

TENDER SPECIFICATION

BHEL:PSSR:SCT: 1333

FOR

**Handling at Site Stores / Storage yard,
Transportation, Erection, Testing and
Commissioning of Electrical and Control &
Instrumentation System for Unit- 8 of 1 x 250 MW
Unit**

At

RAICHUR THERMAL POWER PROJECT - STAGE III

RAICHUR , KARNATAKA .

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 : 1333 – RAICHUR UNIT – 8 - 1 x 250 MW
ELECTRICAL / C & I PACKAGE

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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: 1333

Messrs Date:

Dear Sir,

SUB: Handling at Site Stores / Storage yard, Transportation, Erection, Testing and Commissioning of **Electrical and Control & Instrumentation System** for Unit 8 of 1x 250 MW unit at Raichur Thermal Power Project, at Raichur, Karnataka for KPCL .

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. 1,50,000/- (Rupees One lakh fifty thousand only) in the form Demand Draft drawn in favour of M/s.Bharat Heavy Electrical Limited Chennai - 35.

A SEPARATE LETTER SHALL BE FURNISHED INDICATING THAT THERE ARE NO DEVIATIONS FROM THE TENDER CONDITIONS (As in Page 8.)

Bids with Deviations from the tender conditions will be rejected.

The completed quotation shall reach the office of the under signed on or before **3.3.2009 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

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

SPECIAL INSTRUCTIONS TO BIDDERS

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

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

01. Details of previous experience during the last 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
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 bidder should have completed Erection, Testing and commissioning of DCS/PLC based plant instrumentation system and other field instrumentation works like Impulse piping, cabling, trays, etc in any thermal/gas/nuclear based power plant or in any process industry like petrochemical/Paper/ Fertiliser/ steel, etc, in last seven years. The above work should have been executed in a single work order of value more than Rs.28.00 lakhs (For Erection and commissioning of C&I package excluding supply).

For power plant, first synchronization of the Unit will be considered as completion of C&I Works. For other industries work completion certificate for the qualifying work is to be submitted.

b) The bidders should have a minimum average financial turn over of **Rs. 62.00** Lakhs per year in the preceding three years ending 2008.

The bidder must have earned profit in any one of the last three financial years ending 31.03.2008 and should have positive net worth as on 31.03.2008

The bidder should submit audited balance sheet and profit and loss account of the company for the last three years ending 31.03.2008 in support of above requirement.

c) Approval of the Agency by customer

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

e) 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.1,50,000/-(Rupees One lakh fifty thousand 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: **1333**

Description	EMD
: Handling at Site Stores / Storage yard, Transportation to site of work, Erection, Testing and Commissioning of Electrical and Control & Instrumentation System for Unit 8 of 1x 250 MW at Raichur Thermal Power Project at Raichur, Karnataka for KPCL.	Rs.1,50,000/- (Rupees One Lakh fifty thousand only)

Cost of Tender Documents (Including all Taxes)	:	Rs.1040/-	
Sale Starts on	:	10.02.2009	
Sale closes on	:	02.03.2009	
Due date and Time for Submission	:	03.03.2009	15.00 HRS
Date and time for opening Of Technical Bids	:	03.03.2009	15.30 HRS

QUALIFICATION REQUIREMENT

- a) The bidder should have completed Erection, Testing and commissioning of DCS/PLC based plant Instrumentation system and other field instrumentation works like Impulse piping, cabling, trays, etc in any thermal/gas/nuclear based power plant or in any process industry like petrochemical/Paper/ Fertiliser/ steel, etc, in last seven years. The above work should have been executed in a single work order of value more than Rs.28.00 lakhs (For Erection and commissioning of C&I package excluding supply).

For power plant, first synchronization of the Unit will be considered as completion of C&I Works. For other industries work completion certificate for the qualifying work is to be submitted.

- b) The bidders should have a minimum average financial turn over of Rs.**62.00** Lakhs per year in the preceding three years ending 2008.

The bidder must have earned profit in any one of the last three financial years ending 31.03.2008 and should have positive net worth as on 31.03.2008

The bidder should submit audited balance sheet and profit and loss account of the company for the last three years ending 31.03.2008 in support of above requirement.

