
- 6.1.12 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.
- 6.1.13 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

- 6.1.14 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.
- 6.1.15 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 BOM. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.
- 6.1.16 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.
- 6.1.17 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
- 6.1.18 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances.
- 6.1.19 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
- 6.1.20 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.
- 6.1.21 Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.

6.1.22 The scope of specification covers the installation, testing and commissioning of the instrument, hardware along with accessories as detailed in Bill of Materials.

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 C&I systems**

6.2.0 SCOPE OF WORK –C& I WORK

6.2.1 The C&I works shall be covered for the total power plant, which consists of Boiler, Steam turbine, Generator, ESP and other auxiliaries.

6.2.2 The Scope of C&I work covered in the above packages shall be as follows:

1. Erection and commissioning of All Types of Field Instruments like Temperature, Pressure and Flow instruments (local & remote) and special instruments like EWLI, Sonic Tube Leak Detection system, Vibration Monitoring System, SWAS, Gas analyser, Coal Flow Monitor, Master clock system, Coal Bunker level monitor etc.
2. Erection and commissioning of all types of Control room mounted instruments like Recorders, Indicators, Microprocessor based panels, DCS system and its accessories like system panels, PC, printers, furniture etc.
3. Erection and commissioning of all Types of Pneumatic Power Cylinders, Controllers etc.
4. Commissioning of all Types of Pneumatic operated Valves / Actuators / Power Cylinders / Controllers and Relief Valves.
5. Erection of all types of Hardware like impulse pipes, trays & tray supports, instrument air line, etc.
6. Erection & Testing of all types of power/control/instrumentation cables etc.

7. Erection and commissioning of UPS, ACDB, Battery, Battery Charger, DCDB etc.
8. Erection and commissioning of control panels.
9. Supply of all consumables required for installation as detailed elsewhere in the contract.
10. Installation of any other items that have not been specifically indicated, but required for completing installation.

6.3 DETAILED SCOPE OF WORK FOR C&I:

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

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

1. The different types of Microprocessor based panels like PLC/DCS Panels, Instrument Panels, unit control desk, unit control panel etc. are covered in the scope of work for erection and commissioning.
2. The unit rate quoted for Installation of control panels, shall include fixing of anti-vibration pads, levelling and alignment, welding, grouting, drilling of bottom gland plates for cable entry as required, closing control panels bottoms with suitable flame proof compounds wherever required and checking of internal wiring, instruments, components etc. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels except the Instruments identified in the BOQ.
3. Panels are normally supplied in suite of one / two / three/ four cubicles with bottom base frame and these panels are to be mounted on separate site fabricated base frames as per site condition and if necessary base frame to be properly grouted to the concrete floor or to be tag welded to the embedded insert plates.

4. The panels which are supplied for various control systems have to be erected at different places like unit control room/ near the equipment/ various operating floors as per site layout. The contractor shall take the panels to the desired locations either through floor openings or temporary openings. No claims will be entertained for taking the panels to the location owing to change of route or non-availability of openings as per nearest route.
5. The base frames will be supplied normally along with the boards. Wherever the base channels are not available, the same shall be fabricated, installed and painted at site. The material for the above will be supplied by BHEL. For fabrication and erection of frame, unit rate shall be paid on tonnage basis. Minor concrete chipping and grouting works, including supply of grouting material is included in the scope of works.
6. For panels to be mounted on trenches, if any channel supports are required, the same shall be provided across the cable trenches over which the base frames of the panels shall be mounted. Similarly for the panels to be mounted on false flooring, if mounting frames are not provided, same shall be fabricated at site. The contractor shall carry out fabrication and erection of these support structures on tonnage rate basis. Materials will be provided by BHEL.
7. If any minor grinding is to be carried out on the cut-outs provided in the panels for mounting instruments like recorders, indicators, console etc., the same shall be carried out by the contractor at no extra cost.
8. All the panels and JB's shall be electrically earthed to the nearest earth grid by means of GI flat /wire as per the instructions of BHEL engineer as indicated in the BOQ.
9. Painting of fabricated parts and earthing conductors of panels shall be part of the work. Touch up paints for panels if required shall be carried out by the contractor within the quoted rate.
10. Closing the Panel openings and unused drilled holes with non-flammable sealant materials, including supply of above material, shall be part of erection work.
11. For panels/ equipment erected by other agencies, commissioning work and troubleshooting are to be carried out by the contractor as per the rate quoted in the schedule.
12. 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 unless specified otherwise in the BOM. Similarly, if any loose supplied instruments /modules are to be mounted and wired on customer panels or any other panels not erected by contractor, the same shall be carried out at no extra cost unless otherwise specified in the BOM. 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.

13. Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Any variation within $\pm 20\%$ shall not be considered for payment. However, for variations beyond $\pm 20\%$, price adjustment shall be considered proportional to the length of the panel. Variations in depth, height or weight of the panel shall not be considered for payment.

14. UPS, AC & DC DB AND OTHER ELECTRICAL CONTROL PANELS

The erection & commissioning scope of above panels will be in line with clause 6.3.1.

6.3.2 SCOPE OF WORK OF MMIPIS(DCS)PACKAGE WITH RELATED INSTRUMENTATION :

1. BHEL will supply sophisticated MAX-DNA DCS system. The scope of DCS system includes erection of sophisticated microprocessor based systems MAX control panels, I/O panels, Ethernet switching panels, Network Enclosure cabinets, CPU, Engineers workstations, operator workstations, CRTs, server, printers, portable UPS power supply, furniture and interconnecting cables like Ethernet/Fibre-optic etc.
2. Unit rate quoted for MMIPIS (DCS) equipments shall cover installation & integration of all the above said equipment and providing necessary commissioning assistance. No separate unit rate applicable for installation of all loose items/ modules/ components or accessories etc, which is not explicitly mentioned in the BOQ, but comes as part of the system.
3. Necessary care shall be taken by the contractor while removing the modules, and other components, etc.
4. The DCS System shall be hooked up with all off-site plants through fibre-optic cables. Laying and termination of Ethernet, i.e. Data Highway between CPUs and DCS i.e. panels, workstation etc. shall be on per metre basis, as detailed elsewhere.

5. The complete details of MMIPIS (DCS) System shall be furnished in the BOM so as to enable the contractor to carry out erection as per scope.

6.3.3 SCOPE OF WORK FOR INSTRUMENTS:

1. The type of instruments to be erected and commissioned shall be as detailed below:
 - i) All types of transmitters like temperature, pressure, flow, level and position feed back transmitters etc.
 - ii) Local mounted pressure gauges, DP gauges, thermocouples, RTDs, temperature gauges, temperature switches, pressure switches, DP switches, flow switches and limit switches and flow indicator level switches etc.
 - iii) Air filter regulator sets, Air lock off valve, Power cylinders etc.
 - iv) Panels / Control desk mounted Instruments like indicators, recorder, console and electronic modules etc.
 - v) I/P converters and local controllers.
 - vi) Special instruments like vibration sensors, proximity sensors, electronic water level indicator, SWAS, Gas analyser, PC based instruments, and special type of instruments like Coal Flow Monitor, etc.
 - vii) Pneumatic operated control valves, trip valves, solenoid valves, and electrically operated valves. (commissioning only)
2. Prior to installation, all the Instruments (local & remote), thermocouples and RTDs, I/P converters, etc. shall be calibrated. Similarly, limit switches, flow switches, level switches, solenoid valves, air filter regulator, purge meters, etc. shall be checked for proper operation.
3. Unit rate quoted for each instrument shall include calibration, installation, loop checking, commissioning and trouble shooting until satisfactory performance as per operational and system requirement and maintenance till the end of contract period or trial operation whichever is earlier. In case any instrument requires recalibration to achieve the expected performance, the same shall be carried out at no extra cost. If any re-calibration or replacement of instruments and rechecking of cable termination is found necessary during commissioning, the same shall be done at no extra cost. The unit rate shall also cover marking Tag numbers of instruments or Racks, either by paint or a separate tag plate as per BHEL Engineer's directive.

4. Unit rates have been asked item-wise for instruments, gauges, switches, indicators, recorders etc. as indicated in BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items of work of the rate schedule.
5. If any instrument is to be relocated for reasons not attributable to the contractor, but required for satisfactory performance, the same shall be carried out on extra works basis. This activity is to be coordinated by contractor separately and the manpower for the above activities shall not be availed from commissioning manpower.
6. Unit rate quoted for erection of pressure/ differential pressure transmitters, gauges, switches, shall include fixing the instruments on the racks / supports along with manifolds, and associated fittings and clamps. No separate rate shall be paid for each item. However, for fabrication and installation of racks and supports, rates shall be paid on tonnage basis. Steel materials required for fabrication of Racks and supports shall be supplied by BHEL.
7. Unit rate quoted for Temperature transmitters, I/P converters, Air filter/ Air lock off valves, Purge meters, Rotameters, position transmitter, probes etc shall include fixing the instruments on the racks / supports along with associated fittings and clamps. No separate rate shall be paid for each item. However, for fabrication and installation of racks and supports, rates shall be paid on tonnage basis.
8. The unit rate quoted for control room mounted instruments shall cover mounting of instruments on panels / desk wiring, minor grinding on the cut out of panels for proper fixing.
9. The unit rate quoted for erection of Casing temperature thermocouple of turbine/ metal temperature thermocouple (MTM) shall cover laying, dressing and clamping, supply and fixing of tag plates, etc. Welding of MTM pads shall be carried out by mechanical contractor. Necessary tray supports for routing of MTM thermocouples shall be erected as part of tray erection covered in the tender.
10. Unit rate quoted for erection and checking of thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells, seal welding of thermowell, wherever required as per BHEL specification and directive of site engineers.
11. Unit rate quoted for Erection and commissioning of temperature switches, gauges besides the works covered above (RTD & T/C) suitable support shall be provided for capillary type temperature Gauges/switches that shall be fabricated at site using steel plates and angles. The rate for fabrication and installation shall be on tonnage basis.

12. Unit rate quoted for erection and commissioning of float type Level switches includes fixing of switches on float chambers and fixing of float chambers on stand pipe, providing supports wherever required, any minor modification required to match Float chamber with tapping point etc.
13. The unit rate quoted for erection and commissioning of Electronic type Level switches includes fixing of Electrode standpipe, Electrodes, Electronic unit, any minor modification required to match Float chamber/ Electrode standpipe with tapping point, integration of all loose supplied items etc.
14. Unit rate quoted for erection/commissioning of special instruments like, Flame scanner, H.E.A Igniters systems, Vibration monitoring System, Electronic water level indicator, Sonic Tube Leak Detection system, SWAS, Gas analyser, PC based instruments, Coal Flow Monitor, Bunker level monitor, etc. shall include installation of all loose items which are not explicitly mentioned, but comes as part of the system, integration of total system and commissioning. Lump sum rate shall be quoted as mentioned in the BOQ. No separate rate shall be payable for loose items including furniture. The quantity of loose supplied items are approximate only. No proportional rate will be applicable for any variation in quantity or for any additional items supplied as part of equipments.
15. For Special Instruments like SWAS, Gas Analysers, Bunker level monitor, Vibration Monitoring System, Master Clock system, Battery and UPS, vendor support will be provided by BHEL for commissioning. The contractor shall provide assistance for the commissioning activities.
16. Some of the Gas Analysers are to be installed at Chimney 75 ML / 35 ML as indicated in BOQ. For the erection of associated hardware for these analysers, like cables, trays, GI pipe etc. that are to be routed from the analyser panels at 75 ML/ 35 ML of Chimney to zero meter level, payment will be made at twice the unit rate quoted against each item.
17. For Vibration Monitoring System, installation of sensors along with mounting pads is in the scope of the vendor, and arranged by BHEL. However, if any surface finishing / tapping is required to fix the sensors, the same shall be arranged by the contractor at no extra cost.
18. For Coal Bunker level monitor, fixing / erection of the sensors onto legs of Bunkers is in the scope of Vendor and arranged by BHEL. However, the contractor shall provide necessary approach platforms with ladders and any other assistance for erection of these sensors.

19. All instruments are generally covered in rate schedule. However, if any instruments not covered, but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent unit rate for those instruments shall be considered wherever possible from the BOQ.
20. Canopy shall be provided for field-mounted instruments as per site requirements. Necessary materials like MS Plate shall be provided by BHEL. Rate for fabrication and installation of canopy shall be on square meter basis.
21. Temporary protection by thermocol, polythene sheet, GI sheets shall be provided by the contractor for safe guarding the instruments against damages. The protective materials shall be supplied by the contractor at no extra cost.
22. In case the Instruments are mounted and supplied along with main equipment and the BOQ calls for Erection & Commissioning, the contractor shall carry out removal, calibration, re-fixing and commissioning of same. Payment shall be made only for removal, calibration, re-fixing and commissioning, in line with rate quoted for removal, calibration and re-fixing of Instrument of similar type.
23. In case the Instruments are supplied as loose items, and the BOQ calls for removal, calibration, re-fixing and commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made only for Erection and commissioning in line with rate quoted for Erection and Commissioning of Instruments of similar type.

6.3.4 SCOPE OF WORK FOR IMPULSE PIPES:

1. Different types of impulse pipes, like alloy steel, carbon steel, stainless steel of different sizes and thickness shall be supplied with suitable fittings like coupling, sockets, root valves, drain valves, manifold, condensing pots, syphons, tees, bends, nut and tail piece.
2. Unit rate quoted for impulse piping shall include site routing, cold bending, tig / arc welding of unions, connector Nuts and tail pieces, sockets, nipples, equal tees, couplings, condensing pots, syphons, root valves, isolation valves etc., fixing of manifolds and supporting with suitable fixtures and 'U' clamps and painting as per BHEL specification and site engineers instructions. No separate rate shall be paid for the Impulse pipe fittings. The unit rate also includes supply of U clamps, fasteners, paints, etc. For impulse pipe support materials viz. Angles/ Channels, the rate shall be paid on tonnage basis. The above support materials shall be supplied by BHEL. For scope of painting, please refer Scope of Painting clause. Welding of impulse pipe for High Pressure Lines shall be carried out by High Pressure welder.

3. Suitable root valves will be provided by BHEL on the tapping point wherever required. Wherever the dia of the impulse piping is not matching with valve outlet dia., reducers to be provided and necessary welding to the same to be done at site as part of impulse pipe erection. The reducers will be supplied by BHEL and the contractor shall carry out the welding. No separate rate will be paid for welding of the reducers.
4. TIG-welding sets, welding transformer/generator rectifier, Hydraulic bending machines, DPT kits, Hydraulic testing pumps required for pressure testing of impulse pipes shall be arranged by the contractor. Similarly, consumables such as welding electrodes, gas, Tungsten rods etc., filler wire shall be arranged by the contractor within the quoted rate.
5. The contractor shall obtain necessary approval for welding electrodes, filler wire from BHEL welding engineer at site.
6. Impulse pipes Welder shall undergo test and get approval from BHEL welding engineer according to the nature of welding.
7. For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer at no extra cost.
8. Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work.

6.3.5 SCOPE OF WORK FOR PRE-FABRICATED/ SEMI-FABRICATED LIR/ LIE/ GAUGE BOARDS

1. If the frame or rack is supplied as a pre-fabricated item like LIR, same shall be erected, grouted and painted as per site requirement
2. If any frame or support or rack supplied as semi fabricated item, same shall be assembled at site either by welding or bolting and erected, grouted and painted as per site requirement.
3. Unit rate quoted for such pre-fabricated /semi fabricated items like LIE/LIR and enclosure shall be on Number basis. Unit rate shall cover installation, grouting, painting and supply of nuts, bolts, anchor fasteners, grouting materials such as cement, sand etc as required. Unit rate shall also include full painting of impulse line fitted and supplied along with LIR/LIE/LGB.

4. Wherever LIR/LGB/LIE are supplied with instruments mounted on them, the rate quoted for LIR/LGB/LIE shall include calibration of all the instruments mounted on them as detailed in the BOQ. However if the instruments supplied as loose items, the instruments shall be calibrated and mounted on the LIR/LGB/LIE and separate calibration/erection /commissioning charges shall be applicable in line with other instruments erection.

6.3.6 SCOPE OF WORK FOR COPPER/SS TUBES:

1. Different sizes of copper tubes of different thickness with or without PVC coating shall be supplied in standard lengths of 15 Mtr Coils and SS tube shall be supplied in standard length of 6 meter. The connectors and tees will be of brass/SS of different sizes as per site requirement.
2. The unit rate quoted on meter basis includes site routing, bending, providing supports, fixing of connectors, unions, valves, tees, etc. and connecting to the instrument air line instruments. The unit rate also includes providing tag plates on instruments / power cylinders.
3. If copper/SS tube length is more than ½ mtr, suitable support shall be provided either by angle or trays. Protective angles to be used for copper tube routing. The support materials shall be supplied by BHEL. Separate Rate shall be paid for fabrication and erection of supports as per rate quoted in the BOQ.
4. Copper/SS tubes shall be clamped with suitable clamping materials. Supply of suitable Aluminium clamps and tag plates are under contractor's scope. The unit rate quoted for laying of copper tube shall cover the supply of clamping materials also. For SADC system copper tube Tag plate shall be provided near instruments, TEES and Power cylinders. Leak test shall be carried out after completion of tubing works as per guidelines.

6.3.7 SCOPE OF WORK FOR INSTRUMENT AIR LINES (GI PIPES):

1. Different type of GI pipes of different thickness class shall be supplied along with GI fitting accessories like union, coupling, tee, reducers, elbow, valves, etc
2. Unit rates on length basis for erection of instrument air lines includes site routing, providing supports, fixing "U" clamps, fixing of loose supplied GI accessories mentioned as above as per the drawings, providing fresh threading as required for jointing with unions, valves and all type of other fittings as required in the system. Unit rate also shall include supply of U clamps, Teflon tapes and bolts, etc.

3. Teflon tapes shall be used for tightening all the joints. No bending, welding etc. is allowed. No separate rate shall be paid for erection of GI fittings / accessories and U clamps.
4. After installation of instrument airlines, the line shall be blown and leak test shall be conducted for all the joints as per the guidelines given in section VII.

6.3.8 SCOPE OF WORK OF ELECTRIC & PNEUMATIC ACTUATORS:

1. Different types of pneumatic actuators like regulating type, on-off type, of different stroke length shall be supplied. Some of them may be fitted and supplied with main equipment.
2. The unit rate quoted for erection & commissioning scope of electrical and pneumatic actuators includes fabrication and installation of base frame, modification of linkage mechanism wherever required and connecting the same with driven equipment, fixing of all accessories like air sets, Solenoid valves, air lock off valves, limit switches, if supplied loose item as part of power cylinders, replacing the damaged copper tubes or any other accessories like gauges, solenoid valves, limit switches, etc. connecting to air line, and adjusting the stroke length. No separate rate shall be paid for the above works. For all pneumatic and electrical actuators, the necessary LINKAGE MECHANISM shall be supplied by BHEL as part of actuators. No separate rate shall be paid for erection of linkage mechanism. For fabrication and erection of steel supports and frames, the rate shall be paid on Tonnage basis.
3. The link rods have to be adjusted to suit the opening and closing position. This adjustment has to be repeated number of times till proper operation is obtained. If BHEL site engineer desires to remove the accessories like position transmitters, air locks, positioners, limit switches, solenoids etc. prior to erection either at BHEL stores or at site to avoid damages/pilferage, keep in safe custody and remount the same prior to commissioning, this shall be part of scope of work for power cylinders .
4. For calibration of any Pneumatic Actuator at field, temporary air supply if required shall be arranged by the contractor.
5. In case the power cylinder is supplied in assembled condition along with main equipment and the BOQ calls for Erection & Commissioning of the same, payment shall be made only for commissioning, in line with rate quoted for commissioning of pneumatic power cylinder of similar type.

6. In case the power cylinder is supplied as loose item, and the BOQ calls only for commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made in line with rate quoted for Erection and Commissioning of power cylinder of similar type.
7. Checking of related power cables /MCC of bi-directional electrical actuators shall be done by customer. It shall be the overall responsibility of the C&I Contractor to do the loop checking of command and feedback signals from DCS to the bi-directional Electric actuators besides setting of limit switches, position feed back transmitter etc as detailed in clause elsewhere.
8. During commissioning of the bi-directional Electrical Actuators ,the C&I Contractor shall co-ordinate with customer agencies to ensure that all feedback and command signals and settings are made available. The list of such actuators is indicated separately in the BOM under commissioning scope.
9. The Unit Rate quoted for checking of motors from DCS shall cover all the activities mentioned above. The work for loop checking of bi-directional actuators shall be deemed to be completed only after satisfactory operation of actuator from DCS.