- c) Approval of the agency by customer
- d) 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.
- e) 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:1333

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: 1333 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.1,50,000/- (Rupees One lakh fifty thousand 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.1,50,000/- (Rupees One lakh fifty thousand 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

RAICHUR STAGE – III 1 X 250 MW UNIT – 8

PROJECT INFORMATION - GENERAL

01	Project Title	RAICHUR THERMAL POWER PROJECT STAGE – III 1 X 250 MW UNIT NO. 8
02	Owner/Purchaser	Karnataka Power corporation Limited “ Sudharsan Complex” , II Floor, No. 22/23, Seshadri Road, Bangalore – 560 009
03	Location	Raichur Thermal Power station is 18 Kms away from Raichur on Raichur – Hyderabad State Highway . It is situated 2.5 Kms away on the right bank of river Krishna.
04	Nearest Railway	Krishna, Raichur TPS siding for full wagon and Raichur railway station for smalls. Both the Railway stations are coming in South Central Railway - Broad Gauge .
05	Nearest Airport	Hyderabad
06	Site Elevation	351 Metres, AMSL
07	Ambient Air Temp	
	a) Maximum	45 °C
	b) Minimum	6 °C
	c) Design dry bulb temp	35 °C
	d) Design wet bulb temp	27 °C
	e) Design ambient temp for electrical/air compressor equipment	50 °C

RAICHUR STAGE – III 1 X 250 MW UNIT – 8

PROJECT INFORMATION - GENERAL

08	Relative Humidity	
	a) Maximum during monsoon	85%
	b) Minimum	20%
	c) Average	65%
	Note : For the purpose of guaranteed efficiency of steam generator , the ambient air temperature shall be taken as 31 °C and relative humidity as 60% based on design coal firing with coal analysis.	
09	Rainfall	
	a) Annual average	720 mm
	b) Max. for one day	115 mm
	c) Maximum intensity	38 mm/hr
	d) Period	June to September
10	Seismic Data	
	a) Zone as per IS 1893	Zone - 1
	b) Coefficient (including importance factor and foundation factor)	0.015
11	Wind Data	
	Basic wind pressure as per IS : 875	100 Kg/sq.m
	Wind Velocity	a) Maximum 70 Kmph b) Prevailing wind direction c) North – East, South – West South- East, West
12	Barometric Pressure	734 mm of Hg
13	Transport	
	a) Name of the highway near which plant is located	Raichur – Hyderabad State Highway
	b) Railway (Gauge)	Broad Gauge
14	Construction Power	415 V (+10% - 10%) ,
15	Construction water	Free of cost

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 at his cost.

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 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 charges nearer to the project site. Further distribution shall be arranged by the contractor at his 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 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 2.27 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.

RAICHUR TPS UNIT 8 (1 X 250 MW)

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 scope of work.
- 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 carry out 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 km. 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 BOQ. 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. The quantity indicated in the BOM is tentative only and is liable for variation. Payment will be made as per actual quantum of job executed at the unit rate accepted by BHEL.**
- 6. Section VII contains general guidelines for Erection and Commissioning of C&I systems.**

6.2.0 SCOPE OF WORK

6.2.1 The 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 Electrical/ C&I work covered in the above packages shall be as follows

1. Erection and commissioning of AVR Panels, AC/DC Distribution Boards, Starter Panels, and Electrical/ Instrumentation control panels etc.
2. Erection and Commissioning of VFD System
3. Erection and commissioning of all Types of Field Instruments like Temperature, Pressure and Flow instruments (local & remote) and special instruments like EWLI, Vibration Monitoring System etc.
4. Erection and commissioning of all types of Control room mounted instruments like Indicators, Microprocessor based panels, DCS system and its accessories like system panels, PC's, printers, furniture etc.
5. Erection and commissioning of all Types of Pneumatic Power Cylinders, Controllers etc.
6. Commissioning of all Types of Pneumatic operated Valves / Actuators / Power Cylinders / Controllers and Relief Valves.
7. Erection of all types of Hardware like impulse pipes, trays & tray supports, instrument air line, etc.
8. Laying & Termination of all types of power/ control/ instrumentation cables etc.

9. Installation of local push button stations, Junction Boxes etc.
10. Fabrication and installation of steel supports wherever required.
11. Supply and installation of cable sealing material for sealing of unused openings in panels/ JB's etc.
12. Supply of all consumables required for installation as detailed elsewhere in the contract.
13. Supply of paints and painting of items covered in the scope of works.
14. Commissioning of Generator, HT/ LT-drives, and electrically operated equipment erected by Mechanical contractor.
15. Installation of any other items that have not been specifically indicated, but required for completing installation.

6.3 DETAILED SCOPE OF WORK:

The scope of work for 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 (except 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 LT SWITCHGEARS, POWER DISTRIBUTION BOARDS, AVR AND OTHER CONTROL PANELS.

- a. LT MCCs are simple module type with isolators and fuses. However, some of the MCCs are Double Front draw out type consisting of circuit breakers unit, contactors/starter fuse switch units, MCB etc. These MCCs and ACDBs are mainly supplied to cater the requirement of drives, valves, etc.
- b. The base frames shall normally be supplied along with the boards. These shall be aligned, levelled and grouted in position as per approved drawings. All minor concrete chipping and finishing works are included in the scope of the job. If any grouting bolts are required for the panel, the same shall be supplied at no extra cost.
- c. Wherever the base channels are not available, the same shall be fabricated, erected and painted at site. The material for this shall be supplied by BHEL. For fabrication & erection of base frame, separate rate shall be paid on Tonnage basis.

- d. For the panels to be mounted on the trenches, channel supports have to be provided across the cable trenches over which the base frames of the panels shall be mounted. The contractor shall carry out fabrication and erection of these support structures. Separate rate shall be paid on Tonnage basis for fabrication and erection of support structures.
- e. 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.
- f. Panels will be delivered in different shipping sections. The contractor shall set each section of equipment on its foundation or supporting structures and assemble the panels as required. Necessary interconnection of busbar, inter panel wiring, etc. will have to be done by the contractor.
- g. Normally the panels shall be supplied with complete instrument mounting and wiring. However, if necessary, dismantling of the existing components, making minor modifications in the wiring to suit operating conditions, mounting and rewiring of new components shall be carried out without any extra cost. Mounting and wiring of any instruments, meters, relays, push buttons, indicating lamps, contactors etc. if supplied loose for safety in transit, shall also be included in the scope of the job. However, if any major wiring modification is involved inside the panel, the same shall be carried out at extra cost. The decision of BHEL Engineer shall be final in respect of above extra works.
- h. **The contractor shall carryout touch up painting for panels wherever required and this includes supply of paints also.**
- i. The contractor shall calibrate and commission all switchgear/panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc with well-experienced Engineers/ Technicians.
- j. MCC incomer bus shall be connected to PCC of customer. The contractor shall co-ordinate for proper connection at PCC.
- k. Scope of work shall include drilling of bottom gland plates for cable entry for all the cables to be terminated on the panel, as per requirement.
- l. Contractor shall co-ordinate with other cable-laying agency for proper cable termination.
- m. The contractor shall close unused opening at the panel bottom plate with suitable material in consultation with Site Engineer as part of panel erection.
- n. Rubber mats for Switchgear shall be supplied by BHEL, and these shall be laid, wherever required, by the contractor.
- o. The scope of work shall include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels.

- p. The commissioning of Switchgear shall also involve the trial runs and commissioning of all connected equipment like servomotors and drives etc. The contractor will have to keep his people round the clock, if necessary during the trial runs and promptly take action for any repair, checks and rectification etc. required in the equipment erected by him. (Separate rate shall be paid for commissioning of associated electrical drives as per BOM).
- q. All T&P, Material handling equipment including cranes and Relay Testing/ HV Testing Calibration equipment/ Instruments shall be arranged by contractor.
- r. All testing Instruments/ Equipment deployed to site shall be calibrated before putting the same into service. A copy of calibration certificate shall be submitted to BHEL Engineer for his verification and approval.
- s. Contractor shall prepare all erection/ commissioning log sheets, protocols/test certificates as per field quality plan, get it signed by the concerned BHEL/ Customer Engineer and submit the same to BHEL Engineer as per his instruction.
- t. The contractor shall maintain the charged and commissioned equipment till the same is taken over by customer.
- u. If any removal/ Re-fixing of contactors/relays becomes necessary for the completion of the system, the same shall be done by the contractor at no extra cost.
- v. Contractor shall put his watch and ward for the equipment under his custody and erected in location against theft and damage by other agencies working on the same area.
- w. Any loose supplied items like lamps, lens, contactor, fuse/relays/instruments etc. missed from the custody of the contractor shall be replaced by the contractor at no extra cost.
- x. Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Variations in depth, height or weight of the panel shall not be considered for payment. Any variation in length within $\pm 20\%$ shall not be considered for payment. If the panels have any variation in length beyond $\pm 20\%$ as compared to actual length indicated in the BOQ, payment shall be considered proportional to the length of the panel only.

Note:- BHEL shall provide vendors' support for commissioning of proprietary type of microprocessor based instruments, protection relays which requires software loading and programmer etc. However overall responsibility lies with contractor and the contractor shall provide all support like manpower, standard T&P, instruments etc. for calibration and commissioning of above proprietary type instruments.

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

6.3.2 VFD SYSTEMS

The VFD system comprises of ONAN, 1700 KVA, 6.6/2.3KV Transformer, DC Air cooled Reactor, 6.6 KV VCB, LCI Drive panels, and other control panels, cables etc. The scope works covers erection of all above panels, integration of total system, commissioning etc.

SCOPE OF WORKS OF VFD TRANSFORMER

1. Receipt of all accessories & Spares including oil if supplied in drums from site store/yard, inspection, handling of accessories between stores & transformer yard/location up to respective plinth, storage, erection of all the accessories, cabling from transformer to VFD, control panel, oil testing, dry out, pre-commissioning test, commissioning along with VFD

Note: Refer Section VII for general technical requirements for erection, testing and commissioning.