6.3.9 SCOPE OF WORK FOR CABLES:

1. BHEL will supply LT, 1.1 KV, armoured/ unarmoured, Copper PVC FRLS insulation, Power, Control and Instrumentation cables of different sizes. The special cables supplied shall be of Compensating cable, Ethernet cables and Fibre-optic cable of different sizes and type.
2. Unit rate quoted for cable shall covers laying, termination, drilling of holes on the gland plates of the panels/JB or Enlargement of cable entry holes by tapping or any modification required fixing of cable glands, fixing of glands, ferrules and tag plates and dressing.
3. Unit rates quoted for cabling shall also include supply of clamping/ dressing materials such as Aluminium/GI strips or PVC ties, ferrules, tag plates, lugs upto 2.5 sq. mm. apart from the work mentioned above. Supply of above material shall conform to the specification detailed in Section VII.
4. Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.
5. Ethernet cables and Fibre optic cables shall be isolated from other cables and laid in a separate cable tray as directed by site Engineer. Wherever required I/O Box shall be installed for Ethernet cable termination and PUNCH DOWN crimping tools shall be used for Ethernet cable termination.

6. The scope of work for Fibre Optic cable, if applicable, shall be laying only. Termination of Fibre optic cables is not in contractor's scope. This shall be carried out by the vendor and the contractor shall provide necessary assistance to the vendor during cable termination. Wherever required, the Fibre optic cable shall be laid through HDPE Conduit. Unit rate quoted for laying of Fibre Optic cable shall include laying of HDPE conduit wherever required.
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 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.
13. Contractor shall carefully plan the cutting schedule for each cable drum in consultation with Engineer such that wastage is minimized and any resultant short lengths can be used where appropriate route lengths are available.
14. Contractor shall coordinate with Electrical contractor during loop checking of actuator cables for proper operation of actuators.

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 for the purpose of estimation to be assumed as follows: The average RUN length shall be considered as 150 Mtrs. However, for 10% of the 2 pair and below, the average length shall be considered as 30 Mtrs.
17. The cables covered in the BOQ may be appearing either in C&I cable schedule or in Electrical cable schedule. The contractor shall lay and terminate all the cables covered in the BOQ, as per directive of BHEL Engineers.
18. **SCOPE OF CABLE TERMINATION**
 1. The scope of termination shall also include, termination of cables on various equipment installed by others.
 2. Scope of termination shall include supply of insulating sleeves which shall be fire resistant and long enough to over pass conductor insulation and shall be properly sized.
 3. The work of testing and reconnecting/ rearrangements of leads if required, changing of connectors, shall be carried out without additional cost
 4. Contractor shall arrange all type of termination and crimping Tools/ equipments required for the connections/terminations.
 5. After cable terminations, the debris shall be removed then & there
 6. **Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.**

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

A-CABLE TRAYS

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

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

- a. The unit rate for erection of trays shall be on meter basis. The unit rate quoted for erection of tray shall also include erection of all tray accessories such as elbow, cross, TEEs, bends such as vertical and Horizontal, reducers, coupler plates/fixing plates, anchor bolts, fasteners etc.
- b. For routing of trays standard tray accessories supplied by BHEL shall be used. However if above standard tray accessories are not supplied, the same shall be fabricated and installed at no extra cost .
- c. If standard tray accessories like TEES, Reducers, Bends , cross etc requires any modification to suit the tray routing, the same shall be carried out at no extra cost.
- d. The unit rate quoted for trays shall also cover making of offsets by means of cutting standard tray sections and inserting suitable trays to match with the existing arrangement
- e. No separate rate shall be paid for any such site fabrication/ modification on trays or on tray accessories.
- f. The contractor shall quote a uniform rate on meter basis for erection of trays and Tray accessories like TEES, Reducers, Bends, cross etc.
- g. Tray covers are to be erected after completion of cable lying and no separate payment will be made for fixing these covers. GI strip clamps are to be used for fixing the tray covers.
- h. Welded Joints of trays shall be painted with red lead and aluminium paint in turn with bitumen as per IS 3043. The unit rate shall also include supply of paints, thinner, other consumables and brush etc.

B- RIGID & FLEXIBLE CONDUITS

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

- b. Unit quoted on meter basis for flexible conduit includes drilling of the holes on the plates, fixing of the end connectors, providing suitable supports and fixing tag marks wherever specified as required by BHEL. No separate payment will be made for fixing of end connectors.
- c. Unit quoted on meter basis for GI rigid conduit includes supply of suitable clamps/ fasteners/ tag plates etc.

6.3.11 SCOPE OF WORK FOR JUNCTION BOXES/CJCBs /PUSH BUTTON BOXES:

- 1. Different Junction Boxes/push Button boxes shall be supplied with gland plates.
- 2. The unit rate quoted for erection of junction boxes/push button boxes shall cover 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 on junction boxes/push button boxes, minor chipping, grouting as required for mounting the JBs/PB and supply of all bolts and nuts (Fasteners) including grouting bolts as required for mounting the junction box/push button.
- 3. For fabrication and fixing of supports/Frame, rate shall be paid on tonnage basis.
- 4. The contractor shall close all unused holes on the gland plates using GROMMET or any other suitable materials within the quoted the rate.
- 5. All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.
- 6. Any modification like replacement of terminals, enlarging gland holes etc. that is required to accommodate power cables shall be carried out as part of this works.

6.3.12 SCOPE OF WORK FOR FABRICATION MATERIALS & STRUCTURAL STEEL:

- 1. The scope of fabrication generally includes supports for cable tray, instruments, impulse pipes, GI pipes, support angles for copper tubing, mounting frames for JB, Control Box/Panel, local PB Stations, canopy for local instruments and local instrument rack etc. wherever required.
- 2. The fabrication steel materials such as angles, channels, plates, flats in standard length pieces shall be supplied by BHEL, free of cost.

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. If nuts, bolts, anchor fasteners required for fixing the racks or frames the same shall be arranged by the contractor within the quoted rate.
6. For fixing frames or supports if any minor grouting is required the same shall be carried out within the quoted rate. After installation of frames, grouting of the same is in the scope of contractor.
7. Supply of cement, sand etc. required for grouting of supports shall be included in the unit rate quoted.
8. 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.

6.3.13 SCOPE OF PAINTING:

1. The scope of painting generally includes for all the steel fabrication works such as supports, racks, frames, canopy, LIE/LIR/LGB, impulse pipes etc. carried out by the contractor. 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 painting of synthetic enamel paint of colour approved by BHEL.
4. Paints shall be arranged from standard reputed suppliers in consultation with BHEL.
5. 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

6. For any bare copper tube require painting same shall be carried out by the contractor within the quoted rate.
7. All damaged painted surfaces shall be cleaned and coated with two (2) coats of primer followed by a finishing coat of approved colour.
8. All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
9. Unless otherwise instructed, final painting shall be carried out in the field, only after mechanical completion and completion of cable laying.
10. 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.
11. 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

6.3.14 SCOPE OF CIVIL WORKS

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

6.3.15 SCOPE OF CALIBRATION:

1. Contractor shall calibrate all the local instruments, panel mounted instruments including that will be supplied along with equipments mounted in or as 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, protective 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 etc 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 reimbursed by BHEL. However if above such calibrator is available with BHEL at site the calibration shall be carried out by the contractor within the quoted rate.
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/JSL Engineers.

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

1. PNEUMATIC (ALL TYPES OF VALVES AND POWER CYLINDERS)
 - a) Calibration and checking of instruments mounted on the actuators and setting stroke length of the actuator.
 - b) Servicing of positioners, position transmitters, limit switches, solenoid valves, air lock-off valves, removing/replacement of defective components, copper tubes etc., if necessary.
 - c) If the actuator is to be removed for attending to any mechanical problems, removing of copper tubes, cables etc. reconnecting and re-commissioning of the actuators is to be done.
 - d) Testing and checking the remote/local operation in Auto as well as Manual mode.
 - e) Fixing of instruments if supplied as loose items. (As referred in sl.no. 6.3.9.2 b above)
 - f) Attending to any defects till the contract period.

2. FLOW METERS/ SWITCHES

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

3. LIMIT SWITCHES & LEVEL SWITCHES

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

4. SOLENOID VALVES

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

5. TEMPERATURE ELEMENTS (MOTORS AND GENERATORS WINDING AND BEARING)

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

6. DIRECT WATER LEVEL GAUGES (REMOTE & LOCAL)

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

7. INSTRUMENTS MOUNTED ON THE EQUIPMENTS/ SKIDS/ PANELS

Scope of work covers removal, re-calibration, re-fixing, and re-termination of cables, checking the continuity, replacing any defective parts or replacing the total instrument, if required.

8. Electric Bidirectional Actuators.

- a) Identification and checking of loop cables.
- b) IR value of motor, measurement of winding resistance etc.
- c) Dryout all the motors if required to improve IR value.
- d) Limit switch and torque switch setting
- e) Calibration of Electronic cards, modules etc. and fixing the same if supplied as loose item.
- f) Checking direction of rotation of motors and testing and commissioning from local as well as remote.
- g) Attending to any defects till the handing over of the unit to customer by BHEL
- h) Replacing defective components like limit switches, electronic cards etc.

NOTE:

The scope of work covered in 6.3.9.0 also includes collecting the replacement instruments/parts from BHEL/customer stores, stockyard etc.

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

6.3.17 SCOPE OF WORK FOR UPS, BATTERY AND BATTERY CHARGER

The batteries are of heavy duty type capable of providing normal and emergency DC loads. The cells will be mounted on insulators carried on suitable wooden stands. The rectifiers/inverters are fully thyristorised and shall comprise of Silicon Controlled Rectifier with transformer, switchgear and automatic regulation. Tentative details are given in the BOM. Lump sum shall be quoted for Erection and commissioning of UPS and Battery. No additional payment shall be made for any variation in the number of cells. The unit rate quoted for erection of UPS and battery will include the following works.

1. Collection of batteries and battery chargers and all the accessories like cable connectors, inter lock connectors, equalizing connectors, rack insulators, fuse box etc from stores.
2. Filling of alkali to the individual cells after shipping the cells.

3. Conducting load test with suitable resistive load banks for charging and discharging cycles.
4. Arranging complete manpower requirement in shifts for battery charging and discharging cycles that may be carried out round the clock as per the code of practice.
5. Modifications or changes if any for the loose supplied items or any minor changes in wiring at no extra cost.
6. Arranging necessary tools, T&P, Testing & calibration instruments required for erection and commissioning of the battery and battery chargers.

6.3.18 SCOPE OF EARTHING

1. The scope of earthing covered in this contract is above ground earthing i.e equipments earthing. Scope of earthing covers earthing of field Instruments, JBs, Branch trays, LIR/LIE/ , JB, push Button boxes etc. shall be electrically earthed. All DCS and its accessories PLC/Instrumentation panels/systems etc, shall be earthed to a separate Electronic earth grid.
2. Different type of earthing materials shall be supplied and same shall be erected as per site requirement.
3. The unit rate shall be quoted for earthing on meter basis. The rate shall cover supply of fasteners, lugs, minor civil works etc.
4. All connections from the equipment to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the contractor at site.

6.3.19 SCOPE OF PRE-COMMISSIONING/ COMMISSIONING AND POST COMMISSIONING WORKS:

1. The scope of commissioning works covers commissioning of all instruments covered in the BOQ including loop checking and establishing the operation of instruments /systems to meet plant commissioning/operation. 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 instruments and 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:

- i) Trial run of various equipment.
- ii) Light up of boiler.
- iii) Boiler acid cleaning.
- iv) Boiler alkali boil out.
- v) Turbine barring gear.
- vi) Steam blowing of piping.
- vii) Turbine rolling.
- viii) Safety valve floating.
- ix) First synchronization of unit.
- x) Heavy oil firing and synchronization.
- xi) Coal firing of boiler.
- xii) Full load operation of unit.

The above 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 precommissioning 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 experienced commissioning engineers, supervisors including electricians/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. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and necessary recoveries with overhead cost will be made from the bills of the contractor.
6. 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.
7. For electrical works, 415 volts and above, the contractor has to bring qualified electricians and the total work has to be certified by electrical license holder. The expenditures towards work certificate and all statutory requirements connected towards the high voltage system shall be borne by the contractor.
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:

	Boiler	TG	Station C&I	TOTAL
Engineer (C&I)	1 No.	1 No.	2 Nos	4 Nos.
Supervisor (C&I)	3 Nos.	3 Nos.	4 Nos	10 Nos.
Technician (C&I/ Elec)	6 Nos.	6 Nos.	10 Nos.	22 Nos.

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.

11. 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.
12. 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.
13. The scope of commissioning shall also cover the commissioning of the equipment/drives erected by the mechanical contractors. (as detailed in the BOQ)

6.3.20 EXCLUSIONS

The following are specific exclusions from this work

- a. Erection of dampers, valves, electrical actuators, HT/LT drives
- b. Attachment welding of thermocouple pads, flow nozzle, orifice plates and control valves
- c. Root valves on the instruments tapping points

NOTE:

The above exclusions should not be concluded as final. They are meant for general guidelines. BHEL reserves the right to include or exclude any item which is required for completing the job as per rates indicated in rate schedule. Contractor should carry out all such jobs as per the instructions of BHEL, Engineer.

6.4.0 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS

- 6.4.1 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.
- 6.4.2 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.
- 6.4.3 Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.
- 6.4.4 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.
- 6.4.5 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.
- 6.4.6 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.

6.5.0 STORAGE

- 6.5.1 The equipment should be preferably in its original package and should not be unpacked until it absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.
- 6.5.2 The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damp, sinking into around and to circulate air under the stored equipment. This will also help in lifting the packing with forklift truck.

- 6.5.3 Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when decolorisation takes place or regenerated. BHEL shall supply the material and contractor shall replace.
- 6.5.4 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.
- 6.5.5 The storage room and the equipment should be checked at regular interval of 3 months to ensure protection from termites, mould growth, condensation of water etc. which can damage the equipment.
- 6.5.6 Contractor shall keep BHEL informed about such problem and try to rectify the problem at his risk and cost.
- 6.5.7 All the instrument, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site.
- 6.5.8 Packing material shall be retained if the cubicle to be repacked after inspection
- 6.5.9 All sub-assemblies should be kept in a separate place where it is easily accessible.
- 6.5.10 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. Sub-assemblies should not be stacked one above the other.
- 6.5.11 The loose items supplied for the main equipment falls into various categories like tools, modules, prefabricated cables, console inserts, recorders, modules and display units, printers, sensors and transducers, PCs, monitors, cable glands, cable ducts, frames etc. are to be categorised and stored separately.

6.6.0 T&P TO BE PROVIDED BY BHEL FREE OF CHARGE

EOT Crane for shifting of panels.

Note: The operator for crane shall be arranged by the contractor at his cost.

6.7.0 TOOLS AND PLANT TO BE ARRANGED BY THE CONTRACTOR

6.7.1 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.

6.7.2 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.

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

6.7.4 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.

6.7.5 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.

6.8.0 MATERIALS/CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR WITHIN THE RATE QUOTED FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENT/ ITEMS.

- a. Welding electrodes and gas
- b. Provision for Temporary Scaffoldings.
- c. "U" Clamps with nuts and washers for impulse pipes and GI pipe clamping.
- d. Tags- Plates.
- e. Insulation tape.
- f. Teflon tape for GI pipe coupling.

- g. Paints required for primer coating and final coating of synthetic enamel paint of approved colour, Consumables like thinner, brushes, emery paper etc.
- h. Solder wire (Lead) -(60/40)
- i. Protocol/Calibration report sheets as per BHEL Format.
- j. Fastener for mounting JB and local PB Boxes.
- k. Panel/ JB Sealing compound material (for cable entry from bottom/Top of Panel).
- l. PVC cable tie, Aluminium or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing, grommet
- m. Ferrules, sleeves for cables
- n. Lugs upto 2.5 sqmm

6.9.0 TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS

1 CABLE LUGS:

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

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

6.10.0 MANPOWER REQUIREMENT

Manpower requirement for Erection and Commissioning shall as follows:

There shall be 3 separate Erection In-charges, each for Boiler, TG and station C&I. They shall work independently with required manpower, T&P etc., including storage facilities. Each Erection In-charge shall have minimum 2 erection engineers with adequate supervisors and Technicians. Similarly commissioning Engineers also shall be identified separately for each package and the minimum requirement shall be as indicated in the Tender Specification Section VI. Besides the above, there will be separate engineers for Planning, Safety and Quality. For all practical purposes, each of the above In-charges shall be provided with a PC and good communication facilities.

6.11.0 DOCUMENTATION

6.11.1 The following information shall be furnished after commencement of works.

- a. Calibration certificates for the Instruments calibrated at ste.
- b. Test certificates of various tests conducted at site.
- c. Erection and commissioning protocols signed by customer & BHEL

6.11.2 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.

6.12.0 PROGRESS AND MONITORING OF WORK

6.12.1 It shall be the responsibility of the contractor to provide all the relevant information on a regular basis regarding erection progress, welding progress, labour availability, equipment deployment, consumption of electrodes, gases, etc

6.12.2 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 planned with reasons indicating the delays, if any. The report shall also give the remedial

actions 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.

6.12.3 Contractor shall monitor the progress of works on day to day basis as per the format furnished by BHEL.

6.13.0 ELECTRICAL INSPECTORATE'S APPROVAL:

6.13.1 All electrical installation covered in contractors scope are to be inspected/approved by the electrical inspector/statutory authority. Contractor is responsible for getting the Electrical inspector approval. For getting electrical inspector approval, contractor shall co ordinate with Electrical contractor. Necessary completion/test certificate for the Electrical equipments like DC systems, UPS etc covered in the contractor scope shall be arranged by the contractor.

6.13.2 Contractor shall carry out the modifications/rectifications if any as suggested by the authority at his cost.

6.13.3 BHEL shall pay all fees (Fees for visits, Inspection fees, registration fees, etc)

6.13.4 However any expenditure related to documentation shall be borne by contractor.

6.14.0 DETAILS TO BE FURNISHED BY THE TENDERERS

6.14.1 Apart from other details called for in the tender document under the various other provisions, the tenderers along with their offers shall submit the following details. Please also refer the checklist.

6.14.2 Tenderers shall go through very carefully all the provisions under section VI and shall submit manpower deployment plan as per appendix VI A. The contractor along with his offer shall, also submit the list of T&P and instruments that are available with him for mobilisation for the work as specified in Appendix VI B. 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.

6.14.3 Apart from other details called for in the tender document under the various other provisions, the tenderers along with technical bid shall submit the following details.

- a. HQ Organisation chart
- b. Site Organisation Chart Covering various function
- c. Month wise Manpower deployment plan
- d. T&P deployment plan

6.14.4 The following information shall be furnished within two weeks of award of contract for approval:

- a. Final field quality plan
- b. Detailed organization chart
- c. Erection Schedule.
- d. Experience details of site staff
- e. Details of calibration instruments

6.15.0 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

6.15.1 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.

6.15.2 The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.

6.15.3 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.

6.15.4 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.

6.15.5 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.

- 6.15.6 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.
- 6.15.7 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.
- 6.15.8 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.
- 6.15.9 The erection contractor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed the following limits;
- | S.No. | Item | % Wastage on issued Qty |
|-------|---|-------------------------|
| 1. | Fabrication steel | 2 |
| 2. | Each size of power cables | 1 |
| 3. | Each size of control/Inst cables | 2 |
| 5. | Impulse pipe/tubes/GI pipes/copper tube | 1 |
- 6.15.10 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.
- 6.15.11 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
- 6.15.12 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.

6.16.0 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.

- 93% payment will be made on prorata basis on Erection and commissioning as detailed below.
- 2% on submission and acceptance of final bills and
- Final 5% will be paid after guarantee period or against submission of matching BG valid for the guarantee period.

6.16.1 FOR ALL TYPE OF INSTRUMENTS INCLUDING POWER CYLINDER/ACTUATOR.

- | | | |
|----|--|------|
| a. | Receipt, transport to erection site, assembly, checking, calibration, fixing and clamping Adjustment, Alignment, on pro rata basis and protocol signed | 75 % |
| b. | Pre-commissioning tests, checks, and making ready for energisation pro rata basis and protocol signed | 15 % |
| c. | Completion of pending points | 3 % |

6.16.2 For AC& DCDB / DCS/MMI/PLC system and all types of control panels Including MMIPIS(DCS) Related instrumentation:

- | | | |
|----|---|-----|
| a. | Receipt, transport to erection site Placement, assembly fixing and clamping Adjustment, Alignment, grouting and electrical interconnections on pro rata basis and protocol signed | 70% |
| b. | Pre-commissioning tests, checks, and making ready for energisation on pro rata basis and protocol signed | 20% |
| c. | Completion of pending points/ submission of as built drawing | 3% |

6.16.3	For UPS/ Battery Sets/ Charger	
	a. Receipt, transport to erection site, checking, Placement, assembly, grouting Mounting and wiring of loose components	50%
	b. Adjustment, alignment, inter connections and pouring of Alkali	20%
	c. Pre commissioning test checks, and making ready for Energisation	20%
	d. Completion of pending points	3%
6.16.4	For Cable Laying & Cable Termination	
	a. Laying /tagging /termination on pro rata basis and protocol signed	75%
	b. Checking/dressing on pro rata basis and protocol signed	15%
	c. On submission of as built drawing	3%
6.16.5	For fabrication and installation of steel materials including LIR / LIE	
	a. After fabrication & installation and applying of primer on pro rata basis	85%
	b. On completion of painting and protocol signed	8%
6.16.6	For Cable Trays, Tray Supports, Rigid & Flexible Conduits & Copper tubes, Earthing	
	a. On satisfactory completion of work on pro rata basis	75%
	b. On completion of drawing or area wise on pro rata basis	18%
6.16.7	For Impulse Pipes.	
	a. On Laying and welding on pro rata basis and protocol signed	70%
	b. On Clamping and painting on pro rata basis and protocol signed	23%

- 6.16.8 For commissioning of equipment erected by other agency
- a. On completion of commissioning of individual racks/ skid/ actuators / loop checking/ instruments etc. on pro rata basis 80%
 - b. On completion of commissioning of main equipment/ system on pro rata basis 13%
- 6.16.9 For Supply Items (if applicable)
- a. On submission of running bill along with the Stores Receipt Voucher/ Stores' Endorsement issued by BHEL , on pro rata basis 93%
- 6.16.10 For all other items which are not covered in the above Terms of Payment, the payment shall be made as under.
- a. 70% of the accepted rate for the respective item of work on pro rata basis on satisfactory completion of work.
 - b. 23 % of the accepted rate on completion of the commissioning of the respective Items/Equipments etc on pro rata basis.

6.17.0 TIME SCHEDULE

6.17.1 The contractor shall mobilise his resources and work force within two weeks from the date of telegraphic LOI in such a manner that the entire C&I work covered in his scope is completed to match the following commissioning programme.

- 1) Boiler Light up 2 months from start of work
- 2) Steam Blowing Completion 4 months from start of work
- 3) Synchronization with coal firing 5 months from start of work
- 4) Full Load Operation 7 months from start of work
- 5) Trial Operation 8 months from start of work
- 6) Completion of all pending points 11 months from start of work

6.17.2 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.

- 6.17.3 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 will be recorded in measurement book while entering the first RA bill.
- 6.17.4 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.
- 6.17.5 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.
- 6.17.6 The entire scope of work erection, testing and commissioning shall be completed within 11 months as detailed in overall erection commissioning programs
- 6.17.7 The work under this scope of contract is deemed to be completed in all respects only when all the items/materials/equipment are 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.
- 6.17.8 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.
- 6.17.9 **CONTRACT PERIOD**

The total contract period for completion entire work shall be **11 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.

6.17.10 DELETED

6.18.0 OVER RUN CHARGES

6.18.1 In case due to reasons not attributable to the contractor, the work gets delayed and completion time gets extended beyond 11 (eleven) months from the date of commencement of the work, the contractor shall be entitled for over run Charges. (ORC). In case ORC arise the same will apply @ Rs.50,000/- (Rupees fifty thousand only) per month for extension to the completion period **beyond 11 months** as stated above duly taking into account the balance work at the end of that period.

6.18.2 The period of over run will have to be ascertained before the commencement of grace period

6.18.3 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.

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.

6.19.0 GUARANTEE

All the works executed by the contractor including supplies are to be guaranteed for a period of 12 months from the start of guarantee period.

The guarantee period will commence from the date of handing over of the unit to Customer or 6 months from the date of first synchronisation of the Unit, whichever is earlier. The contractor shall be responsible for the quality of workmanship and shall guarantee the work done, shall rectify/replace at no extra cost, all defects due to faulty supply/erection and commissioning during the guarantee period.

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.

6.20 DELETED

6.21. DELETED

6.22.0 EXTRA CHARGES FOR MODIFICATION AND RECTIFICATION WORK

- 6.22.1 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.
- 6.22.2 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
- 6.22.3 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 shall be considered for payment.
- 6.22.4 The decision of BHEL in this regard shall be final and binding on the contractor.
- 6.22.5 The following man hour rates shall be applicable for modification/rectification work.

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.**

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**

- 6.22.6 Extra works are broadly defined as below:
- Design changes which shall be intimated to the contractor after the start of the work which calls for dismantling of the erected components, rectification, modification, etc.
 - Modification, rectification of erection wrongly erected /fabricated at site as per drawing subject to acceptance by approving authority.
 - Jobs which require major modification, major repair, major reworks etc which shall be identified as major and warrant extra, payment, certified as such by the Project Manager and accepted by the designers/competent authority of BHEL.

6.22.7 However prior to carryout the repair/rework BHEL site will obtain administrative approval with the estimate before starting the works.

6.22.8 The decision of BHEL in this regarding the Extra works shall be final and binding on the contractor.

6.23.0 **PRICE VARIATION**

The price variation clause applicable will be as indicated below :

The finally accepted rates for scope of work as defined in this tender are subjected to price escalation provisions as per the following formulae.

$$P1 = 0.75 \times P0 (F1-F0)/F0$$

P1 = Increase in billing amount (escalation for the particular month of billing)

P0 = Billing amount calculated on the accepted contract rate

F1 = New All India Average CPI published by Labour Bureau, Simla, Government of India for Industrial workers (Base 2001 - 100) applicable for the month under consideration i.e. for which bill has been raised.

F0 = New All India Average CPI published by Labour Bureau, Simla, Government of India for Industrial workers (Base 2001-100) applicable from the month of commencement of work at site.

2 Price escalation as per above formula shall be calculated and paid (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 prior escalation as per above clause, 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) shall be payable during the entire period of execution including extended period, if any.
- 4 The payment of PVC shall be restricted to 10 % of the contract value.

6.24.0 **Taxes and Duties**

6.24.1 **Value Added Tax (VAT) for the works**

Price quoted shall be inclusive of VAT except service tax.

Notwithstanding the fact that this is only an erection service contract not involving any transfer of materials whatsoever and not attracting VAT liability, being labour oriented job work, for the purpose of VAT 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., interalia indicating the name of the supplier, address and VAT Registration No. and VAT paid for the purchases, etc

The bidder shall get registered with State VAT authorities and the registration certificate shall be forwarded to BHEL immediately after commencement of work. In case the bidder had already registered under respective State VAT, they must quote their registration Number and forward copy of Registration Certificate while submitting this tender. The bidder has to obtain VAT clearance certificate from the concerned authorities, on completion of work and submit along with the final bill as one of the documents for contract closure.

In case the Bidder decides to include any VAT element along with the quoted price, they shall specify (1) The value of VAT included in the quote, (2) the rate of VAT adopted and (3) On what value etc , as additional information, in the price bid.. If no VAT element is included in the price, the same shall be indicated in the quote.

The bidder shall quote very competitive price after taking into consideration of above points.

6.24.2 Service Tax

Price quoted shall be exclusive of Service Tax. The service tax as statutorily leviable and payable by the bidder under the provisions of service tax Law / Act shall be paid by BHEL as per bidder claim through various running bills. The bidder shall furnish proof of service tax registration with Central Excise Department specifying the name of services covered under this contract. Registration Certificate should also bear the endorsement for the premises from where the billing shall be done by the bidder on BHEL for this project. The bidder shall obtain prior consent of BHEL before billing the service tax amount.

6.24.3 Other Taxes & Levies

Any other taxes and duties (except VAT & Service Tax) viz. Entry Tax, Octroi, Seigniorage, Licenses, Deposits, Royalty, Stamp Duty, other charges / levies, etc. prevailing / applicable on the date of opening of technical bids and any variation thereof during the tenure of the contract **are in the scope of bidder**. In case BHEL is forced to pay any such taxes, BHEL shall have the right to recover the same from the bidder either from running bills or otherwise as deemed fit.

6.24.4 New Levies / Taxes

In case Government imposes any new levy / tax after award of the work during the tenure of the contract, 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.

6.24.5 Statutory variations

Statutory variations are applicable only in the cases of Value Added Tax and Service Tax. The changes implemented by the Central / State Government in the VAT Act / Service Tax during the tenure of the contract viz. increase /decrease in the rate of taxes, applicability, etc. and its impact on upward revision / downward revision are to be suitably paid/ adjusted from the date of respective variation. The bidder shall give the benefit of downward revision in favour of BHEL. No other variations shall be allowed during the tenure of the contract including extended period, if any.

6.24.6 Direct Tax

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

6.25 OTHER STATUTORY REQUIREMENTS

- 1) The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no alongwith the first running bill.
- 2) The contractor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC 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.
- 3) The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Non-compliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
- 4) The Contractor shall submit copies of Final Settlement statement of disbursement of retrenchment benefits on retrenchment of each workman under I D Act 1948, copies of Form 6-A(Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (If applicable) to BHEL along with the Final Bill.
- 5) In case of any dispute pending before the Appropriate authority under I D Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserves 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.
- 6) In case of any dispute prolonged/pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

6.26.0 PROVIDENT FUND & MINIMUM WAGES

- 6.26.1 The contractor is required to extend the benefit of Provident Fund to the labour employed in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, Contractor is required to get himself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted by the Provident Fund authorities within one month from the date of issue of this letter of intent. In case the contractor is exempted from such remittance, an attested copy of authority for such exemption is to be furnished. Please note that in the event of failure to comply with the provisions of said Act, if recoveries therefor 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 the contractor.
- 6.26.2 The contractor shall ensure the payment of minimum labour wages to the workmen under him as per the rules applicable from time to time in the state. The final bill amount would be released only on production of clearance certificate from PF/ESI and labour authorities as applicable.

6.27.0 IMPORTANT CONDITIONS FOR PAYMENT

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

1. PF Regn. No.
2. Labour Licence No.
3. Workmen Insurance Policy No.
4. Un Qualified Acceptance for Detailed L.O.I.
5. Initial 50% Security Deposit.
6. Rs. 100/- Stamp Paper for Preparation of contract agreement

All payments due to the contractor shall be made only through "e-Payment", through account payee cheque including return of EMD amount to unsuccessful tenderers. The tenderer has to furnish details of his Bank account as certified by the concerned Banker in the format furnished to enable e-payment.

FORM TO BE FILLED BY VENDORS FOR REGISTERING FOR E-PAYMENT

Details of Bank Account details of Contractor for remittance of e-Payment

1	NAME & ADDRESS OF THE CONTRACTOR / SUPPLIER	:
2	BANK A/C NO.	:
3	TYPE OF A/C (CC / CURRENT)	:
4	NAME OF THE BANK	:
5	NAME OF THE BRANCH	:
6	BRANCH CODE	:
7	BANKER'S ADDRESS (BRANCH)	:
8	MICR NO.	:
9	IFSC CODE	

ANNEXURE VI –A

T&P TO BE PROVIDED BY BHEL

EOT Crane for shifting of panels will be provided by BHEL on sharing basis, free of charge.

The contractor has to arrange experienced operator for the operation of crane at his cost.

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ANNEXURE VI –B

RECOMMENDED LIST OF TOOLS AND TACKLES / INSTRUMENTS TO BE
ARRANGED BY CONTRACTOR AT HIS COST

SL NO	DESCRIPTION	QUANTITY
01	Dead Weight tester rated 400 Kg/Sq.cm with weights & test gauges facility	02 No.
02	Oil temperature bath suitable to calibrate upto 300 Deg C	02 No.
03	Furnace range 600 Deg C	01 No.
04	Standard Pressure Gauges as below :	
	0 to 1 Kg/Sq.cm	01 No.
	0 to 5/6 Kg/Sq.cm	01 No.
	0 to 10 Kg/Sq.cm	01 No.
	0 to 16 Kg/Sq.cm	01 No.
	0 to 25 Kg/Sq.cm	01 No.
	0 to 60 Kg/Sq.cm	01 No.
	0 to 100 Kg/Sq.cm	01 No.
	0 to 250 Kg/Sq.cm	01 No.
05	Standard Temperature Gauges as below :	
	0 to 100 Deg C	02 No.
	0 to 200 Deg C	02 No.
	0 to 600 Deg C	02 No.
06	Standard compound pressure gauge -1 to +3 kg/Sq.cm	02 No.
07	Standard Vacuum Gauge -760 mm Hg to 0 Kg/Sq.cm	01 No.
08	Manometer 0 to 1000 mm WC with hand bulb	03 Nos.

**RECOMMENDED LIST OF TOOLS AND TACKLES / INSTRUMENTS TO BE
ARRANGED BY CONTRACTOR AT HIS COST**

SL NO	DESCRIPTION	QUANTITY
09	Portable air compressor with drier and regulator rated for 10 Kg/Sq.cm	01 No.
10	Vacuum pump with standard vacuum gauge	01 No.
11	Standard Milliamps Source (Digital)	03 Nos.
12	Standard Millivolts Source (Digital)	03 Nos.
13	Mercury Manometer different range	04 Nos.
14	DC Power Supply , 24 V ; 5A	03 Nos.
15	Single Phase Variac 250V; 10A	01 Nos.
16	Glass Thermometers of ranges in Deg C as below : 0-120 ; 0-200; 0-600	02 Nos. (Each)
17	Tong tester AC 5/10/25 ; KEW Snap Make	01 No. (Each)
18	Function Generator	01 No.
19	Hand Operated Megger 500V ; 2.5 KV / 100 M Ohms	Each type As required
20	Torque wrench	As required
21	AC Voltmeter 0-125 ; 250 ; 625V	01 No. (Each)
22	AC Ammeter 0-2A ; 10A	1 No. (Each)
23	Analog Multimeter Motwane Make	03 Nos.
24	Digital Multimeter 3 1/2 Digit	08 Nos.
25	Digital Multimeter 4 1/2 Digit	03 Nos.
26	Wire wrapping tool	As required
27	Oscilloscope	01 Nos.
28	Soldering irons, soldering pump, Vacuum cleaner, Air blower etc.	As required

ANNEXURE VI –C

RECOMMENDED LIST OF HANDLING INSTRUMENT AND MAJOR TOOLS & PLANTS TO BE ARRANGED BY CONTRACTOR

S.NO	DESCRIPTION	QUANTITY
01	Steel wire ropes	As required
02	Chain pulley block/turfer	As required
03	2 " size pipe bending machine	As required
04	Grinding machine	As required
05	Drilling machines : 1/4" , 1/2" , 3/4" , 1 "	As required
06	Copper tube bender and cutter sizes 6 mm ;8 mm ;1/2",1/4"	As required
07	Dye sets for threading upto 2 " pipe	As required
08	Set of spanners	As required
09	Allenkey sets	As required
10	Bench vice	1 No.
11.	Spirit level	As required
12	Tap sets for both BSP & NPT threads upto 1 "	1 Set each
13	Measuring instruments like micrometers, calipers etc.	1 each
14	Welding generator	1 No.
15	Welding transformer	As required
16	TIG Welding set	1 No.
17	Mechanical tool kit for fitters	As required
18	Electrician tool kit	As required
19	Crimping tool	As required
20	Flood light fittings	As required
21	Fire extinguishers	As required
22	Distribution boards with power cable complete as required	As required
23	Hydraulic test pump rating 750 Kg/SQ.cm	As required
24	Painting brush	As required
25	Fire proof tarpaulin	As required
26	Safety belts & safety helmets	As required
27	Telephone sets	As required

ANNEXURE VI –D

ACCURACY REQUIREMENT OF CALIBRATION INSTRUMENTS

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY
01	Digital Multimeter	Voltage 200 mV to 1000 V DC	$\pm 1\% + 1$ digit
		Philips Voltage 200mV to 1000 V AC	$\pm 1\% + 1$ digit
		Hcl Current 200 mA to 10 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 20M*	$\pm 0.5\% + 1$ digit
		Resistance (Hcl) 2105 200* to 200M*	$\pm 0.25\% + 3$ digits
		Hcl Voltage 200 mV to 750 V	$\pm 0.8\% + 1$ digit
		Philips Current 20 mA to 20 A DC	$\pm 0.5\% +$ digit
		Hcl Current 200 mA to 010 A AC	$\pm 1\% +$ digit
		02	Analog Multimeter
Current 100 mA to 10A AC	$\pm 2.0\%$		
Current 250 micro A to 1A DC	$\pm 1.5\%$		
Resistance upto 100 ohms	$\pm 3.0\%$		
Voltage 2.5V to 2500V DC	$\pm 1\%$		
03	MV/mV Source		Dial size
		0 to 200 mA/200mV	0.2%
		0 to 700	$\pm 1\%$ Lc – 10 kg/cm ² 10”
		0 to 700	$\pm 1\%$ Lc – 5 kg/cm ² 10”
		0 to 100	$\pm 1\%$ Lc – 0.2 kg/cm ² 10”
		0 to 70 kg	$\pm 1\%$ Lc – 1 kg/cm ² 10”
		0 to 60 kg	$\pm 1\%$ Lc – 11 kg/cm ² 10”
		0 to 60 kg	$\pm 1\%$ Lc – 0.5 kg/cm ² 10”
		0 to 10.5 kg/cm ²	$\pm 1\%$ Lc – 0.25 kg/cm ² 10”
		0 to 420	$\pm 1\%$ Lc – 2.5 kg/cm ² 10”
0 to 280	$\pm 1\%$ Lc – 2.5 kg/cm ² 10”		

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY		
04	Hand operated Megger 500V/1000V Standard Pressure Gauges	0 to 40	$\pm 1\% \text{ Lc} - 1 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 106	$\pm 1\% \text{ Lc} - 2.5 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 28	$\pm 1\% \text{ Lc} - 0.5 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 25 kg/cm ²	$\pm 1\% \text{ Lc} - 0.5 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 250 kg/cm ²	$\pm 1\% \text{ Lc} - 0.25 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 16 kg/cm ²	$\pm 1\% \text{ Lc} - 0.25 \text{ kg/cm}^2 \text{ } 10''$		
		Upto 200 m Ohms	$\pm 5\%$ at Centre scale		
		0 to 1 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 0.02 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 10 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 0.02 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 25 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 0.25 \text{ kg/cm}^2 \text{ } 10''$		
05		0 to 60 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 0.1 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 250 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 2.5 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 400 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 2.5 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 600 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 2.5 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 6 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 0.1 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 1000 kg/Cm ²	$\pm 0.25\% \text{ Lc} - 1.0 \text{ kg/cm}^2 \text{ } 10''$		
		0 to 400	$\text{Lc} - 5 \text{ kg/cm}^2$		
		0 to 600	$\text{Lc} - 5 \text{ kg/cm}^2$		
		06	Standard Hg in glass Thermometer	0 to 100 ⁰ C	$\text{Lc} - 1^{\circ}\text{C}$
				0 to 110 ⁰ C	$\text{Lc} - 1^{\circ}\text{C}$
0 to 250 ⁰ C	$\text{Lc} - 1^{\circ}\text{C}$				
0 to 150 ⁰ C	$\text{Lc} - 1^{\circ}\text{C}$				
0 to 360 ⁰ C	$\text{Lc} - 1^{\circ}\text{C}$				
0 to 420 ⁰ C	$\text{Lc} - 1^{\circ}\text{C}$				
08	Single Phase Variac	15A Capacity	N/A		

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY
09	Power Pack	0 to 50V DC, 3A	$\pm 2\%$
10	Vibration Measuring Equipments	Velocity upto 50 mm/sec. Displacement upto 300 microns	$\pm 0.5\%$ mm/sec ± 2 microns
11	a) Tongue tester	0/300/600A AC	$\pm 5\%$
	b) Tongue tester	0 to 300A DC	$\pm 5\%$
12	Tacho Meter (Hand held)	0 to 4000 rpm	$\pm 5\%$
13	Phase Sequence Meter		N/A
14	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	$\pm 5\%$ at Centre Scale range
15	DC Ammeter	0 to 300 A	$\pm 10\%$
16	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 cranes of heavy lift, the 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 except proprietary type equipment.
- 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: PEX:FOX 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.