2. Transformers that are to be mounted adjacent to ESP building will be transported from stores with suitable trailer, unloaded at erection site and erected in position. The necessary material handling equipment required for this operation will be arranged by the contractor at his cost. However, the transformers may be sent to site in completely assembled conditions.
3. Samples of oil will be tested and treated to achieve the desired BDV value. The entire arrangement for testing the oil sample, filtering whenever required to achieve the desired PPM, BDV within the shortest time shall be made by the contractor. The job has to be taken up in consultation with BHEL Engineers at site at the cost of the contractor. All the test equipment for testing specific gravity, PPM, BDV of the oil shall be arranged by the contractor.
4. All the T&P, material handling equipment like cranes, Trailer, filter machines with adequate capacity and 5 kV motorised megger will be arranged by the contractor at his cost. The transformers may have to be suitably lagged/ covered during the drying out operation by the contractor at no extra cost.
5. The auxiliary components of the transformers are to be cleaned and checked before the assembly as instructed by BHEL Engineer.
6. The contractor has to carry out all pre-commissioning works for the transformer using their own testing equipment under the supervision of BHEL Engineer.
7. Test value of dielectric strength/PPM, specific gravity shall be as per recommended value of BHEL. If the test results are not satisfactory and if the customer desires to carry out the tests through some other agency, the same shall be carried out at contractor's cost.
8. Healthiness of all transformer protective systems such as winding temperature detectors etc. shall be checked under the guidance of BHEL Engineer.

9. Transformer protective relays are to be checked prior to the commissioning of the transformer.
10. The scope of erection work includes minor civil work such as chipping and grouting of the support structure as well as for the support of the transformer.
11. The contractor shall maintain the equipment erected and commissioned by him until taken over by Customer.

VFD HT SWITCHGEARS (6.6 KV)

6.6 KV Switchboards are of BHEL make, floor mounting, sheet steel drawout truck type suitable for indoor installation. The switchboards comprise of vacuum break circuit breakers and are suitable for operation on 6.6 KV, 3 phase, 50 Hz system. HT Switchgear equipment shall be installed at 3.5 Mtr level in ESP building. The tentative details are as under.

SCOPE OF WORK FOR HT SWITCH BOARD AND OTHER PANELS

1. The scope of work for erection & commissioning will be generally in line with that for LT Switchgear as detailed in Clause 6.3.1.
2. All Relay Calibration and commissioning of breakers shall be carried out by well experienced Engineers/ Technicians as per instructions of BHEL Engineer.
3. Contractor shall co-ordinate with cable laying agency for proper cable termination and also during HV testing of cable.

SCOPE OF WORK OF CONTROL & PROTECTION PANELS

All these panels shall be installed in VFD Control rooms. The scope works of control & protection panels shall be in line with E&C of LT electrical boards as indicated in Clause.6.3.1.

Protection panels shall be supplied with loose items like Relays, Recorders, Printers, Indicators, interconnecting cables, etc. as part of panel supply. Any special instruments/testing equipment like secondary injection kits, CRO, frequency counter etc. are required for calibration and testing same shall be arranged by the contractor. All the loose supplied items shall be mounted and wired up at no extra cost.

6.3.3 SCOPE OF WORK FOR C&I PANELS

1. Different types of Microprocessor based panels like PLC Panels, Instrument Panels, 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 panel bottom 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. The base frames to be properly grouted to the concrete floor or to be TIG welded to the embedded insert plates. The structural steel material for the above will be supplied by BHEL. For fabrication and erection of frame, unit rate shall be paid on tonnage basis.
4. For panels to be mounted on trenches, if any channel supports are required, the same shall be provided across the cable trenches over which the base frames of the panels shall be mounted. Similarly for the panels to be mounted on false flooring, if mounting frames are not provided, same shall be fabricated at site. The contractor shall carry out fabrication and erection of these support structures on tonnage rate basis.
5. The panels which are supplied for various control systems have to be erected at different places like unit control room/ near the equipment/ various operating floors as per site layout. The contractor shall take the panels to the desired locations either through floor openings or temporary openings. No claims will be entertained for taking the panels to the location owing to change of route or non-availability of openings as per nearest route.
6. Minor concrete chipping and grouting works, including supply of grouting material is included in the scope of works.
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 wire as per the instructions of BHEL engineer.
9. Painting of fabricated parts and earthing conductors of panels shall be part of the work. Touch up painting for panels, including supply of points 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. Variations in depth, height or weight of the panel shall not be considered for payment. Any variation within $\pm 20\%$ of length shall not be considered for payment. However, for variations beyond $\pm 20\%$ in length, price adjustment shall be considered proportional to the length of the panel.