NOTE

- 01. Minimum Number of persons to be indicated month wise.**
- 02. Above deployment plan will be discussed with BHEL Site Engineer in details after award necessary changes shall 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 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. Lab Technicians should have experience in Thermal Power Stations.**
- 06. Contractor should have one Store Keeper and one Transport Supervisor for the safe transportation of materials.**
- 07. Planning/safety Engineers should have experience in construction field especially in power plant**

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.

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ANNEXURE VI –G

BHEL PS:SR

Format No. **CP: PEX:FOX**

CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS

Name of Site :

Name of Sub-contractor :

Sl.No .	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

* Lump sum rate to be quoted per set

SIGNATURE OF CONTRACTOR

KAKATIYA TPP (1 X 500 MW)

SECTION VII

CONTROLS & INSTRUMENTATION PACKAGE

GENERAL TECHNICAL REQUIREMENTS AND GUIDELINES FOR INSTALLATION, TESTING & COMMISSIONING

7.1. GUIDELINES FOR INSTALLATION OF C & I EQUIPMENTS

- 7.1.1 Instruments location shall be decided to the convenience of operation and maintenance. The location shall have least mechanical vibration and placed where corrosive, toxic and explosive gases and dust particles will not deposit and the place is not subject to high-temperature atmosphere or radiation. However, actual location shall be decided in consultation with customer/consultant.
- 7.1.2 Maintenance platforms & approach facilities shall be provided for all sensing & primary devices wherever possible.
- 7.1.3 Instruments shall be located in weatherproof enclosures and wherever required suitable canopy shall be provided.
- 7.1.4 High & Low pressure impulse lines shall not be grouped and run together. Also impulse lines for explosive & inert gases shall not run together.
- 7.1.5 Impulse lines of high pressure steam, harmful gases, etc. shall not be brought into the control room, as far as possible.
- 7.1.6 Intrinsically safe circuits shall be used for explosion hazardous areas.
- 7.1.7 Separate cable routing shall be followed for high and low voltage lines.
- 7.1.8 All electrical equipments shall meet the requirements of Indian Electricity Rules.
- 7.1.9 Wherever severe vibrations are expected, shock absorbers shall be provided
- 7.1.10 Installation of instruments with radioactive isotopes, mercury and other toxic substances shall be as per statutory regulations provided by authorities.
- 7.1.12 Compensating cables should be connected directly to instruments, i.e. no junction boxes shall be used if CJCBs are not provided..

- 7.1.13 Orifice plates or flow nozzles must be provided with at least 10D upstream and 5D downstream straight length of pipe from bends tees, branch pipes & control valves.
- 7.1.14 Pressure gauges shall be provided with snubbers, syphons (for more than 100°C), 3 way valve manifolds wherever applicable.
- 7.1.16 For pneumatic instruments, air shall be dry & free from oil. Air must be supplied from oil-free compressors specially erected for this purpose. After drying, air must be stored in receiver. Pressure gauges must be provided on each supply line and after the pressure reducer.
- 7.1.17 Correct level (height) between detecting element and tapping point and transmitter shall be maintained.
- 7.1.18 The equipment shall maintain its normal posture (level, perpendicular, front and back).
- 7.1.19 Connection between detecting element/tapping point and transmitter shall be maintained at short distances wherever practicable to avoid any time lag.
- 7.1.20 Orifice plates and control valves shall be mounted on process piping, only after completion of cleaning of the process piping in order that these instruments may not suffer damage from metal waste, etc.
- 7.1.21 For details of installing each measuring instruments, instruction manual issued by the respective manufacturer of instruments may be referred to, wherever necessary.
- 7.1.22 The drain pipes shall be terminated in a common closed header and finally the common header shall be connected to plant open drain.
- 7.1.23 Impulse pipe material shall be identified for each individual pipe prior to its use at site. For this purpose coloring is to be done immediately after receipt.

7.2.0 GUIDE LINE FOR ERECTION OF IMPULSE LINES

- 7.2.1 All impulse lines burrs and airlines shall be thoroughly cleaned of any foreign matter by cleaning with compressed air and the same shall be done before installation.
- 7.2.2 The routing of pipelines shall include sufficient flexibility near tappings to allow for thermal expansion of the process equipment.

- 7.2.3 The pipes shall be cold bent using hydraulic bending machines only.
- 7.2.4 The horizontal impulse lines shall be laid with proper slopes towards the tapping point.
- 7.2.5 Supports for piping and tubing shall be adequate and in no case exceed limits shown below:
- | | |
|----------------------------|------------|
| a) 1/4" OD/ 3/8" OD Copper | Continuous |
| b) 1/2" NB Pipe/Tube | 5' |
| c) 3/4" NB Pipe/Tube | 5' |
| d) 1" NB Pipe/Tube | 8' |
- 7.2.6 All impulse line welding shall be done through welding generator/rectifier and only structural welding could be done through welding transformer.
- 7.2.7 Impulse pipe of Alloy Steel/SS/CS shall be TIG welded wherever required. Welding of impulse pipe shall be carried out in accordance with BHEL welding procedure. The welding electrodes shall be approved by BHEL welding Engineers. Impulse pipes welders shall undergo welding Test and approved by BHEL welding engineer at site.
- 7.2.8 Minimum number of fittings shall be used on all lines wherever possible, to keep threaded joints to a minimum wherever thread connections are to be made.
- 7.2.9 The impulse pipe laying is recommended to be limited to a maximum of 10 metres (each limb) generally, unless otherwise specified, to have optimum response from the transmitter. However, this will depend upon plant layout.
- 7.2.10 Where the tapping point is subjected to mechanical shift due to heating/cooling of main equipment, care should be taken to route the impulse pipe in such a way as to absorb the shift of tapping point without straining the impulse piping. To accommodate this, sufficient loop for the impulse pipes can be provided near to the tapping point.
- 7.2.11 Alternatively hose assembly - S.S. flexible may be used for connection between tapping point and impulse pipe.
- 7.2.12 The expansion bends are to be avoided as far as possible, as these act as air/sedimentation traps hampering the system performance.

7.2.13 Impulse piping shall be arranged as short as possible with a minimum of bends.

7.2.14 Horizontal piping shall be avoided and 1/10 slope shall be maintained.

7.2.15 Pipes shall not be laid parallel to high temperature process piping.

7.2.16 Pipe joints shall be carried out using sockets and flanges. Union fittings may be used when pressure is low. In the case of D.P. instruments both piping on low side and high side shall be maintained at same length and in the same route.

7.2.17 Impulse Piping for Air & Flue Gas System

For furnace pressure and furnace flue gas, suitable piping for air and furnace flue gas pressure, the impulse pipe shall be arranged to rise vertically from the tapping point to a distance at least of 300 mm before a change of direction is made.

7.2.18 Arrangements should be made for air purge in the impulse piping system at the end of the instrument airline or roding facilities may also be provided with suitable tees and cross.

7.2.19 In order to take care of the boiler expansion, suitable flexible connecting pipes can be arranged either at the tapping point end or at the instrument end.

7.2.20 Impulse Piping for Vacuum Measurement

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

7.2.21 Impulse Piping for Steam and Water System

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

7.2.22 Impulse pipes shall have a minimum slope of 1:10 and shall be supported at every 2 metres length.

7.2.23 At the transmitter end, the connection can be either through 2 way valve manifold or nipple with coupling.

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

7.2.28 **Bending**

It is recommended for cold bend for the impulse pipes with the help of a hydraulic bending machine to achieve a particular shape.

- 7.2.29 Use of 45° elbow and 90° bends (ready-made) is restricted to bare minimum to minimise the number of joints in a system. Hot bending is not to be used as this leads to flattening of pipes at the bends and also results in thinning of walls, apart from introducing changes in metallurgical properties of the pipe material.
- 7.2.30 Hot bending may be permitted for carbon steel pipe for low pressure service as instructed by supervisor only when it cannot be avoided. In the case of 90° bending radius shall be more than 3 times the outside diameter of pipe and in the case of 'u' bending, radius of bending shall be 5 times the outside diameter of pipe. When the radius of bending becomes small, elbow fitting shall; be used.
- 7.2.31 Large bending shall be so made as to form smooth curve.

7.2.32 **Cutting**

- Pipe cutter or wheel grinder shall be used for pipe cutting.

- Gas cutting shall be avoided.
- Burr inside the cut end shall be removed.
- The cutting surface shall be as perpendicular to the axis as possible.

7.2.33 Impulse Pipe Welding

Generally, welding of impulse pipe and fitting shall be carried out by arc welding and socket welding is adopted. Welding shall be performed by a qualified welders. Only D.C. arc welding is recommended for impulse pipe. Motor generator is preferred to rectifier transformer, since it may damage the welding joints due to surge.

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

7.2.34 Testing

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

The impulse lines shall be isolated from the instruments and tested at 2 times the maximum working pressures. The fall in pressure shall not be more than 1 Kg/Cm² or 1% of the working pressure whichever is less, in 30 minutes and there shall be no leaks, at any of joints/welds, when isolated from source of press.

7.3.0 GUIDELINES FOR INSTALLATION OF PNEUMATIC LINE

- 7.3.1 Copper tubing shall be connected with Olive type of compression fittings,
- 7.3.2 When two or more lines run together, the joint in the adjacent alternate line shall be a offset.
- 7.3.3 In case of copper tubing, the single run copper tube may be supported with an angle. However, suitable trays shall be used for more than one tubing.
- 7.3.4 Multi-core copper tubing shall not to be bend less than 10 deg and D is the OD if the multi-core copper.
- 7.3.5 All air distribution, main and branch lines shall be galvanised internally as well as externally and the galvanised pipe, never, shall be braced or welded.

- 7.3.6 The joints shall be screwed with Teflon tapping wherever the pipes are to be removed frequently for cleaning and other purposes and suitable union fittings shall be used.
- 7.3.7 Care shall be taken while taking a branch pipe to see that the line is not taken from the lower part of the main line or main header in order to avoid entry of any drain or dust into the system.
- 7.3.8 Instrument airline should not be routed where severe vibration, high temperature exists and adequate space should be available for maintenance.
- 7.3.9 Care shall be taken when removing the PVC sheeting, while connecting the copper tube. The exposed portion after jointing shall not be excessive and also while removing PVC, the tube should not get damaged. Pipe cutters should not be used for cutting the copper tube, instead the specific copper tube cutter shall be used. Similarly, for bending copper tubes, specific copper tube bender should be used and the radius of the bending shall be more than 2.5 times of the OD of the copper tube.
- 7.3.10 While using the pipe cutter, care shall be taken to remove burr from the cutting side.
- 7.3.11 In locations where the copper tube is likely to be damaged from outside, the copper tube can be routed near a different pipe. While laying copper tube either inside angle or trays, the tube shall be supported at least at every one meter distance.
- 7.3.12 While fixing the copper tube fittings only Teflon tapes should be used. However, no tape shall be used while tightening the ferrules.
- 7.3.13 **Instrument Air line Testing**
- All instrument air lines shall be isolated from the instruments and pressurised pneumatically to maximum working pressure. It shall then be isolated from the source of pressure and fall shall be less than 1 psi in 20 minutes.
 - All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurised pneumatically 20 psi, and checked with soap solution for leak.

7.4.0 GENERAL GUIDELINES ON INSTALLATION OF FLEXIBLE HOSES

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

- 7.4.1 Under pressure, a hose may change in length. Always provide some slack in the hose to allow for this shrinkage or expansion. (However, excessive slack in hose lines is one of the most common causes of poor appearance).
- 7.4.2 At bends, provide enough hose for a wide radius curve. Too tight a bend pinches the hose and restricts the flow. The line could even kink and close entirely. In many cases, use of the right fittings or adapters can eliminate bends or kinks.
- 7.4.3 In applications where there is considerable vibration or flexing, allow additional hose length. The metal hose fittings, of course, are not flexible and proper installation protects metal parts from undue stress, and avoids kinks in the hose.
- 7.4.4 Hose assemblies in service should be inspected frequently for leakage, kinking, corrosion, abrasion or any other signs of wear or damage. Hose assemblies that are worn or damaged should be removed from service and replaced immediately.
- 7.4.5 The service life expectation of a flexible hose mainly depend on the correct installation layout. In most cases, when flexible hoses fail prematurely, the reason of failure may be found in an incorrect layout.
- 7.4.6 As a rule, the hose is not to be bent over its limit of elasticity. The choice of the right hose length is of crucial importance. The hose should not be subject to torsion. Torsion can be usually eliminated by changing the layout.

7.5.0 GENERAL NOTES ON INSTALLATION OF LOCAL INSTRUMENT RACKS AND JB FRAMES

- 7.5.1 In cases where the local instrument stands are to be installed on a concrete foundation, it shall be fixed by anchor bolts.
- 7.5.2 In cases where the local instrument stands are to be installed on the base plate, the stand can be placed on an angle and the same can be welded. However, in cases where there is a probability for removal of stand is likely to arise, it shall be fixed by bolts.

- 7.5.3 Installation of local junction boxes shall be installed in such a way that they are fixed on a column by welding or by fixing bolts.
- 7.5.4 Local Instrumentation rack, which shall be installed utilising the Beam and Structure, shall be fixed by welding. Care shall be taken while deciding the location in order to ensure that no hindrance is caused to the maintenance personnel in their moving space within the work area. Further, as a standard practice, it should be ensured that no instrument stands/racks/JBs shall be supported by/welded on to any of the working equipments, or even hand gridded or floor gridded, as per safety norms.
- 7.5.5 Proper care should be taken to ensure that welding of the stand on any structure or Beam is fully welded.

7.6.0 GENERAL GUIDELINE ON FLOW INSTRUMENTS INSTALLATION

- 7.6.1 Extreme care shall be taken when welding and assembling the flow element on the pipe. Any misalignment or rough particle or edge inside the welded area may cause inaccuracy and this will increase as the flow increases.
- 7.6.2 Flow elements should always be located in upstream from any valve. Downstream side of valve shall no longer be a homogenous mixture and this may cause erratic behaviour of reading periodically.
- 7.6.3 Care shall be taken while welding the impulse pipe. Improper arrangement of piping of DP instruments can create error in the reading and even it gives an indication of negative flow of steam even though the flow is to be positive. Inadequate exchange of steam and condensate in the piping may cause negative flow. The presence of burr or dirt in the pipe can impede the flow of condensate back to the pipe, and when this happens, the pipe becomes full of water and has the effect of creating negative head.
- 7.6.4 Always $\frac{3}{4}$ " to 1" pipe is recommended for free flow condensate. Gate valve shall be used for the tapping and pipe should be insulated up to condensing pot.
- 7.6.5 The Measuring instrument shall be located close to the flow-sensing element. The speed of response is reduced if there is a long run,
- 7.6.6 The orifice plates shall be installed such that the extreme face is perpendicular to the axis of the pipe within the +2 deg or -2deg. and it should be ensured that

when the extreme face is facing the direction of flow, invariably the sign of positive (+) is marked on the upstream.

- 7.6.7 Location of Flow element should have clear straight run of 10D in upstream and 5D in downstream.
- 7.6.8 For non-viscous liquid flow measurements, the best location for the instruments shall be below the pipeline, If the instrument is above the line, more maintenance will be involved. Suitable vapour traps shall be provided.
- 7.6.9 In the case of air and gas flow measurement system, as part of basic requirement, it should be transmitted to the instruments without any change in the differential head due to leakage.
- 7.6.10 If the flow of any dry gases are to be measured, the location of instrument can be kept above or below the tapping points.
- 7.6.11 For air flow measurements, it is always preferable to install the instruments above the pipeline. Incase, if the instrument must be installed below the duct/pipeline, suitable Dust Collection Chamber can be installed.
- 7.6.12 The condenser pot should be located nearer to the tapping point and both condenser chamber should be at the level of upper tapping,
- 7.6.13 The unequal level will cause significant error due to false heads. If the flow nozzle is installed in vertical pipe, the lower tapping pipe which is bent and taken up to upper tapping in order to align with the upper condensate pot, must be insulated, otherwise, error is created when the bent pipe fills with condensate. The error may add or subtract depending upon the direction of flow.
- 7.6.14 For flow measurements, the instruments should always be located below the condenser pot, otherwise, the condensate will be lost from the system and the instrument will reach 'O' during the shutdown and the total system must be vented after the start up of the boiler in order to remove Air and Vapour which might have got entrapped.
- 7.6.15 In an installation where the instruments must be located above the tapping points and the condensing chamber should be equally located above the instruments the pipeline up to the condensing pot should be insulated.

- 7.6.16 In the case of viscous fluids, flow measurements which are likely to freeze or concealed in the pressure pipe or like such corrosive type fluids, suitable sealing chamber shall be used, the sealing liquid should not mix or react with the medium to be measured.
- 7.6.17 The commonly used sealing liquid includes water, light oil, glycerol, ethylene glycol and mixtures of the last two with water.
- 7.6.18 The sealing chambers, in each pressure pipe, should be installed at the same level and as close as possible to the pressure tapplings.
- 7.6.19 The general arrangement for pressure tapplings from the Sealing Chamber to the instrument is shown in the sketch.
- 7.6.20 The flow elements should be inspected before installation to find out the presence of any corrosion/rusting or any blockage on the pressure tapping holes or any deposits on the face of the orifice plate.

7.7.0 GENERAL GUIDELINE ON INSTALLATION OF VALVES

- 7.7.1 Primary isolating valves (root valves) must be located at the tapping which can be of globe valves.
- 7.7.2 These valves shall be installed where access is possible.
- 7.7.3 Secondary isolating valves shall be located at the end of inter-connecting pipe. It should be as nearer as possible to the measuring instruments and should be of needle type.
- 7.7.4 For pressure more than exceeding 40 kg, 2 isolating valves shall be provided.
- 7.7.5 In the case of heavy duty isolating valves, suitable support shall be provided to avoid any loading on the stubs.
- 7.7.6 In viscous fluids, suitable steam tracing shall be provided.
- 7.7.7 These valves are always located as nearer to the measuring device as possible.

7.7.8 Blowdown Valves or Drain Valves

- a) These valves are fixed at the lowest end of impulse pipe.

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

7.8.0 PAINTING

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

7.9.0 GUIDELINES FOR CABLE LAYING

- 7.9.1 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.
- 7.9.2 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.
- 7.9.3 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.
- 7.9.4 GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.
- 7.9.5 In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy-duty PVC pipes shall be provided.

- 7.9.6 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.
- 7.9.7 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.
- 7.9.8 All cables routed along walls or in equipment rooms shall be protected by means of laying them through GI pipes or by providing sheet metal covers up to a height of 2000mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be of enclosed type.
- 7.9.9 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.
- 7.9.10 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.
- 7.9.11 Wherever direct heat radiation exists, heat isolating barriers (subject to customers approval), for cabling system shall be adopted.
- 7.9.12 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.
- 7.9.13 If required, a few number of cables in exceptional areas may be directly buried into the earth.
- 7.9.14 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.
- 7.9.15 At certain places where hazardous fumes/gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.
- 7.9.16 In corrosive atmosphere, PVC conduits shall be used for cables.

- 7.9.17 Single core cables, when pulled individually shall be taken through PVC pipes only.
- 7.9.18 Laying and installation of power, control and special cables shall generally conform to IS : 1255
- 7.9.19 The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
- 7.9.20 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.
- 7.9.21 Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.
- 7.9.22 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.
- 7.9.23 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.
- 7.9.24 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.
- 7.9.25 Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material.
- 7.9.26 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacings not less than one cable diameter of bigger diameter cable.

- 7.9.27 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.
- 7.9.28 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.
- 7.9.29 Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formation:
- a) HT cables shall be laid in the top tier(s)
 - b) LT power cables to be laid in the tray(s) below the HT cable trays.
 - c) LT control cables to be laid in the Tray(s) next below to the LT power cable (trays)
 - d) Special control cables including screened control cables to be laid in the bottom most tray(s).
- 7.9.30 For vertical formations, the trays closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed. However, where there is no clear distinction of bottom/top trays, the order convenient for linking the horizontal and vertical formations shall be followed.
- 7.9.31 When it may not be possible to accommodate the cables as per the criteria indicated in the two clauses indicated above, the following rules shall override the criteria. However, prior approval of the Engineer will be required.

In hierarchical order:

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

- d) LT power cables are mixed up with special control cables with clear minimum gap of 200mm between them.
- 7.9.32 In case of duplicate feeders to essential loads, the respective cables shall be laid through separate raceways. Alternatively, such cables shall be laid on the opposite sides of a trench/tunnel/basement.
- 7.9.33 For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanised.
- 7.9.34 For laying cables along concrete walls, ceilings etc. The cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using raw plus and MS flat spacers of minimum 6mm thickness.
- 7.9.35 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.
- 7.9.36 No single core cable shall pass through a GI conduit or duct except DC single core cables. AC single core cables shall pass through GT conduits/pipes in trefoil formation only.
- 7.9.37 In case of a 3 phase, 4 wire system, more than one single phase circuit, unless originating from the same phase shall not be taken in the same GI conduit.
- 7.9.38 Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for consideration by BHEL.
- 7.9.39 Wherever specific cable routes are not shown in cable schedules cables shall be laid as directed by Engineer.
- 7.9.40 Support Spacings & Clampings**

Support spacing and clamping suitably provided and as required

7.9.41 Laying of cables directly buried in ground

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

7.10.0 CODES AND STANDARDS

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

IS 1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating.
IS 732	Electrical wiring installation (system voltage not exceeding 650 V).
IS 5216	Guide for safety procedures and practices in electrical works.
IS 226	Structural steel (Standard quality)
IS 800	Code of practice for use of structural steel
IS 316	Code of practice for use of metal arc welding for general construction in mild steel.
IS 1363	Hexagonal bolts, nuts and screws
IS 1572	Electroplated coatings of cadmium on iron and steel.
IS 2629	Code of practice for hot dip galvanising for iron and steel.
IS 2633	Method of testing uniformity of coating on zinc coated articles.

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
- 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.

7.11.0 GUIDELINES FOR ERECTION OF CABLE TRAYS, GI PIPES, SUPPORTS AND ACCESSORIES

- 7.11.1 Constructional details and supporting arrangement for the cable trays shall be as shown in the drawings which will be handed over to the successful bidder. All cable trays, vertical raceways and supporting steel work shall be installed along the routes as indicated in the drawings and as per the instructions of the Engineer-in-charge. The contractor has to fabricate and install complete tray supporting structures as per the drawing/site requirement.
- 7.11.2 Wherever specified or directed by Engineer, the contractor shall install galvanised MS sheets covers over cable trays. The width of the covers shall be same as that of cable trays. Bolting shall be done to fasten covers to the cable trays, elbows, reducers, tees, crosses etc.
- 7.11.3 The contractor shall install all angles, channels, beams, hangers, brackets, clamps etc. as may be necessary to suit the actual site conditions to support the cable trays.
- 7.11.4 Straight pieces of standard MS angles/channels shall be used for fabrication of supports/racks. All welded joints shall be smooth enough to provide a good appearance and shall not cause injury to working personnel.
- 7.11.5 Cable trays within cable trenches, tunnels and basements shall be of ladder type. Bottom most tray within plant buildings for overhead runs of trays shall be of perforated type. Cable trays in the areas exposed to coal dust shall be installed in vertical formation. Wherever due to layout constraints, it is not possible to install the trays in vertical formation with Engineer's prior permission installing the trays in horizontal formation may be considered.
- 7.11.6 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way or maintenance of adjacent equipment.
- 7.11.7 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.

- 7.11.8 For equipment and devices having GI conduit entry arrangement other than standard GI conduit adopter, adopters shall be provided as required to enable the GI conduit to be properly terminated, between conduit end and motor T.B.
- 7.11.9 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.
- 7.11.10 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.
- 7.11.11 Bends of GI pipes/conduits shall be made without causing damage to the pipes/conduits.
- 7.11.12 Occupancy of conduits shall not be greater than 40%.
- 7.11.13 The adopter for coupling rigid GI pipe/conduits and flexible conduit shall be of aluminium or galvanised steel.
- 7.11.14 Transportation and storage of cable drums

Transportation and storage of cable drums shall generally conform to the requirements of IS : 1255
- 7.11.15 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.
- 7.11.16 The cable drums shall be transported on wheels to the place of work.

7.12.0 GUIDELINES FOR CABLE TERMINATION AND JOINTING

- 7.12.1 Contractor shall carry out cable terminations at various electrical and electronic equipment terminals.
- 7.12.2 When the equipment are provided with undrilled gland plates for cable/conduit entry into the equipment, drilling and cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site and drawings shall be prepared and take engineer's approval before drilling holes. cutting shall not be allowed.
- 7.12.3 Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the contractor. Looping of cores/wires at

terminals as shown in interconnection diagrams is to be done by the column at no extra cost as part of the termination.

- 7.12.4 All cable entries in the equipment shall be sealed after glanding the cables..
- 7.12.5 Adequate length of cables shall be pulled inside the switch boards, control panels, terminal boxes etc. as per near termination of each core/conductor.
- 7.12.6 Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals.
- 7.12.7 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes/nylon ties and suitably supported to keep them in position at the terminal block. All spare cores shall be connected to spare terminals wherever possible. If spare terminals are not available, spare cores shall be neatly dressed and suitably taped at both ends.
- 7.12.8 Screened control cables of 0.5 sq. mm cross-sectional area shall be terminated by means of wire rapping system.
- 7.12.9 Individual cores of control cables shall have ferrules for identification. Ferrule numbers shall be provided as per the control schemes and other related documents supplied.
- 7.12.10 End sealing/termination of cables shall be done by means specified on the specification for terminations. The system shall be suitable for types of cable specified and complete with stress relief system.
- 7.12.11 Termination and jointing of aluminium/copper conductor power cables shall be done by means of compression method using compression type aluminium/tinned copper lugs.
- 7.12.12 Copper conductor control cables shall be terminated directly into screwed type terminals provided in the equipment. Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.
- 7.12.13 Cable joints shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit, subject to BHEL's approval of Engineer shall be taken for deciding location of joint.

7.12.14 Junction boxes shall be used, wherever required, for jointing of control cables.

7.12.15 Termination and jointing shall generally conform to the requirements of IS : 1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.

7.14.0 DESIGN REQUIREMENTS OF ITEMS SUPPLIED FOR CABLING INSTALLATION WORK (if supply is covered in contractor scope).

7.14.1 Strip Cable Clamps

- a) Strip Clamps shall be of aluminium alloy or cast steel or M.S. and shall be used to fasten the group of multicore cables on the tray.
- b) Clamps shall be of simple construction, made of 4 mm thick, 25 mm wide strip to cover the entire width up to 300 wide tray and part of the tray for more than 300 wide trays. Strip shall have two right angle bends for fixing on the rung with two bolts.
- c) Clamps shall be of different lengths for different sizes of tray width. The maximum size of clamp width shall be 300 mm and for cable trays of greater width, two clamps shall be used.

7.14.2 Self Locking Clamps

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

7.14.3 Ferrules

- a) Ferrules shall be required for individual core of cable hence they shall be suitable for the insulated conductor diameter.

- b) Ferrules shall be of plastic material.
- c) Numbering on the ferrules shall be engraved type with contrast colour to the base. Engrave 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.

7.14.4 Tags

- a) Cables shall be provided with cable number tags for identification.
- b) Cable tags shall be of durable fibre, aluminium, stainless steel sheets or lead. of suitable thickness
- 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.

7.15.0 GUIDELINES FOR EARTHING INSTALLATION

- 7.15.1 All equipments shall be earthed by two separate and distinct connections. Earthing terminals will be available in all the equipment supplied by BHEL.
- 7.15.2 The earthing conductors shall be mild steel/G.I. strips/wires. All connections from the equipments to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the successful tenderer.
- 7.15.3 A continuous earthing conductor shall be installed in all cables trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run on parallel a 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.

- 7.15.4 All joints in the earthing system shall be welded type. Earthing connections to all equipment including motors shall be bolted type.
- 7.15.5 Earthing connections shall be free from tinning scale, paint, enamel, grease, rust or dirt at the time of making joint.
- 7.15.6 Metallic sheaths, screens/shields and armour of all multicore cables shall be bonded and earthed.
- 7.15.7 Earthing conductors along with their run on columns, beams, walls etc., shall be supported by suitable cleats at intervals of 750 mm.
- 7.15.8 Conduits shall be bonded together and grounded at all switchgear and control centres.
- 7.15.9 M.S.Earthing conductors shall be coated with one coat of bituminous paint, wrapped with a layer of bitumen tape and finally coated with bitumen paint. For site welded GI strips/wires required coat of aluminium paint should be given.
- 7.15.10 If the equipment is not available at the time of earthing conductor laying tap connections from the main earthing conductor shall be brought out up to slab equipment foundation level with at least 200 mm spare length left for further connections to equipment earthing terminals.

7.16.0 GUIDELINES FOR ERECTION OF CONTROL PANELS AND DISTRIBUTION BOARDS

7.16.1 Erection

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

- 7.16.2 For the panels which are to be mounted on the trenches, channel supports have to be provided across the cable trenches over which the base frames of the panels shall be mounted. Fabrication and erection of these support structures shall be carried out as per drawings.

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

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

7.16.5 The following points shall be checked up during erection

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

7.16.6 415 V switchgear and Electrical panels tests(as applicable)

- a) IR Test on each pole of breaker
- b) IR test on control circuit
- c) Measurement of contact resistance for all three phases of breaker
- d) Measurement of resistance of the closing and tripping coil of breaker
- e) Checking the close trip operation at 70% and 100% of the rated auxiliary D.C. Voltage.
- f) Checking of interlocks provided and tripping of breaker through relays
- g) Space heater operation check
- h) Opening and closing time check
- i) Control and metering circuit checks.
- j) Primary and secondary injection tests.
- k) Thermal overload relay testing and checking
- l) Calibration of all instruments and meters
- m) Phase rotation checks
- n) High voltage test on 7C.1.3KV switchboard

7.17.0 CUTTING & WASTAGE ALLOWANCE

7.17.1 The following scrap allowances are permissible:

	non- salvageable	unaccountable
1. Length below 0.5 M steel pipes, SS/Cu tubes, Single pair cables	2%	0.5%
2. Length below 20m multi cable, multitubes	2%	0.5%

7.18.0 GUIDELINES FOR HANDLING OF SOLID STATE MODULES:

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

7.19.0 GUIDELINES FOR HANDLING AND STORAGE OF ELECTRONIC CUBICLES/SUB-ASSEMBLISES/LOOSE ITEMS.

- 7.19.1 Immediately after unloading at site, the electronic equipment should be kept in the covered area. Handling and lifting of the package should be done without jerks or impacts. Packing case should not be dripped or slid along the floor under any circumstances. Suitable forklift should be used to move the case to its final position. All the above points are to be strictly followed as the electronic equipments cannot withstand any stress due to vibration and shock.
- 7.19.2 After unloading at site, the package of the equipment shall be inspected for external damage. In case the package is damaged, the package number and details of the damage should be noted. The details of the damage should be reported to the responsible site Engineer.

- 7.19.3 Cases should be opened/unpacked using correct nail pullers. While opening the planks, care should be taken to see that the equipment is not damaged. Cases should not be unpacked in areas where they are exposed to rain water/liquid splashing, dust or other harmful materials like chlorine gas, sulphur dioxide etc.
- 7.19.4 After opening the case, all supports provided for transport are to be removed with due care.
- 7.19.5 Hinged frames should not be opened when equipment is not secured to the floor as this is likely to cause it to topple over. The hinged frame can be opened only if the equipment is still fixed on to the bottom wooden pallet.

KAKATIYA TPP (1 X 500 MW)
BILL OF MATERIALS FOR
ERECTION, TESTING AND COMMISSIONING OF C&I PACKAGE

Bill of Materials (BOM) contains detailed specification of various instruments and items, system-wise and 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 are also to be referred.

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.1.0	FUEL OIL SYSTEM		
A.1.1	PD Type Flow meter (including erection of 2 Nos. Pulse Amplifiers, shielded signal cables, condensing pots etc.).	2 sets*	6.3.3
A.1.2	Pressure Gauges	58 Nos.	6.3.3
A.1.3	Temperature Gauges	12 Nos.	6.3.3
A.1.4	Pressure Switches	28 Nos.	6.3.3
A.1.5	Temperature Switches	7 Nos.	6.3.3
A.1.6	Level Switches	6 Nos.	6.3.3
A.1.7	DP Switches	7 Nos.	6.3.3
A.1.8	Flame Scanner Head Assembly (including erection of fibre optic cable of length 120", Lens Barrel Assembly, Miniature 6 way Junction Box etc.)	24 sets*	6.3.3
A.1.9	Speed Regulator/ Air Lock Valves/ Air Sets	12 sets*	6.3.3
A.1.10	OD 8 mm Copper Tube	25 Mtrs	6.3.6
A.1.11	Air sets	2 Nos.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 1

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.1.12	FSSS Local Oil Gun Maintenance Switch Box	12 Nos.	6.3.11
A.1.13	H.E.A. Excitor box along with retractor assembly, flexible spark rod, spark tip, flexible cable assembly, S.S. Hose (1 Mtr long, 6.35 mm ID), Air Filter Regulator etc.	12 sets*	6.3.3
	Commissioning of the following		
A.1.14	Limit Switches (checking only).	47 Nos. ^{\$}	6.3.16.3
A.1.15	Pneumatic Valves: On/Off Type	47 Nos. ^{\$}	6.3.16.1
A.1.16	Pneumatic Valves: Regulating Type	6 Nos. ^{\$}	6.3.16.1
A.2.0	AIR & FLUE GAS SYSTEM		
A.2.1	Pressure Gauges/ Draft Gauges	10 Nos.	6.3.3
A.2.2	DP Gauges	8 Nos.	6.3.3
A.2.3	Pressure Switches	16 Nos.	6.3.3
A.2.4	DP Switches	3 Nos.	6.3.3
A.2.5	Air Filter Regulators- SADC	16 Nos.	6.3.3
A.2.6	¼" OD PVC Sheathed Copper Tube	2,300 Mtrs	6.3.6
A.2.7	1" size Teflon Hose of 3M length	4 Nos.	6.3.10
A.2.8	¼" size Teflon Hose of 2M length	64 Nos.	6.3.10
A.2.9	Burner Tilt Shear Pin Failure Indication Box Approx. Dimension: 300 x 340 x 150 mm; weight 14 kg each	4 Nos.	6.3.11
A.2.10	Heavy Duty Limit Switch (for Burner Tilt Shear Pin Failure Indication Purpose)	16 Nos.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 2

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.2.11.0	PNEUMATIC POWER CYLINDERS (REGULATING TYPE)		
A.2.11.1	For ID Fans I/L Control (Weight 350 kg each)	2 Nos.	6.3.8
A.2.11.2	Cold Air Regulating Dampers (Weight 70 kg each)	7 Nos.	6.3.8
A.2.11.3	Hot Air Regulating Dampers (Weight 125 kg each)	7 Nos.	6.3.8
A.2.11.4	PA Fan Vane Regulating Dampers (Weight 58 kg each)	2 Nos.	6.3.8
A.2.11.5	FD Fan Vane Regulating Dampers (Weight 58 kg each)	2 Nos.	6.3.8
A.2.11.6	Power Cylinders for SADC (Weight 15 kg each)	64 Nos.	6.3.8
A.2.11.7	Dynavane Filter Bleed Air Damper (Weight 100 kg each)	1 No.	6.3.8
A.2.12.0	PNEUMATIC ACTUATORS (ON/OFF TYPE)		
A.2.12.1	Scanner Air Emergency Damper	1 No.	6.3.8
A.2.13.0	COMMISSIONING OF THE FOLLOWING		
A.2.13.1	Furnace Temperature Probe (Cr-Al Thermocouples)	2 Nos. \$	6.3.16.5
	<i>Pneumatic Actuators (On/Off Type)</i>		
A.2.13.2	Hot Air Gate	7 Nos. \$	6.3.16.1
A.2.13.3	Cold Air Gate	7 Nos. \$	6.3.16.1
A.2.13.4	Seal Air To Mill	7 Nos. \$	6.3.16.1
A.2.13.5	Seal Air To Mill Coal Pipes	7 Nos. \$	6.3.16.1
A.2.13.6	Feeder Outlet Gate	7 Nos. \$	6.3.16.1

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 3

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
	<i>Pneumatic Actuators (Regulating Type)</i>		
A.2.13.7	Burner Tilt Power Cylinders	4 Nos. ^{\$}	6.3.16.1
A.3.0	PULVERISER SYSTEM		
A.3.1	Pressure Gauge	1 No.	6.3.3
A.3.2	DP Gauges	8 Nos.	6.3.3
A.3.3	Temperature Gauges	7 Nos.	6.3.3
A.3.4	Pressure Switches	5 Nos.	6.3.3
A.3.5	DP Switches	29 Nos.	6.3.3
A.3.6	Air Filter Regulators (for Mill)	7 Nos.	6.3.3
A.3.7	Purge Meter cum DP regulator	24 Nos.	6.3.3
A.3.8	Pneumatic Pressure Controllers including 1 No. Pneumatic Transmitter, 2 Nos. Air Filter Regulators etc.	1 set*	6.3.3
A.3.9	Ultrasonic Coal Flow Monitor consisting of sensor transmitter and receiver probe, local JB, control unit, flexible conduit, mounting flanges, fasteners etc. The job includes providing holes in the spacer (spool) pipe at raw coal bunker outlet and welding of two mounting flanges to the pipe facing each other for fixing the instrument.	8 sets*	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 4

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.3.10	GRAVIMETRIC FEEDER PANEL Microprocessor based Gravimetric Feeder Remote Power Cabinet (including keyboard and display) Size: 1200 x 600 x 2315 mm; weight: 640 kg each	7 Nos.	6.3.1
A.3.11.0	<i>Commissioning of the following</i>		
A.3.11.1	Feeder Mounted C&I Equipment like motion monitor sensor, micro switches, etc. along with Feeder Integral Cabinet	7 sets* ^{\$}	6.3.16.7
A.3.11.2	Bunker Gate Limit Switches (Only checking)	14 Nos. ^{\$}	6.3.16.3
A.3.11.3	Feeder Inlet Gate Limit Switches (Only checking)	14 Nos. ^{\$}	
A.4.0	STEAM & WATER SYSTEM		
A.4.1	Pressure Switches	3 Nos.	6.3.3
A.4.2	Pressure Gauges	37 Nos.	6.3.3
A.4.3	Temperature Gauges	16 Nos.	6.3.3
A.4.4	DP Gauge	1 No.	6.3.3
A.4.5	DP Switch	1 No.	6.3.3
A.4.6	Flow Switches	4 Nos.	6.3.3
A.4.7.0	Instruments of Boiler Circulating Water Pump (Vendor Scope)		
A.4.7.1	Chromel Alumel Thermocouple	12 Nos.	6.3.3
A.4.7.2	Temperature Switches	6 Nos.	6.3.3