6.3.4 SCOPE OF WORK OF DCS PACKAGE:

1. BHEL will supply sophisticated MAX-DNA DCS system. The tentative details of DCS System is furnished in the BOM.
2. The scope of DCS system includes erection of 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.
3. The scope of work for DCS Panels will generally be in line with that for C&I Panels as detailed in Clause 6.3.3
4. Unit rate quoted for DCS equipment shall cover installation & integration of all the above equipment and providing necessary commissioning assistance. No separate unit rate is applicable for installation of all loose items/ modules/ components or accessories including furniture etc, which is not explicitly mentioned in the BOQ, but comes as part of the system.
5. Separate rate shall be applicable for laying and termination of cables including fibre optic/ Ethernet as detailed in the scope of work for cabling.

6.3.5 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 etc.
 - iii) Air filter regulator sets, Air lock off valve, Power cylinders etc.
 - iv) Panels / Control desk mounted Instruments like indicators, recorder, electronic modules etc.
 - v) I/P converters and local controllers.
 - vi) Special instruments like vibration sensors, proximity sensors, electronic water level indicator, 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.
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.

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.
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. Proper care to be taken during cleaning the crevices where the MTM t/c are inserted.
10. Unit rate quoted for erection and checking of temperature switches, gauges, thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells, seal welding of thermowell, wherever required as per BHEL specification and directive of site engineers.
11. 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.
12. The unit rate quoted for erection and commissioning of Electronic type Level switches includes fixing of Electrode standpipe, Electrodes, Electronic unit, any minor modification required to match Float chamber/ Electrode standpipe with tapping point, integration of all loose supplied items etc.
13. **Unit rate quoted for erection/commissioning of special instruments like, Flame scanner, H.E.A Igniters systems, Vibration monitoring System, Electronic water level indicator, PC based instruments, 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 indicated in Rate Schedule. 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.**
14. **For Special Instruments like Vibration Monitoring System, vendor support will be provided by BHEL for commissioning. The contractor shall provide assistance for the commissioning activities.**
15. **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.

16. 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.
17. Canopy shall be provided for field-mounted instruments as per site requirements. Necessary materials like MS Plate shall be provided by BHEL. Rate for fabrication and installation of canopy shall be on tonnage basis
18. 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.

6.3.6 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 using reducers (at root valve) unions, connector Nuts and tail pieces, sockets, nipples, equal tees, couplings, condensing pots, siphons, root valves, isolation valves cold bending, tig / arc welding. etc., fixing of manifolds and supporting with suitable fixtures and 'U' clamps and painting as per BHEL specification and site 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. Suitable root valves will be provided by BHEL on the tapping point wherever required
3. TIG-welding sets, welding transformer/generator rectifier, Hydraulic bending machines, DPT kits, Hydraulic testing pumps required for pressure testing of impulse pipes shall be arranged by the contractor. Similarly, consumables such as welding electrodes, gas, Tungsten rods etc., filler wire shall be arranged by the contractor within the quoted rate.
4. For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer.
5. Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work.

6. The contractor shall obtain necessary approval for welding electrodes, filler wire from BHEL welding engineer at site.
7. Impulse pipes Welder shall undergo test and get approval from BHEL welding engineer according to the nature of welding.

6.3.7 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.

6.3.8 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.

6.3.9 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.

6.3.10 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. During commissioning of the bi-directional Electrical Actuators the Contractor shall ensure that all feedback and command signals (loop checking) and settings are made available. The list of such actuators is indicated separately in the BOM under commissioning scope. The work for loop checking of bi-directional actuators shall be deemed to be completed only after satisfactory operation of actuator from DCS. The Unit Rate quoted for checking of motors from DCS shall cover all the activities mentioned above.

6.3.11 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 cover laying, drilling of holes on the gland plates of the panels/JB or Enlargement of cable entry holes by tapping or any modification required fixing of cable glands, fixing of glands, ferrules termination, and providing tag plates and dressing.
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 shall be isolated from other cables and laid in a separate cable tray as directed by site Engineer.
6. 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.
7. 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.
8. Wherever cable entry holes have not been provided for equipment installed by another agency, the contractor shall co-operate to get the same done.
9. 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.
10. 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.
11. **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.**
12. SCOPE OF CABLE TERMINATION
 1. The scope of termination shall include termination of cables on various equipment installed by others.
 2. Re-termination if required during testing/ commissioning, shall be carried out without additional cost.
 3. Scope of termination shall include supply of insulating sleeves. The sleeves shall be fire resistant and long enough to over pass conductor insulation.
 4. Contractor shall arrange all type of termination and crimping Tools/ equipments required for the connections/terminations.
 5. **Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.**
 6. After cable terminations, the debris shall be removed then & there

6.3.12 SCOPE OF WORK FOR CABLE TRAYS/ HOSE:

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.

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

1. Different Junction Boxes/ CJCBS/ Push Button boxes with gland plates shall be supplied by BHEL.
2. The unit rate quoted for erection of junction boxes/push button boxes shall cover the following also.