* Lump sum rate to be quoted per set

^{\$} Rate to be quoted ONLY for commissioning

BOM - 5

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.4.7.3	Flow Indicators (checking only)	3 Nos. ^{\$}	6.3.16.2
A.4.7.4	Temperature Gauges	3 Nos.	6.3.3
A.4.7.5	Pressure Gauges	3 Nos.	6.3.3
A.4.7.6	DP Indicator	1 No.	6.3.3
A.4.7.7	Flow Switches	3 Nos.	6.3.3
A.4.7.8	Electronic Flow Transmitters	3 Nos.	6.3.3
A.4.8.0	Chromel-Alumel Thermocouples & JBs		
A.4.8.1	MTM T/Cs of route length 10 to 14 Mtrs (6 mm OD)	20 Nos.	6.3.3
A.4.8.2	MTM T/Cs of route length 16 to 20 Mtrs (6 mm OD)	59 Nos.	6.3.3
A.4.8.3	MTM T/Cs of route length 22 to 26 Mtrs (6 mm OD)	102 Nos.	6.3.3
A.4.8.4	12 channel RJCB, 6 Nos. Duplex Weight: 15 kg each	2 Nos.	6.3.11
A.4.8.5	24 channel RJCB, 12 Nos. Duplex Weight: 15 kg each	17 Nos.	6.3.11
A.4.8.6	Power Distribution Boxes (Wall Mounted) Weight: 15 kg each	2 Nos.	6.3.11
A.4.9	ERV Controller with Pressure Switch Dimension: 350 x 290 x 180 mm; weight: 10 kg each	2 sets*	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 6

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.4.10	Electronic Water Level Indicator EWLI comprising of the following: <ul style="list-style-type: none"> - 1 No. 16 Port pressure vessel with loose supplied electrodes - 1 No. Ascetor Cabinet, of dimension: 600 x 350 x 600 mm; Weight: 40 kg each - 2 Nos. of Remote Display Unit (100 x 90 x 234 mm), 1 No. at UCB and 1 No. at operating floor - 1 No. Local Indication box of wt 10 kg - 10 P x 0.6 sq. mm PTFE probe cable: 30 Mtrs - interconnecting cables between local panel and electrodes 	2 sets*	6.3.3
A.4.11	Steam leak detection system (BHEL- STLD), comprising the following <ul style="list-style-type: none"> - Sensor Assembly along with head amplifier: 24 sets - Junction Box (36 way): 9 Nos. - BHELSONIC Panel: 1 No. Size of the panel: 800 x 800 x 2315 mm; 600 kg	1 set*	6.3.3
A.4.12.0	<i>Commissioning of the following</i>		
A.4.12.1	Flow Switches (only checking)	4 Nos. \$	6.3.16.2
A.4.12.2	Direct Water Level Gauges	2 Nos. \$	6.3.16.6
A.4.12.3	Control Valves	10 Nos. \$	6.3.16.1

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 7

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.5.0	HARDWARE LIST		
A.5.1.0	<i>CABLES (PVC, FRLS, Armoured) for Scanner, Mill feeder, AC Control, and Instruments</i>		
A.5.1.1	Flame Scanner Cable (2P x 1 sq. mm Triple Screened, Unarmoured cable)	4,200 Mtrs	6.3.9
A.5.1.2	2P X 0.5 sq. mm, overall Shielded cable	6,800 Mtrs	6.3.9
A.5.1.3	4P X 0.5 sq. mm, overall Shielded cable	29,000 Mtrs	6.3.9
A.5.1.4	8P X 0.5 sq. mm, overall Shielded cable	19,800 Mtrs	6.3.9
A.5.1.5	16 P X 0.5 sq. mm, Shielded cable	600 Mtrs	6.3.9
A.5.1.6	2 P x 1.5 sq. mm, armoured shielded cable	7157 Mtrs	6.3.9
A.5.1.7	2 Pair x 1.3 sq. mm, Compensating cable	1400 Mtrs	6.3.9
	Control Cables		
A.5.1.8	4 C x 1.5 sq. mm, control cable	10700 Mtrs	6.3.9
A.5.1.9	10 C x 1.5 sq. mm, control cable	5600 Mtrs	6.3.9
A.5.1.10	19 C x 1.5 sq. mm, control cable	3400 Mtrs	6.3.9
A.5.1.11	2 C x 2.5 sq. mm, control cable	3400 Mtrs	6.3.9
A.5.2.0	<i>CABLE TRAYS</i>		
A.5.2.1	Perforated Cable Tray, 100 mm wide	3500 Mtrs	6.3.10
A.5.2.2	Perforated Cable Tray, 150 mm wide	1325 Mtrs	6.3.10
A.5.2.3	Perforated Cable Tray, 300 mm wide	500 Mtrs	6.3.10
A.5.2.4	Perforated Cable Tray, 50 mm wide	875 Mtrs	6.3.10

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 8

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer
A.	BHEL-TRICHY SCOPE		Clause
A.5.3.0	JUNCTION BOXES		
A.5.3.1	Junction Box (12 way)	29 Nos.	6.3.11
A.5.3.2	Junction Box (24 way)	87 Nos.	6.3.11
A.5.3.3	Junction Box (36 way)	32 Nos.	6.3.11
A.5.3.4	Junction Box (48 way)	13 Nos.	6.3.11
A.5.3.5	Push Button Boxes	3 Nos.	6.3.11
A.5.4.0	CHANNELS, PIPES, TUBES ETC.		
A.5.4.1	Soft Galvanized wire-1.219	1700 Mtrs	6.3.18
A.5.4.2	Structural Steel for fabrication of supports consisting of angles, channels (ISA 40x40x5, ISMC 100x50x6, Flat 50 x 6 etc)	12 MT	6.3.12
A.5.5	IMPULSE PIPES		
A.5.5.1	1/2" Sch 80, CS impulse pipe (21.3 X 3.73)	1300 Mtrs	6.3.4
A.5.5.2	1" Sch80, CS impulse pipe (33.4 X 4.55)	1750 Mtrs	6.3.4
A.5.6.0	COMMISSIONING OF THE FOLLOWING		
A.5.6.1	Commissioning of bidirectional motors, including loop checking	80 Nos. ^{\$}	6.3.16.8
A.5.6.2	Checking the operation of Soot Blower Motors and LT Motors (unidirectional) from DCS	200 Nos. ^{\$}	

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 9

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
B.	BHEL- RANIPET SCOPE		
B.1.0	AIR PRE-HEATERS		
B.1.1	Pressure Indicators	12 Nos.	6.3.3
B.1.2	Temperature Indicators (with thermowell)	6 Nos.	6.3.3
B.1.3	RTDs for Bearing Temperature Measurement	4 Nos.	6.3.3
B.1.4	Pressure Switches	4 Nos.	6.3.3
B.1.5	Temperature Switches	4 Nos.	6.3.3
B.1.6	Thermocouple Assembly consisting of 10 Nos. Cr-Al M.I. thermocouples along with integral terminal box	4 sets*	6.3.3
B.1.7	Rotor Stoppage Alarm Box- including sensors, interconnecting cables etc.	2 sets*	6.3.3
B.1.8	ON/OFF Switch Box including light assembly and interconnecting cable	2 sets*	6.3.3
	COMMISSIONING of the following		
B.1.9	Solenoid Valves	2 Nos. \$	6.3.16.4

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 10

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
B.	BHEL- RANIPET SCOPE		
B.1.10	<p>Air Preheater Skids</p> <p>The scope of work includes removal of instruments, calibration, refixing, checking cable connection from JB to instruments, motor connection, meggering and improving IR value of motor etc.</p> <p>The approximate quantity of instruments for each skid is given below:</p> <p>LT Motors - 2 Nos.</p> <p>Pressure Gauges – 2 Nos.</p> <p>Temperature Gauges –2 Nos.</p> <p>Flow Switch - 1 No.</p>	4 sets* ^{\$}	6.3.16.7, 6.3.3
B.2.0	INSTRUMENTS FOR FANS		
B.2.1	Fan Bearing RTDs	18 Nos.	6.3.3
B.2.2	Fan Bearing Temperature Indicators	18 Nos.	6.3.3
B.2.3	Fan Motor Bearing Temperature Indicators. (The scope of work is removal, calibration and refixing)	12 Nos.	6.3.3
B.2.4	Fan Motor Bearing/ Winding RTDs (checking of healthiness only)	84 Nos. ^{\$}	6.3.16.5

* Lump sum rate to be quoted per set

^{\$} Rate to be quoted ONLY for commissioning

BOM - 11

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
B.	BHEL- RANIPET SCOPE		
<i>B.2.5.0</i>	<i>COMMISSIONING OF FOLLOWING</i>		
B.2.5.1	<p>LUB OIL SKIDS FOR FD-A&B, ID-A&B, PA-A&B FANS</p> <p>The scope of work includes removal of instruments, calibration, refixing, checking cable connection from JB to instruments, motor connection, meggering and improving IR value of motor etc.</p> <p>The approximate total quantity of instruments for all the 6 Nos. skids put together is given below:</p> <p>LT Motors - 12 Nos. DP Gauges - 2 Nos.</p> <p>Pressure Gauges – 14 Nos. Temperature Gauges – 26 Nos.</p> <p>DP Switches – 6 Nos. Level Switches - 6 Nos.</p> <p>Pressure Switches- 28 Nos. Flow Switches – 4 Nos.</p>	6 sets* ^{\$}	6.3.16.7, 6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
C.	BHEL-PIPING CENTRE SCOPE		
C.1.0	S.G. PACKAGE		
C.1.1.0	LOCAL/FIELD INSTRUMENTS		
C.1.1.1	Pressure Gauges	20 Nos.	6.3.3
C.1.1.2	DP Gauges	2 Nos.	6.3.3
C.1.1.3	Temperature Gauges with Thermowell (capillary/ stem type)	80 Nos.	6.3.3
C.1.1.4	Pressure Switches	3 Nos.	6.3.3
C.1.1.5	DP Switches	2 Nos.	6.3.3
C.1.1.6	Level Switches (float type)	8 Nos.	6.3.3
C.1.2.0	JUNCTION BOXES		
C.1.2.1	Junction Boxes, 12 way	2 Nos.	6.3.11
C.1.2.2	Junction Boxes, 24 way	5 Nos.	6.3.11
C.1.2.3	Junction Boxes, 36 way	2 Nos.	6.3.11
C.1.3.1	Control Panel for HP Dosing System Size: 1000 x 700 x 2000 mm; 400 kg	1 No.	6.3.1
C.1.4.0	Instrument Erection Material		
C.1.4.1	CS Pipe 21.3 x 3.73	150 Mtrs	6.3.4

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 13

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
C.	BHEL-PIPING CENTRE SCOPE		
C.1.5.0	GI Pipes (Heavy duty)		
C.1.5.1	NB 15 x 3.25	1800 Mtrs	6.3.7
C.1.5.2	NB 25 x 4.05	700 Mtrs	6.3.7
C.1.5.3	NB 40 x 4.05	110 Mtrs	6.3.7
C.1.5.4	NB 50 x 4.05	400 Mtrs	6.3.7
C.1.5.5	NB 100 x 5.4	160 Mtrs	6.3.7
C.1.6.0	Commissioning of the following-		
C.1.6.1	Pneumatic Control Valves	3 Nos. \$	6.3.16.1

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.1.0	SG PACKAGE		
D.1.1.0	PANELS		
D.1.1.1	Panel: (Single Cubicle) (Panel No. CAF61, CJF34) Size 1050 x 1050 x 2700 mm; Approx. weight- 600 kg	2 Nos .	6.3.1, 6.3.2
D.1.1.2	Panels: Suite of Two Cubicles (CJF07&76, CAF16&17, CJF20&21) Size 1700 x 1050 x 2700 mm; Approximate weight- 1200 kg	3 Nos.	6.3.1, 6.3.2
D.1.1.3	Panels: Suite of Three Cubicles (CJF23,24&CAF20, CJF25,26 &CAF21, CJF27,28&CAF31) Size 2400 x 1050 x 2700 mm; Approximate weight- 1800 kg	3 Nos.	6.3.1, 6.3.2
D.1.1.4	Panels: Suite of Four cubicles (CJF51,52,66&67) Size 3200 x 1050 x 2700 mm; Approximate weight-2400 kg	1 No.	6.3.1, 6.3.2
D.2.0	STG PACKAGE		
D.2.1.0	PANELS		
D.2.1.1	Panels: (Single Cubicle) (Panel No. CJJ01, CJJ02, CJJ08, CJJ09, CJJ20, CJJ30) Size 1050 x 1050 x 2700 mm; Approx. weight- 600 kg	6 Nos.	6.3.1, 6.3.2
D.2.1.2	Panels: (Single Cubicle) (Panel No. CWW01) Size 1150 x 1050 x 2700 mm; Approx. weight- 600 kg	1 No.	6.3.1, 6.3.2
D.2.1.3	Panels: Suite of Two Cubicles (Panel No. CJJ03&04, CJJ11&12, CJJ21&22, CJJ23&24, CJJ31&32, CJJ33&34, CCA04&05, CCA06&07) Size 1700 x 1050 x 2700 mm; Approximate weight- 1200 kg	8 Nos.	6.3.1, 6.3.2

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 15

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.2.1.4	Panels: Suite of Three cubicles (Panel No. CJJ05,06&07, CCA01,02&03, CCA10,11&12) Size 2400 x 1050 x 2700 mm; Weight. 1800 Kg	3 Nos.	6.3.1, 6.3.2
D.2.2.0	CABLES		
	<i>Special Cables (PTFE/FEP insulated cables)</i>		
D.2.2.1	2 pair x 0.5 sq. mm cable	6000 Mtrs	6.3.9
D.2.2.2	4 pair x 0.5 sq. mm cable	2000 Mtrs	6.3.9
D.2.2.3	5 Core x 1.5 sq. mm control cable	1000 Mtrs	6.3.9
D.2.2.4	2 Pair x 0.5 sq. mm K type compensating cables	5500 Mtrs	6.3.9
D.2.2.5	2 Pair x 0.5 sq. mm T Type compensating cables	1500 Mtrs	6.3.9
D.2.3.0	CABLE DUCTS WITH COVERS (GI SOLID BOTTOM)		
D.2.3.1	60 x 60 x 1000 mm	200 Nos.	6.3.10
D.2.3.2	180 x 100 x 1000 mm	100 Nos.	6.3.10
D.2.3.3	250 x 100 x 1000 mm	100 Nos.	6.3.10

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 16

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.2.4.0	MOUNTING FRAMES to be assembled & erected <i>Assembly and installation of Mounting Frames with loose supplied prefabricated materials of suitable size, like slotted angles, channels, base plates & fasteners etc.</i>		
D.2.4.1	MFA 150 (1600 x 718 x 1700 mm)	2 Nos.	6.3. 5
D.2.4.2	MFC 150 (1600 x 858 x 1700 mm)	2 Nos.	6.3.5
D.2.4.3	MWK 100 (1100 x 300 x 700 mm)	2 Nos.	6.3.5
D.2.4.4	MWG 200 (2100 x 470 x 1700 mm)	3 Nos.	6.3.5
D.2.4.5	MWG 250 (2600 x 470 x 1700 mm)	2 Nos.	6.3.5
D.2.4.6	MFA 100 (1100 x 718 x 1700 mm)	3 Nos.	6.3.5
D.2.4.7	MFA 200 (2100 x 718 x 1700 mm)	2 Nos.	6.3.5
D.2.4.8	MFA 300 (3100 x 718 x 1700 mm)	2 Nos.	6.3.5
D.2.4.9	MFZ 100 (1100 x 424 x 700 mm)	3 Nos.	6.3.5
D.2.5.0	JUNCTION BOXES		
D.2.5.1	64 way Junction Boxes	77 Nos.	6.3.11
D.2.5.2	Thermocouple Junction Box for K-type Thermocouple (NiCrNi)	32 Nos.	6.3.11
D.2.5.3	Thermocouple Junction Box for T-type Thermocouple (CuCuNi)	2 Nos.	6.3.11
D.2.5.4	Fire Protection Switch with Junction Box	4 Nos.	6.3.11

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.0	STATION C&I PACKAGE		
D.3.1.0	PANELS		
D.3.1.1	Relay Panels (CTE01 & CTE02) (Single Cubicle) Size 1050 x 1050 x 2700 mm; Approximate weight- 600 kg each	2 Nos.	6.3.1, 6.3.2
D.3.1.2	Functional Group Control Panels (Suite of Two Cubicles) (CRE01&02, CRE03&04, CRE05&06, CRE07&08, CRE09&10, CRE11&12, CRE13&14, CRE15&16, CRE17&18, CRE19 & 20, CRE21&22, CRE23&24, CRE25&26, CRE27&28, CRE29&30, CRE31&32, CRE33&34, CRE35&36, CRE37&38, CRE39&40, CRE41&42, CRE43&44, CRE71&72, CRE73&74, CRE91&92) Size 1700 x 1050 x 2700 mm; Approximate weight- 1200 kg each	25 Nos.	6.3.1, 6.3.2
D.3.1.3	Transducer Panel & Relay Panel (Suite of Three Cubicles) Size 2400 x 1050 x 2700 mm; Approximate weight- 1800 kg	1 No.	6.3.1, 6.3.2
D.3.2.0	FIELD INSTRUMENTS		
D.3.2.1	Pressure Gauges	153 Nos.	6.3.3
D.3.2.2	Temperature Gauges with thermowell	103 Nos.	6.3.3
D.3.2.3	RTDs along with thermowell	92 Nos.	6.3.3
D.3.2.4	MTM Thermocouples (K type), 30 Mtr – flexible type	53 Nos.	6.3.3
D.3.2.5	Thermocouples (K type/ R type) with thermowell	155 Nos.	6.3.3
D.3.2.6	Pressure Switches	21 Nos.	6.3.3
D.3.2.7	DP Switches	5 Nos.	6.3.3
D.3.2.8	Level switches (capacitance type)	4 Nos.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 18

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.2.9	Level switches (conductivity type) with sensors, cables, electronic units etc.	2 sets*	6.3.3
D.3.2.10	DP Transmitters	110 Nos.	6.3.3
D.3.2.11	Pressure Transmitters	141 Nos.	6.3.3
D.3.2.12	E/P Converters	38 Nos.	6.3.3
D.3.2.13	Air Filter Regulators	38 Nos.	6.3.3
D.3.2.14	Bypass Rotameters (Checking only)	14 Nos. ^{\$}	6.3.16.2
D.3.2.15	Electronic Water level indicator for CRH drain pot level measurement	2 sets*	6.3.3
D.3.3.0	SECONDARY INSTRUMENTS TO BE MOUNTED IN UCP		
D.3.3.1	Digital Indicators (96 x 48 mm)	16 Nos.	6.3.3
D.3.3.2	Bar Graph Indicators	8 Nos.	6.3.3
D.3.3.3	3 point Recorders	1 No.	6.3.3
D.3.3.4	6 point Recorders	5 Nos.	6.3.3
D.3.3.5	30 point Recorders	1 No.	6.3.3
D.3.4.0	ALARM ANNUNCIATION SYSTEM		
D.3.4.1	Alarm Annunciator Panels for UCP (Suite of 4 panels) Approximate Size: 3200 x 750 x 2415 mm; 2000 kg	1 No.	6.3.1
D.3.4.2	Alarm Annunciator Panels for ECP (Suite of 2 panels) Approximate Size: 1600 x 750 x 2415 mm; 1000 kg	1 No.	6.3.1

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.4.3	Digital Buffer Cabinets (Suite of 2 panels) Approximate Size: 1600 x 750 x 2415 mm; 1000 kg	1 No.	6.3.1
D.3.5.0	MASTER AND SLAVE CLOCK SYSTEM		
D.3.5.1	Master clock control panel Approximate Size: 900 x 600 x 2415 mm	1 No.	6.3.1
D.3.5.2	Slave clock Approximate Size: 700 x 100 x 200 mm	20 Nos.	6.3.3
D.3.5.3	GPS Antenna along with around 100 Mtrs antenna cable from antenna to GPS Receiver	1 set*	6.3.3
D.3.5.4	RS232 Data Cable for RS232 Communication – 5 Core	1000 Mtrs	6.3.9
D.3.5.5	RG58 Coaxial Cable for Pulse/ IRIGB	3,000 Mtrs	6.3.9
D.3.5.6	Power Supply Cable, 3 Core x 2.5 sq. mm	1,500 Mtrs	6.3.9
D.3.5.7	GI Conduit pipe, 19 mm OD	1,000 Mtrs	6.3.10
D.3.5.8	Junction Boxes	10 Nos.	6.3.11