- Providing necessary supports
 - Drilling of bottom gland plates for cable glands as required
 - Painting the tag Nos. or fixing a separate tag plate on junction boxes/push button boxes
 - Minor chipping, grouting as required for mounting the JBs/PB
 - Supply of all bolts and nuts (Fasteners) including grouting bolts as required for mounting the junction box/push button.
 - Closing all unused holes on the gland plates using grommet or any other suitable materials.
 - Any modification like replacement of terminals, enlarging gland holes etc. that may be required to accommodate power cables.
3. All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.
 4. For fabrication and fixing of supports/Frame, rate shall be paid on tonnage basis.

6.3.14 SCOPE OF WORK FOR FABRICATION & ERECTION OF STEEL MATERIALS:

1. Scope of steel fabrication and installation covers, fabrication and installation of various type of supports for cable tray, instruments, impulse pipes, GI pipes, support angles for copper tubing, mounting frames for JB, Control Box/Panel, local PB Stations, canopy for local instruments and local instrument rack etc. wherever required.
2. The fabrication steel materials such as angles, channels, plates, etc shall be supplied in standard lengths by BHEL. Fabrication shall be carried out by the contractor as per schemes in consultation with site engineers.
3. Immediately after fabrication, primer shall be applied to prevent corrosion. The installation shall be carried out only after applying the primer as detailed in painting clause.
4. All fabricated steel materials shall be painted as detailed in the scope of painting.
5. A composite rate shall be quoted for fabrication and installation of steel, on tonnage basis. The above rate shall include supply of paints and painting, grouting and grouting material as required.

6.3.15 SCOPE OF EARTHING (if applicable)

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, JB's, 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 scope of work shall include 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.

6.3.16 SCOPE OF PAINTING:

1. The scope of painting generally covers all the steel fabrication works such as supports, racks, frames, canopy, LIE/LIR/LGB, impulse pipes etc. carried out by the contractor. Painting shall be carried out for any bare copper tube also.
2. 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.
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. All damaged painted surfaces shall be cleaned and coated with two (2) coats of primer followed by a finishing coat of approved colour.
5. All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
6. Unless otherwise instructed, final painting shall be carried out in the field, only after mechanical completion and completion of cable laying.
7. The scope of work includes supply of paints, primers, consumables like brushes, emery papers, thinner etc. also.
8. Paints shall be arranged from standard reputed suppliers in consultation with BHEL.
9. 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. The paint manufacturer's instructions shall be followed at all times.

10. 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

6.3.17 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.

6.3.18 SCOPE OF CALIBRATION:

1. Contractor shall calibrate all the instruments (Gauges, Transmitters and switches), panel mounted instruments including that will be supplied along with equipments mounted in or as loose.
2. Contractor shall submit calibration records as per the BHEL format enclosed in the tender specification.
3. All testing Instruments/ Equipment deployed for calibration shall be calibrated before taking it into service. A copy of valid calibration certificate issued by recognized/accredited agencies. shall be submitted to BHEL Engineer for verification and approval.
4. **BHEL will provide vendor support for calibration of proprietary instruments such as analysers etc. 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. 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**
5. **The contractor shall carry out calibration with their own calibration and testing equipments and shall be done under the supervision of BHEL/Customer Engineers.**

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

1. ALL TYPES OF HT DRIVES AND GENERATOR

- a) Cable identification, checking and meggering.
- b) IR value of motor, measurement of winding resistance etc.
- c) Dry out all the motors if required to improve IR value.
- d) Checking direction of rotation of motors and testing and commissioning from local as well as remote.
- e) Checking the bushing and HV test/Tan delta test
- f) Attending to any defects till the handing over of the unit to customer

2. ALL TYPES OF LT DRIVES AND MOTOR OPERATED VALVES

- a) Cable identification, checking and meggering.
- b) IR value of motor, measurement of winding resistance etc.
- c) Dry out all the motors if required to improve IR value.
- d) Limit switch 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.

3. ESP TRANSFORMER

- a) Dry out of transformers (Oil filtration) till achieving desired BDV, IR Value, Calibration of oil temperature gauges, Checking of breather gauge, HV Test etc. i.e. scope of commissioning of ESP Transformer shall be in line with transformers erected by the contractor.
- b) Replacing defective components like Temperature gauges, breather glass etc.
- c) Attending to any defects till handing over of the unit to customer by BHEL

4. PANELS.

The panels shall be mostly skid mounted and the skid will be erected by mechanical contractor. The scope of commissioning of Panels covers checking of internal wiring and

associated loop cables from panels to field instruments, Push Buttons, JBs, drives, replacing defective components/instruments/electronic cards etc.

If any loop cables (power or control) are to be laid or replaced, the same shall be carried out at unit rates available in the BOQ.

For commissioning of associated drives, if any, the unit rate will be as per BOQ and this will not be part of panel commissioning.