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 20

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.6.0	FLUE GAS ANALYSERS		
D.3.6.1	SOX/NOX/CO analyser system along with Sample Handling System consisting of 1 No. local analyser cabinet of size 1200 x 800 x 1900 mm, with a local air conditioner separately supplied, 2 Nos. sample gas tube with electrically heat traced 1500 mm probes, 2 Nos. junction boxes, 2 Nos. thermostat, zero gas cylinder and span gas cylinder, control unit, loose ¼ " SS tubes for field tubing and with field cabling. The analyzer is to be installed at 35 ML of chimney.	1 set*	6.3.3
D.3.6.2	O2 Analyser Consisting of probes with JB's, Electronic Unit, Reference Air Kit, Gas regulator, instrument air connection and gas connection tubes, interconnecting power and control cables etc.	2 sets*	6.3.3
D.3.6.3	Opacity Analyser Dust monitor consisting of two Nos. of transceiver units with air purge connections, one No. temperature transmitter unit, an air compressor unit with air distribution pipes and tubes for purge air connection, one No. signal processor unit, one No. power supply unit, associated power and control cables etc. This is to be installed at 75 ML of chimney. Weight of compressor unit: 150 kg (approx.)	3 sets*	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 21

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.7.0	COAL BUNKER LEVEL MONITORING SYSTEM		
D.3.7.1	Coal Bunker Level Monitoring System consisting of the following Sensors along with probe extension cables, JB cum amplifier units: 56 Nos. Electronic Unit, to be housed in Flame Scanner Panel: 1 No. Bar Graph Indicators: 7 Nos. : Rack for Bar Graph Indicators: 1 No. Fixing / Erection of the sensors onto legs of Bunkers is in the scope of Vendor. Providing necessary approach platforms with ladders as well as any other assistance, if required, is in the scope of this contract.	1 set*	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 22

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.8.0	STEAM AND WATER ANALYSIS SYSTEM		
D.3.8.1	<p>Steam and water analysis system, SWAS consisting of:</p> <ul style="list-style-type: none"> - Primary Cooler Racks: 2 Nos. <p>One rack of size 2000 x 600 x 2000 mm & app. weight 250 kg and the other of app. size, 600 x 600 x 2000 mm & app. weight 100 kg</p> <ul style="list-style-type: none"> - Chiller Unit (redundant) : 1 No. <p>Size 3040 x 1340 x 1800 mm; Approx. Dead weight of chiller unit: 1700 kg</p> <ul style="list-style-type: none"> - Wet Panel: 1 No. <p>Approximate size 2800 x 1500 x 2300 mm; Weight 850 kg</p> <ul style="list-style-type: none"> - Dry panel: 1 No. <p>Approximate size 3600 x 700 x 2300 mm; Weight 500 kg The Wet Panel will be supplied along with associated cooler, flow meters, indicators etc. The Dry Panel consists of sensors, electronic instruments etc. The SWAS System will have the following measurements.</p> <ul style="list-style-type: none"> ▫ Conductivity Analyser: 13 Nos. ▫ Dissolved Oxygen Analyzer : 3 Nos. ▫ Hydrazine Analyzer : 1 No. ▫ pH Analyzers : 5 Nos. . ▫ Silica Analyzer: 2 Nos. ▫ Sodium Analyzers: 3 Nos. <p>The scope of work includes erection of the above, including loose supplied instruments, if any, interconnection pipes between cooler, chiller and wet panel, cooling water connection pipes between cooler, chiller and wet panel etc.</p>	1 set*	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 23

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.9.0	VIBRATION MONITORING SYSTEM, VMS for Fans, Pumps & Mills		
D.3.9.1	<p>Consisting of the following:</p> <ul style="list-style-type: none"> - Control Panel (fully wired) of approximate size: 800 x 780 x 2415 mm, 500 kg : 2 Nos. - Velocity Transducer, along with 10 Mtr long Sensor Extension cable with SS conduit (from pickup upto local JB): 66 sets.[#] - Junction Box (8 way): 33 Nos. <p>Total number of loose supplied items to be mounted in the 4 cabinets is as follows: Instrument racks: 4 Nos. along with 33 Nos. of Dual Seismic monitors, 33 Nos. of Relay Output Modules, 8 Nos. of Power Supply Units, etc.</p> <p>[#] Installation of sensors with mounting bracket will be in the scope of vendor, arranged by BHEL. However, assistance for installing the same like drilling, tapping etc., if required, shall be provided by the contractor.</p>	1 set*	6.3.3, 6.3.1

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.10.0	24V DC BATTERY & BATTERY CHARGERS FOR SG- TG PACKAGE & BOP PACKAGE		
D.3.10.1	<p>24V /2 x 1200 AH L.A. Battery Charger with DCDB</p> <p>comprising of the following:</p> <p>Float charger Panels: 2 Nos. Boost charger Panels: 2 Nos. DCDB Panel: 2 Nos. Battery Isolation Box : 2 Nos. (wall mounted type)</p> <p><u>Approximate Dimensions:</u></p> <p>Each Float charger Panels: 1200 x 1000 x 1800 mm Each Boost charger Panels: 1000 x 1000 x 1800 mm Each DCDB Panel: 1200 x 1000 x 1800 mm Each Battery Isolation Box : 700 x 350 x 1000 mm</p> <p><u>Approximate Weights:</u></p> <p>Each charger panel: 800 kg SWC + DCDB: 500 Kg.</p>	2 sets*	6.3.17

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.10.2	<p>24V Battery 1200AH, Lead Acid Battery, made up of 24 Nos. cells, arranged in wooden stand, along with 630/ 95 sq. mm Copper cables of suitable length, inter cell connectors, inter pole connectors, inter row connectors etc. Size of Battery Racks: 2200 x 1100 x 900 mm (approx.) Approximate Weight of Battery: 4000 kg</p>	2 sets*	6.3.17
D.3.11.0	24V DC BATTERY & BATTERY CHARGERS for CW PACKAGE		
D.3.11.1	<p>24V/ 120 AH Battery Charger consisting of Float Cum Boost Chargers along with integral DCDB : 2 Nos., Battery Isolation Box: 2 Nos. etc. Total size of chargers: 2400 x 600 x 1600mm; dispatched in suitable shipping sections. Battery Isolation Box: 450 x 300 x 550 mm <u>Approximate Weights:</u> Each charger panel: 800 kg SWC + DCDB: 500 Kg.</p>	1 set*	6.3.17

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.11.2	24V Battery 120AH, VRLA Battery, made up of 12 Nos. cells, arranged in CRCA Stack box, along with 630/ 95 sq. mm Copper cables of suitable length, inter cell connectors, inter pole connectors, inter row connectors etc. Size of Stack: 800 x 350 x 500 mm (approx.) Total Weight: 110 kg (approx.)	1 set*	6.3.17
D.3.12.0	24V DC BATTERY & BATTERY CHARGERS for FOPH		
D.3.12.1	24V/80 AH VRLA Battery Charger consisting of Float Cum Boost Chargers along with integral DCDB: 2 Nos., Battery Isolation Box: 2 Nos. etc. Total Size of chargers: 2400 x 600 x 1600 mm Size of Battery Isolation Box: 450 x 300 x 550 mm <u>Approximate Weights:</u> Each charger panel: 800 kg SWC + DCDB: 500 Kg.	1 set*	6.3.17
D.3.12.2	24V Battery 80AH, VRLA Battery, made up of 12 Nos. cells, arranged in CRCA stack, along with 630/ 95 sq. mm Copper cables of suitable length, inter cell connectors, inter pole connectors, inter row connectors etc. Size of Stack: 800 x 350 x 375 mm (approx.) Total Weight: 90 kg (approx.)	1 set*	6.3.17

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.13.0	MAIN UPS WITH ACDB & BATTERY		
D.3.13.1	<p>2 x 80 KVA, 240 V UPS comprising of following panels: Servo Controlled Voltage Stabilizer cubicle, Isolation Transformer Cubicle-1 & 2, UPS-1 & 2 along with Attached Battery Breaker Enclosure. Approximate total dimension: 4900mm x 890mm x 2110mm <u>Approximate Weights</u> SCVS Cubicle: 800 kg Each Isolation Trfr Cubicle: 600 kg Each UPS panel: 1500 kg</p>	1 set*	6.3.17
D.3.13.2	<p>ACDB Approximate Size and weight: 1400 x 900 x 2110 mm; 400 kg</p>	2 Nos.	6.3.1
D.3.13.3	<p>UPS Battery: 375AH, Plante Battery made up of 192 cells, housed in two tier wooden rack, along with intercell connectors, inter row connectors, inter tier connectors, 70/120 sq. mm Copper cables of suitable length, wall mounted switch fuse unit etc. Approximate Size for battery is 5100 x 3000 x 2000 mm Weight: 10,000 kg (Approximate)</p>	2 sets*	6.3.17
D.3.14.0	IMPULSE PIPES		
D.3.14.1	AS Pipe, ½" NB SCH XXS, P22	600 Mtrs	6.3.4
D.3.14.2	AS Pipe, ¾" NB SCH 80, P22	250 Mtrs	6.3.4
D.3.14.3	CS Pipes, 1" NB SCH 80, Gr B	150 Mtrs	6.3.4

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 28

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.14.4	CS Pipe, ½" NB SCH 80, Gr C	3,250 Mtrs	6.3.4
D.3.14.5	CS Pipes, ½" NB SCH 160, Gr C	1,200 Mtrs	6.3.4
D.3.14.6	CS Pipes, ¾" NB SCH 80, Gr 'C'	2,100 Mtrs	6.3.4
D.3.14.7	A312 TP 316 ½" NB SCH40 SS	1,000 Mtrs	6.3.4
D.3.14.8	A312 TP 316 ¾" NB SCH80 SS	750 Mtrs	6.3.4
D.3.14.9	A312 TP 316 ¾" NB SCH160 SS	750 Mtrs	6.3.4
D.3.15.0	INSTRUMENTATION CABLES		
	<i>PVC/FRLS, Armoured, individually and overall shielded, Cu cables</i>		
D.3.15.1	2 pair x 0.5 sq. mm cable	10,050 Mtrs	6.3.9
D.3.15.2	4 pair x 0.5 sq. mm cable	36,400 Mtrs	6.3.9
D.3.15.3	8 pair x 0.5 sq. mm cable	17,700 Mtrs	6.3.9
D.3.15.4	12 pair x 0.5 sq. mm cable	16,100 Mtrs	6.3.9
	<i>PVC/FRLS, Armoured, Overall shielded, Cu Cables</i>		
D.3.15.5	2 pair x 0.5 sq. mm cable	14,180 Mtrs	6.3.9
D.3.15.6	4 pair x 0.5 sq. mm cable	53,080 Mtrs	6.3.9
D.3.15.7	8 pair x 0.5 sq. mm cable	20,940 Mtrs	6.3.9
D.3.15.8	12 pair x 0.5 sq. mm cable	19,800 Mtrs	6.3.9
	<i>Compensating Cables</i>		
D.3.15.9	2 pair x 1.0 sq.mm 'KX' type T/C cable	4,700 Mtrs	6.3.9
D.3.15.10	4 pair x 1.0 sq.mm 'KX' type T/C cable	7,000 Mtrs	6.3.9

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 29

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.15.11	6 pair x 1.0 sq.mm 'KX' type T/C cable	15,000 Mtrs	6.3.9
D.3.15.12	2 pair x 1.0 sq.mm 'SX' type T/C cable	1000 Mtrs	6.3.9
D.3.16.0	POWER CABLES		
D.3.16.1	1 C x 630 sq.mm, Cu cables	700 Mtrs	6.3.9
D.3.16.2	1 C x 95 sq.mm, Cu cables	2200 Mtrs	6.3.9
D.3.16.3	1 C x 16 sq.mm, Cu cables	10,000 Mtrs	6.3.9
D.3.16.4	2 C x 6 sq.mm, Cu cables	15,000 Mtrs	6.3.9
D.3.17.0	CABLE TRAYS		
D.3.17.1	Perforated Cable Trays, 50 mm wide	2,500 Mtrs	6.3.10
D.3.17.2	Perforated Cable Trays, 100 mm wide	4,500 Mtrs	6.3.10
D.3.18.0	JUNCTION BOXES		
D.3.18.1	12 way Junction Boxes	20 Nos.	6.3.11
D.3.18.2	24 way Junction Boxes	15 Nos.	6.3.11
D.3.18.3	36 way Junction Boxes	19 Nos.	6.3.11
D.3.18.4	48 way Junction Boxes	5 Nos.	6.3.11
D.3.18.5	64 way Junction Boxes	10 Nos.	6.3.11
D.3.18.6	72 way Junction Boxes	17 Nos.	6.3.11
D.3.18.7	96 way Junction Boxes	5 Nos.	6.3.11

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 30

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.3.19.0	LOCAL INSTRUMENT ENCLOSURES/ RACKS (LIE/ LIRs)		
D.3.19.1	LIE, type A of size: 1450 x 800 x 2300 mm; Approximate weight: 375 kg each	8 Nos.	6.3.5
D.3.19.2	LIE, type B of size: 1100 x 800 x 2300 mm; Approximate weight: 300 kg each	20 Nos.	6.3.5
D.3.19.3	LIE, type C of size: 700 x 600 x 2100 mm; Approximate weight: 250 kg each	1 No.	6.3.5
D.3.19.4	LIR, type A of size 2150 x 650 x 2150 mm; Approximate weight: 325 kg each	23 Nos.	6.3.5
D.3.19.5	LIR, type B of size 1650 x 650 x 2150 mm; Approximate weight: 250 kg each	16 Nos.	6.3.5
D.3.19.6	LIR, type C of size 1150 x 650 x 1600 mm; Approximate weight: 500 kg each	14 Nos.	6.3.5
D.3.20.0	OTHER ERECTION MATERIALS		
D.3.20.1	100 x 50 x 5 mm MS Channels, 50 X 50 X 5 MS angles, MS Flat 3.15 mm thick etc.	11 Tonnes	6.3.12
D.3.20.2	½" heavy duty GI pipes	3150 Mtrs	6.3.7
D.3.20.3	1" heavy duty GI pipes	150 Mtrs	6.3.7
D.3.20.4	¼" OD x 1mm thick SS 316 tube	170 Mtrs	6.3.6
D.3.20.5	GI Wire, 8 SWG for earthing	2500 Mtrs	6.3.18

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 31

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
D.	BHEL-EDN SCOPE		
D.4.0	MMI PACKAGE		
D.4.1.1	<p>COMPUTER STATIONS</p> <p>PCs along with 20"/ 15" TFT monitor, and other loose supplied items like keyboard, mouse, printer (A4/A3 size), modems, 1 kVA UPS, interconnecting power and communication cables etc.</p> <p>The PCs are for various specific functions like Engineer Workstation (Programmer Station/ system documentation station), 'maxStorian' Station, Operator Work Stations ('maxOperator' Stations), maxLINK Stations, etc.</p> <p>The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.</p>	18 sets*	6.3.2
D.4.1.2	<p>Network Panels/ Link Panel</p> <p>Dimension: 1050 x 1050 x 2700 mm; Approximate Weight: 600 kg</p>	3 Nos.	6.3.1, 6.3.2
D.4.1.3	<p>CRT DESK</p> <p>CRT Desk for housing Work Stations, CRTs, keyboards and mouse for the above etc.,</p> <p>Approximate Total size 7000 x 900 x 740 mm, in suitable shipping sections</p>	1 set*	6.3.1, 6.3.2
D.4.2.0	CABLES FOR MMI PACKAGE		
D.4.2.1	Ethernet Cable	15250 Mtrs	6.3.9
D.4.4.2	Power Cables: 3 C x 1.5 sq. mm cables	500 Mtrs	6.3.9
D.4.4.3	Laying of Fibre Optic Cable	2200 Mtrs	6.3.9

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
E.	BHEL-HYDERABAD SCOPE		
E.1.0	PUMPS (TDBFP, MDBFP, CEP)		
E.1.1.0	INSTRUMENTS		
E.1.1.1	RTDs along with thermowells	24 Nos.	6.3.3
E.1.1.2	Removal, calibration & re-fixing of Temperature Indicators of BFP & CEP motors	10 Nos.	6.3.3
E.1.1.3	Checking of BFP motor speed switch	2 Nos. ^{\$}	6.3.16.7
E.1.1.4	Checking healthiness of RTDs fixed on BFP & CEP motors (for bearing & winding)	56 Nos. ^{\$}	6.3.16.5
E.1.1.5	Vibration Monitoring Panel for 2 TDBFPs, BP and 1 MDBFP & BP	1 No.	6.3.1, 6.3.3
E.1.1.6	Reverse Rotation Monitoring System for BFPs along with 3 Nos. Reverse Rotation Probes, probe fixtures, 6 Nos. of 12 way JB's & communication cable with conduit, Reverse Rotation Monitors etc. The Reverse Rotation Monitors shall be mounted in one of the panels in Control Equipment Room.	1 set*	6.3.3
E.1.1.7	Hydraulic Coupling of MDBFP The scope of work includes removal, calibration & refixing of instruments. The approximate quantity of instruments to be removed, calibrated & fixed is as follows. Pressure Gauges: 2 Nos. DP Gauge: 1 No. Temperature Gauges: 14 Nos. DP Switches: 1 No. Pressure Transmitters: 6 Nos. Level Switch: 1 No. Limit Switch: 1 No. Speed Transmitter: 2 Nos. RTDs (Checking only): 18 Nos.	1 set*	6.3.16.7, 6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
E.	BHEL-HYDERABAD SCOPE		
E.1.2.0	LOCAL GAUGE BOARD (LGB) / LOCAL INSTRUMENT RACK (LIR)		
E.1.2.1	LGB Assembly for Feed Water Service for BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JB's. Approximate Size 1400 x 550 x 1900 mm ; Weight = 200 kg each. Quantity of instruments per set is Pressure Gauge: 5 Nos. DP Gauges: 2 Nos. Temperature Gauges: 2 Nos. Pressure Switch: 1No.	3 Nos.	6.3.5
E.1.2.2	LGB Assembly for Seal and Cooling Water Service of Booster Pump & BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JB's. Approximate Size 1400 x 550 x 1900 mm ; Weight = 200 kg each. Quantity of instruments per set is DP Gauges: 4 Nos. Temperature Gauges: 12 Nos. DP Switches: 4 Nos.	3 Nos.	6.3.5
E.1.2.3	LGB Assembly for Oil Service of TDBFP/ MDBFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JB's. Approximate Size 1400 x 550 x 1900 mm ; Weight = 200 kg each. Quantity of instruments per set is Pressure Gauges: 6 Nos. Temperature Gauges: 8 Nos.	3 Nos.	6.3.5

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 34

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
E.	BHEL-HYDERABAD SCOPE		
E.1.2.4	LGB Assembly for CEP set including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JB's. Approximate Size 1400 x 550 x 1900 mm; Weight = 200 kg each. Quantity of instruments per set is Pressure Gauges: 9 Nos. Temperature Gauges: 3 Nos. DP Gauges: 3 Nos. Pressure Transmitter: 1 No.	1 No.	6.3.5
E.1.2.5	Local instrument rack (LIR) assembly for 2 TDBFPs, including transmitters, tubing, fittings, JB's, Main-fold valves and wiring from JB's to transmitters. Approximate Size 2000 x 650 x 2200 mm; Weight = 300 kg each. Quantity of instruments per set is Pressure transmitters: 4 Nos. DP transmitters: 4 Nos.	1 No.	6.3.5
E.1.2.6	Local instrument rack (LIR) assembly for MDBFP, including transmitters, tubing, fittings, JB's, Main-fold valves and wiring from JB's to transmitters. Approximate Size 1200 x 600 x 2200 mm; 200 kg each. Quantity of instruments per set is Pressure transmitters: 2 Nos. DP transmitters: 2 Nos.	1 No.	6.3.5
E.1.2.7	Local Instrument Rack (LIR) assembly for CEPs including Transmitters, tubing, fittings, JB's, Manifolds Valves and wiring from JB's to transmitters Approximate Size:1200 x 600 x 1500 mm; Weight = 200 kg Quantity of instruments per set is DP transmitters: 3 Nos.	1 No.	6.3.5