5. HOIST:

All cabling will be carried out by the vendors. However the scope of works of hoist covers besides works mentioned in SI No1, the checking of control panels wiring, field wiring like push button, motors, limit switch etc., fixing of Trailing cables, and making ready for load test by mechanical agency.

6. ESP HEATING ELEMENTS AND THERMOSTATS

- a) Checking the healthiness of Elements and Thermostats.
- b) Setting the value
- c) Replacement of defective Elements and Thermostats.

7. PNEUMATIC (ALL TYPES OF VALVES AND POWER CYLINDERS)

- a) Calibration and checking of instruments mounted on the actuators and setting stroke length of the actuator.
- b) Servicing of positioners, position transmitters, limit switches, solenoid valves, air lock-off valves, removing/replacement of defective components, copper tubes etc., if necessary.
- c) If the actuator is to be removed for attending to any mechanical problems, removing of copper tubes, cables etc. reconnecting and re-commissioning of the actuators is to be done.
- d) Testing and checking the remote/local operation in Auto as well as Manual mode.
- e) Fixing of instruments if supplied as loose items.
- f) Attending to any defects till the contract period.

8. FLOW METERS/ SWITCHES

- d) Checking the calibration and servicing if required.
- e) Setting the alarm value
- f) Replacement of defective components if any

9. LIMIT SWITCHES & LEVEL SWITCHES

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

10. SOLENOID VALVES

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

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

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

12. DIRECT WATER LEVEL GAUGES (REMOTE & LOCAL)

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

13. 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.

NOTE:

The scope of work covered in 6.3.19.0 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.

6.3.20 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. 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 alkali boil out
- iv) Boiler acid cleaning.
- v) Turbine barring gear.
- vi) Steam blowing of piping.
- vii) Turbine rolling.
- viii) Safety valve floating.
- ix) First synchronization of unit.
- x) 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. 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.
11. 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.
12. The scope of commissioning shall also cover the commissioning of the equipment/drives erected by the mechanical contractors. (as detailed in the BOQ)

6.3.21 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 ground 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

Subject to availability, EOT Crane shall be provided on sharing basis, for shifting of panels.

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

6.7.0 TOOLS AND PLANTS 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. Al/Fiberglass/ Stainless Steel
- 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 Yellow/White
- n. Lugs upto 2.5 sq. mm Solderless crimping type

6.9.0 MANPOWER REQUIREMENT

Manpower requirement per unit for Erection shall as follows: There shall be separate Erection In-charges, for Boiler and TG. They shall work independently with required manpower, T&P etc., including storage facilities. Each Erection In-charge shall have minimum 1 erection engineer with adequate supervisors and Technicians.

Similarly commissioning Engineers also shall be identified separately for each package and the minimum requirement shall be as indicated below.

	Boiler/ ESP	TG	TOTAL
Engineer (C&I)	1 No.	1 No.	2 Nos.
Engineer (Elec)	1 No.		1 No.
Supervisor (C&I)	3 Nos.	3 Nos.	6 Nos.
Supervisor (Elec)	2 Nos.		2 Nos.
Technician (C&I/ Elec)	6 Nos.	6 Nos.	12 Nos.

The commissioning group shall be identified at the Pre-commissioning and commissioning time. The commissioning group shall have the knowledge of various systems referred in the tender and also should have adequate experience.

In addition to the above, the contractor shall provide three data entry operators for documentation works such as preparation of calibration records, protocols, progress reports etc.

The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor. Besides the above, there will be separate engineers for Planning, Safety and Quality. For all practical purposes, each of the above In-charges shall be provided with a PC and good communication facilities.

If the contractor fails to deploy the above Engineer/Supervisor/ Technician at appropriate time of commissioning, BHEL Engineer will have the right to withhold the payment towards commissioning activities as defined in terms of payment.

6.10.0 DOCUMENTATION

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

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

6.10.2 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.

6.11.0 PROGRESS AND MONITORING OF WORK

6.11.1 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.

6.11.2 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.

6.12.0 ELECTRICAL INSPECTORATE'S APPROVAL: (if applicable)

6.12.1 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.

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

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

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

6.13.0 DETAILS TO BE FURNISHED BY THE TENDERERS

- 6.13.1 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.
- 6.13.2 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.
- 6.13.3 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
- 6.13.4 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

6.14.0 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

- 6.14.1 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.
- 6.14.2 The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.
- 6.14.3 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.

- 6.14.4 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.
- 6.14.5 While carrying out material reconciliation with contractor, all the above points will be taken into account. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity(ies) will be taken as the net quantity(ies) issued to the contractor. Material appropriation shall be done and allowable scrap quantity calculated as per wastage allowance specified 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.
- 6.14.6 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.
- 6.14.7 Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard pro forma prescribed for this purpose by the site in charge.
- 6.14.8 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 |
- 6.14.9 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
- 6.14.10 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.