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 35

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
E.	BHEL-HYDERABAD SCOPE		
E.1.2.8	Local Instrument Rack (LIR) assembly for CEPs including Transmitters, tubing, fittings, JBs, Manifolds Valves and wiring from JBs to transmitters Approximate Size:2000 x 650 x 2200 mm; 300 kg Quantity of instruments per set is Pressure transmitters: 9 Nos.	1 No.	6.3.5
E.1.3.0	IMPULSE TUBE		
E.1.3.1	Impulse Tube, Dia 16 x 2.6, CS	1500 Mtrs	6.3.4
E.1.4.0	JUNCTION BOXES		
E.1.4.1	Junction Box, 24 terminals	6 Nos.	6.3.11
E.1.5.0	CABLES/ CABLE TRAYS		
E.1.5.1	4 Pair, 0.5 sq. mm cable (for Vibration Monitoring system and RTDs)	2500 Mtrs	6.3.9
E.1.5.2	4 Triad, 0.5 sq. mm cable (for Reverse Rotation Indicator)	1000 Mtrs	6.3.9
E.1.5.3	Perforated cable tray, 50 mm wide	80 Mtrs	6.3.10
E.1.5.4	Perforated cable tray, 150 mm wide	45 Mtrs	6.3.10
E.1.6.0	SUPPORT MATERIALS		
E.1.6.1	Structural steel (ISMC 100 x 50 x 7.5 mm, Angle 45 x 45 x 5 mm etc.)	1 MT	6.3.12

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 36

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
E.	BHEL-HYDERABAD SCOPE		
E.2.0	BFP DRIVE TURBINE		
E.2.1.0	INSTRUMENTS (LOCAL/FIELD MOUNTED)		
E.2.1.1	Pressure Gauges	64 Nos.	6.3.3
E.2.1.2	DP Gauges	8 Nos.	6.3.3
E.2.1.3	Pressure Transmitters	40 Nos.	6.3.3
E.2.1.4	Pressure Switches	30 Nos.	6.3.3
E.2.1.5	DP Switches	8 Nos.	6.3.3
E.2.1.6	Temperature Gauges with thermowell	56 Nos.	6.3.3
E.2.1.7	RTDs with thermowell	36 Nos.	6.3.3
E.2.1.8	Cr-Al Thermocouples with thermowell	20 Nos.	6.3.3
E.2.1.9	Level Transmitters (capacitance type, top mounted) along with probes, electronic unit etc.	4 sets*	6.3.3
E.2.1.10	Speed measuring loop, with probe, proximeter unit, local field cable etc.	6 Sets*	6.3.3
E.2.1.11	I/P Transducers	6 Nos.	6.3.3
E.2.1.12	Position Transmitters (commissioning only)	8 Nos. ^{\$}	6.3.16.7
E.2.1.13	Control Valves (commissioning only)	12 Nos. ^{\$}	6.3.16.1

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
E.	BHEL-HYDERABAD SCOPE		
E.2.2.0	PANEL MOUNTED INSTRUMENTS & PANELS		
E.2.2.1	Vibration Monitoring System for BFP Drive Turbine consisting of the following- <ul style="list-style-type: none"> - 1 No. Monitor rack with modules (to be mounted on BHEL EDN cabinet), of approximate weight 40 kg - 16 Nos. of Vibration/ Axial displacement probes, probe extension cables, 8 nos. proximitors, proximitor housing, flexible conduit etc. 	2 Sets*	6.3.3
E.2.2.2	Removal, calibration and refixing of Governing Console Board Instruments, including wiring. The approximate quantity of instruments is <ul style="list-style-type: none"> - Pressure Gauges: 6 Nos. - Pressure Switches: 13 Nos. 	2 sets* ^{\$}	6.3.16.7, 6.3.3
E.2.2.3	Fabrication of Local Instrument Racks, each of size 1500 x 1700 mm, with the following material Channel ISMC 100 x 50 mm, Angle 50 x 50 x 6 mm, Plate 10 mm thick (375 x 770 mm), Sheet 4 mm thick (400 x 120 mm) etc.	1 Tonne	6.3.12
E.2.3.0	IMPULSE PIPES & FITTINGS		
E.2.3.1	CS Pipe, ½" SCH 80 (21.3 x 3.73)	800 Mtrs	6.3.4
E.2.3.2	CS Pipe, 60.3 x 3.91	100 Mtrs	6.3.4
E.2.3.3	AS Pipe, ½" SCH 80 (21.3 x 3.73)	660 Mtrs	6.3.4
E.2.3.4	SS tube, 12.7 x 2.1 mm	300 Mtrs	6.3.4
E.2.3.5	SS tube, 6 x 1.5 mm	60 Mtrs	6.3.4

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.1.0	GENERATOR		
F.1.1.0	Generator Auxiliary Control Cabinets		
F.1.1.1	Generator Instrumentation Cabinet (CXW01B) Dimension & weight: 1000 x 800 x 2200 mm; 450 kg	1 No.	6.3.1
F.1.1.2	Gas Analyser Cabinet (CXW01C) including sensor, analyser etc. Dimension & weight: 1200 x 600 x 2200 mm; 450 kg each	1 set *	6.3.1
F.1.1.3	Annunciation Cabinet (CXW01D) Dimension & weight: 1000 x 800 x 2200 mm; 400 kg	1 No.	6.3.1
F.1.2.0	<i>GENERATOR INSTRUMENTS:</i>		
F.1.2.1	Pressure Gauges	28 Nos.	6.3.3
F.1.2.2	Temperature Gauges	15 Nos.	6.3.3
F.1.2.3	Flow Meters	2 Nos.	6.3.3
F.1.2.4	Pressure Transmitters	8 Nos.	6.3.3
F.1.2.5	DP Transmitters	13 Nos.	6.3.3
F.1.2.6	Level Transmitter	1 No.	6.3.3
F.1.2.7	Level Switches (capacitance type)	9 Nos.	6.3.3
F.1.2.8	RTDs	17 Nos.	6.3.3
F.1.2.9	Pressure Switch	1 No.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 40

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.1.2.10	Thermocouples (NiCrNi) (Generator Bearing Temp:- 4 Nos. Exciter Bearing Temp: 2 Nos.)	6 Nos.	6.3.3
F.1.3.0	Removal, Calibration and Re-fixing of following Generator Instruments:		
F.1.3.1	Pressure Gauges	13 Nos.	6.3.3
F.1.3.2	DP Gauges	2 Nos.	6.3.3
F.1.3.3	Temperature Gauges	9 Nos.	6.3.3
F.1.3.4	Flow Gauge (commissioning only)	1 No.	6.3.3
F.1.3.5	Pressure Transmitters	5 Nos.	6.3.3
F.1.3.6	DP Transmitters	5 Nos.	6.3.3
F.1.3.7	Pressure Switches	8 Nos.	6.3.3
F.1.3.8	Level Switches	7 Nos.	6.3.3
F.1.3.9	Flow Meters	5 Nos.	6.3.3
F.1.3.10	Conductivity Cells	2 Nos.	6.3.3
F.1.3.11	PW Conductivity Indicator	1 No.	6.3.3
F. 1.4.0	Checking the healthiness of the following RTDs/Thermocouples mounted on equipment		
F.1.4.1	Temperature- Stator Core (TC CuCuNi)	24 Nos. ^{\$}	6.3.16.5
F.1.4.2	Temperature Stator Slot (Pt 100 RTD)	24 Nos. ^{\$}	6.3.16.5
F.1.4.3	Temperature- PW outlet manifold (Pt 100 RTD)	3 Nos. ^{\$}	6.3.16.5

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 41

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.1.4.4	Temp- Hot Gas Coolers (Pt 100 RTD)	6 Nos. \$	6.3.16.5
F.1.4.5	Temp- Cold Gas Coolers (Pt 100 RTD)	6 Nos. \$	6.3.16.5
F.1.4.6	Temp- Cold Gas (Pt 100 RTD)	2 Nos. \$	6.3.16.5
F.1.4.7	Temp- Cold Air Main Exciter (Pt 100 RTD)	2 Nos. \$	6.3.16.5
F.1.4.8	Temp- Hot Air Main Exciter (Pt 100 RTD)	3 Nos. \$	6.3.16.5
F.1.4.9	Temp- Hot Air Rectifier Wheel (Pt 100 RTD)	1 No. \$	6.3.16.5
F.1.4.10	Temp After Pump (Pt 100 RTD)	1 No. \$	6.3.16.5
F.1.4.11	Temp Stator Winding Outlet (Pt 100 RTD)	1 No. \$	6.3.16.5
F.1.4.12	Temp Upper Bar PW Outlet (Pt 100 RTD)	48 Nos. \$	6.3.16.5
F.1.4.13	Temp Lower Bar PW Outlet (Pt 100 RTD)	48 Nos. \$	6.3.16.5
F.1.4.14	Temp CO2 Flash Evap.	1 No. \$	6.3.16.5
F.1.4.15	Temp for H2 side Seal Oil Drain (Pt 100 RTD)	2 Nos. \$	6.3.16.5
F.1.4.16	Seal Oil Temp before SO Cooler (Pt 100 RTD)	2 Nos. \$	6.3.16.5
F.1.4.17	Seal Oil Temp after SO Cooler (Pt 100 RTD)	5 Nos. \$	6.3.16.5
F.1.4.18	Temp at I/L to PW Cooler (Pt 100 RTD)	1 Nos. \$	6.3.16.5
F.1.5.0	Loose supplied Instruments for Generator Piping		
F.1.5.1	Vacuum Switches	2 Nos.	6.3.3
F.1.5.2	Pressure Gauges	7 Nos.	6.3.3
F.1.5.3	Pressure Switches	1 No.	6.3.3
F.1.5.4	Pt RTD, Duplex	2 Nos.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 42

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.1.5.5	Bimetallic Dial Thermometer	5 Nos.	6.3.3
F.1.6.0	Loose supplied Instruments for H2 Cooler Piping		
F.1.6.1	Pressure Gauges	8 Nos.	6.3.3
F.1.6.2	Pressure Switches	1 No.	6.3.3
F.1.6.3	Pt RTD, Duplex	17 Nos.	6.3.3
F.1.6.4	Bimetallic Dial Thermometer	6 Nos.	6.3.3
F.1.6.5	Moisture Sensor Probes	2 Nos.	6.3.3
F.1.7.0	Loose Items to be mounted on UCB/ Control Room		
F.1.7.1	H2 Gas Dew Point Temperature	1 No.	6.3.3
F.1.8.0	IMPULSE PIPES		
F.1.8.1	21.3 x 2.3 CS pipe	200 Mtrs	6.3.4
F.1.8.2	21.3 x 2.3 AS pipe	250 Mtrs	6.3.4
F.1.8.3	21.3 x 2.3 SS pipe	800 Mtrs	6.3.4
F.1.8.4	13.5 x 2.6 CS pipe	100 Mtrs	6.3.4
F.1.8.5	13.5 x 2.6 AS pipe	50 Mtrs	6.3.4
F.1.8.6	13.5 x 2.6 SS pipe	50 Mtrs	6.3.4

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.2.0	STEAM TURBINE		
F.2.1.0	GAUGES AND SENSORS		
F.2.1.1	Resistance Thermometer	24 Nos.	6.3.3
F.2.1.2	Thermocouples	89 Nos.	6.3.3
F.2.1.3	Temperature Gauges	17 Nos.	6.3.3
F.2.1.4	Temperature Switches	3 Nos.	6.3.3
F.2.1.5	Pressure Transmitters	38 Nos.	6.3.3
F.2.1.6	DP Transmitter	4 Nos.	6.3.3
F.2.1.7	Pressure Switches	37 Nos.	6.3.3
F.2.1.8	DP Switches (Removal, calibration & re-fixing)	12 Nos.	6.3.3
F.2.1.9	Pressure Gauges	47 Nos.	6.3.3
F.2.1.10	Level transmitters with amplifier, bar probe	6 sets*	6.3.3
F.2.1.11	Level Switches	9 Nos.	6.3.3
F.2.1.12	Level Switch (Conductivity type) with electronic unit	2 sets*	6.3.3
F.2.1.13	Level Switches with amplifier, bar probe including interconnecting cable	7 sets*	6.3.3
F.2.1.14	Position Transmitter for Extraction NRV	10 Nos.	6.3.3
F.2.1.15	Position Transmitters (Removal, calibration and re-fixing)	18 Nos.	6.3.3
F.2.1.16	Flow Transmitters	3 Nos.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 44

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.2.1.17	Temperature Transmitters	2 Nos.	6.3.3
F.2.2.0	INSTRUMENT RACKS Removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc.		
F.2.2.1	Governing System Control Rack The approximate quantity of instruments is as below: ▫ Pressure Gauges : 9 Nos. ▫ Pressure Switches : 4 Nos.	1 set*\$	6.3.16.7, 6.3.3
F.2.2.2	LP Bypass Control Rack The approximate quantity of instruments is as below: ▫ Pressure Gauges : 11 Nos. ▫ Pressure Switch : 1 No.	1 set*\$	6.3.16.7, 6.3.3
F.2.2.3	Supply Unit Racks for HP Valve-1, HP Valve-2, IP Valves Total quantity of instruments for all 3 racks is as below: ▫ Pressure Gauges : 17 Nos. ▫ Pressure Switches: 12 Nos ▫ DP Switches : 3 Nos.	3 sets*\$	6.3.16.7, 6.3.3
F.2.2.4	Seal Oil Rack	1 set*\$	
F.2.2.5	Stator Water Rack	1 set*\$	
F.2.2.6	Seal Oil Level / Pr Txr Instrument Rack	1 set*\$	
F.2.2.7	Stator Water DP Instrument Rack	1 set*\$	
F.2.2.8	H2 Dryer Unit	1	

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 45

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.2.2.9	Gland Steam and Seal Steam Oil Supply Units	2 sets**\$	
F.2.2.10	TD BFP Pump Coupling Engage Oil Supply Unit	2 sets**\$	
F.2.3.0	PRESSURE INSTRUMENTS RACKS (IR1 to IR12) Assembly/welding and installation of Instrument Racks with loose supplied prefabricated materials of suitable size, like equal/unequal angles, canopy mounting plates, LHS/RHS stands & fasteners etc. Total wt. of loose supplied items for 12 racks: Approx. 3 Tonnes		
F.2.3.1	Rack of Size 2150 x 700 x 2150 (WXDXH) mm	10 Nos.	6.3.5
F.2.3.2	Rack of Size 1250 x 700 x 2150 (WXDXH) mm	2 Nos.	6.3.5
F.2.4.0	HEAT EXCHANGERS (CONDENSER, GSC, LP HEATER-1, TOC, CFC)		
F.2.4.1	Level Switches	5 Nos.	6.3.3
F.2.4.2	Temperature Gauges	20 Nos.	6.3.3
F.2.4.3	Pressure Gauges	3 Nos.	6.3.3

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 46

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.2.5	CONDENSER VACUUM PUMP Removal, calibration and commissioning of CVP skid mounted instruments including CVP PLC and motor mounted on the skid. The approximate quantity of skid mounted instruments shall be Pressure Indicators – 2 Temperature Indicators - 2 Flow Indicator – 1 Flow Switch – 1 Level Switches – 2 DP Switch – 1 Pressure Switch – 1 Temperature Switch- 1 Limit Switch – 1 Solenoid Valve – 2	2 sets* ^{\$}	6.3.16.7, 6.3.3
F.2.6.0	IMPULSE PIPES		
F.2.6.1	Seamless CS Tube, D=13.5 x 2.6	340 Mtrs	6.3.4
F.2.6.2	CS Tube DN-80	20 Mtrs	6.3.4
F.2.6.3	Seamless CS Tube, D=21.3 x 2.3	510 Mtrs	6.3.4
F.2.6.4	Seamless SS tube D=21.3 x 2.6	330 Mtrs	6.3.4
F.2.6.5	Seamless SS tube D=13.5 x 2.6	31 Mtrs	6.3.4
F.2.6.6	Seamless AS tube D=21.3 x 2.77	485 Mtrs	6.3.4
F.2.6.7	Seamless AS tube D=13.5 x 2.6	14 Mtrs	6.3.4
F.2.7.0	JUNCTION BOXES		
F.2.7.1	Junction Box (Pedestal and Proximeter JB)	15 Nos.	6.3.11
F.2.7.2	Thermocouple JB for HPC & IPC	8 Nos.	6.3.11
F.2.7.3	80 pt. Junction Box	2 Nos.	6.3.11

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 47

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
F.	BHEL-HARDWAR SCOPE		
F.2.7.4	48 pt. junction box	2 Nos.	6.3.11
F.2.8.0	COMMISSIONING OF THE FOLLOWING		
F.2.8.1	NRV Valves, Stop Valves, Control Valves, HP/LP Bypass Valves	40 Nos. ^{\$}	6.3.16.1
F.2.8.2	Flow Switches	2 Nos. ^{\$}	6.3.16.2
F.2.8.3	Limit Switch (checking only)	62 Nos. ^{\$}	6.3.16.3
F.2.8.4	Checking the operation of LT Motors (unidirectional) from DCS (including those supplied by Hyderabad)	100 Nos. ^{\$}	

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 48

C&I bom

SL. NO.	DESCRIPTION	QUANTITY	Refer Clause
G.	FOR EDTA CLEANING		
G.1.0	Calibration (as required), Erection, Removal and Normalization after completion of EDTA		
G.1.1	MTM thermocouple length 10 mtrs	12 Nos.	
G.1.2	Junction boxes - 12 way/ 6 way/ 24 way	10 Nos.	
G.1.3	Compensating cables 2 P x 0.5 sq. mm	200 Mtrs	
G.1.4	Compensating cables 6 P x 0.5 sq. mm	300 Mtrs	
G.1.5	Pressure gauges	5 Nos.	
G.1.6	Drum MTM thermocouple adaptor fabrication - 1/4 inch NPT(M) x 1/4 inch OD SS	2 sets	
G.1.7	16 P x 0.5 sqmm cable for Teletel Drum level indication	500 mtrs	
G.1.8	3C x 2.5 sqmm power cable Teletel Drum level indication	100 mtrs	
G.1.9	9 port lamp indication at control room and 9 port switching at Drum floor	1 set	
G.1.10	Switchboards with switches	3 Nos.	

* Lump sum rate to be quoted per set

\$ Rate to be quoted ONLY for commissioning

BOM - 49

C&I bom

DATA SHEET

SPECIFIC TECHNICAL REQUIREMENTS

FOR SUPPLY ITEMS IF MENTIONED IN THE BOQ

1. Clamps
 - a. Material & Type : Nylon self locking ties aluminium strips clamps as per Section VI
 - b. Sizes : To meet the requirements of Section VI
2. Ferrules : As per Section VI
3. Tag
 - a. Material : Aluminium/Fibre/Stainless Steel
 - b. Markings : Engraving/Embossing/Printing
 - c. Size : As required.
4. Cable lugs : Copper/Aluminium (crimping type)
5. Clamp Spacing:
 - a. 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 150mm 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 35 mm 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

6. **Cable termination:**

Type of Lugs:

- a. Power Cables : Copper/Aluminium/Both crimping type
- b. Control Cables : Copper pin type, copper screw type, Direct termination
- c. Special Cables : Pin type, maxi-termi type.

7. **Wastage Allowance:**

- a. HT cables : 1%
- b. LT cables above 70mm : 1%
- c. LT cables upto 70mm : 1%
- d. Control & Special cables : 1%
- e. Fire Survival cables : 1%
- f. Steel materials (for cable trays/tray support installation) : 1% by weight

SECTION VIII

APPENDIX - II

DECLARATION SHEET

I, _____ hereby certify that, all the information and data furnished by me with regard to this Tender Specification No.**BHEL:PSSR:SCT:1307** are true and complete to the best of my knowledge. I have gone through the specifications, conditions, stipulations in detail and agree to comply which 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 VIII

APPENDIX - III

TENDER SPECIFICATION NO BHEL:PSSR:SCT:1307

**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
474, Anna Salai, Nandanam, Chennai - 600 035.

SECTION VIII
APPENDIX - IV
CHECK LIST

TENDER SPECIFICATION NO, BHEL: PSSR : SCT : 1307

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 status : 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 (asper 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 | YES/NO |
| 13. | Whether PF exemption No. is allotted by RPFC of your area if so, indicate number | YES/NO |

SIGNATURE OF THE TENDERER