6.15.0 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.(Ref :

6.15.1 Transformers :

- | | | |
|----|---|-----|
| a. | Receipt, transport to the placement of erection on Placement, assembly, alignment, grouting mounting and wiring loose parts on pro rata basis | 50% |
| b. | Filtration and BDV checking on pro rata basis | 20% |
| c. | Pre commissioning checks, tests, calibration and energisation and commissioning on pro rata basis | 20% |
| d. | On painting | 3% |

6.15.2 ESP Transformers

- | | | |
|----|--|-----|
| a. | Oil filtration and satisfactory BDV checking on pro rata basis | 50% |
| b. | Precommissioing checks, test and calibration on pro rata basis | 25% |
| c. | Energisation and commissioning on pro rata basis | 18% |

6.15.3 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 on pro rata basis | 10 % |
| c. | Commissioning and protocol signed | 5 % |
| d. | Completion of pending points | 3 % |

6.15.4 For VCB, AVR, 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 | 75% |
| b. | Pre-commissioning tests, checks, and making ready for energisation on pro rata basis | 10 % |
| c. | Commissioning and protocol signed | 5 % |
| d. | Completion of pending points/ submission of as built drawing | 3% |

6.15.5 For UPS/ Battery Sets/ Charger (if applicable)

- | | | |
|----|--|-----|
| 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% |

6.15.6 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 | 10% |
| c. | Loop checking and commissioning of connected systems | 5% |
| d. | On submission of as built drawing | 3% |

6.15.7 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% |

6.15.8 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% |

6.15.9 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 | 18 % |
| c. On system charging | 5 % |

6.15.10 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% |

6.15.11 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 erection.
- b. 23 % of the accepted rate on completion of the commissioning of the respective Items/Equipments etc on pro rata basis.

6.15.12 The last 5 % of the value shall be paid after a guarantee period of 12 months. The guarantee period starts from the date of handing over of the unit to Customer or 6 months from the date of first synchronisation of the unit which ever is earlier.

6.15.13 However this 5 % of the value can be released against submission of matching bank guarantee for this value , as per format , valid for the entire guarantee period.

6.16.0 TIME SCHEDULE

6.16.1 CONTRACT PERIOD

The total contract period for completion entire work shall be **12 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.

- 6.16.2 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 Unit commissioning schedule.
- 6.16.3 BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule. Contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.
- 6.16.4 The contractor shall reach site and establish his site office and mobilize to commence the work as per directions of BHEL engineer. The date of starting the work at site shall be fixed in consultation with BHEL's engineer and the same will be recorded in measurement book while entering the first RA bill.
- 6.16.5 Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the monthly progress and keep up the schedules.
- 6.16.6 Contractor shall draw the monthly erection programme along with BHEL engineer indicating the work to be achieved and events to be completed. Once the programme is drawn, he shall adhere to the same. Contractor shall plan and erect the materials as it is received at site. The monthly planned percentage shall take into consideration the material available at site before the start of the month and also any material received during the month. Contractor shall mobilize his resources required to achieve the monthly programmes.
- 6.16.7 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.
- 6.16.8 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.

6.17.0 GUARANTEE

All the works executed by the contractor including supplies are to be guaranteed for a period of 12 months from the date of taking over of the work. The contractor shall be responsible for the quality of workmanship and shall guarantee the work done, shall rectify/replace at 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.

6.18.0 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 12 (Twelve) 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 12 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 DELETED

.

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 –with base index applicable a the schedule date of Bid opening.
- 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.

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. Incase of "Non-compliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
- 4) The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act 1948, copies of Form 6-A(Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act1948 (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 reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.
- 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 there for 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

BHEL shall provide the following T&P at free of cost

EOT crane on sharing basis.---For shifting of panels

However, operator shall be arranged by the contractor at his cost.

ANNEXURE VI- B

RECOMMENDED LIST OF TOOLS AND TACKLES / INSTRUMENTS

A) FOR ELECT WORKS

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

a) Insulation tester:

i) Motorised megger - 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohms

ii) Hand operated megger - 0.5 KV/1.0 KV/2.5 KV, 200 - 100 M ohm

b) Earth resistance tester 0 to 1, 10, 100 ohms

c) Transformer oil test kit

d) Torque wrench

e) Voltmeter ac 0 - 125 - 250 - 625 V ac

f) Ammeter ac 0 - 2A - 10A ac.

g) Wattmeter - ac/dc - 0 - 125 - 250 V 0-5-10A.

h) Multimeter - analogue :acV 2.5V - 2500V, ac A - 100 mA - 10 A
dc V 25.V - 2500V, dc A - 50mA - 10A
Resistance - 0 - 200 M ohms
digital : voltages ac & dc - 100mv - 1000 V
current 10-mA - 10A Resistance - 0-20 M ohms

i) High vacuum stream line oil filter of 2000 KL (1No)

j) Variac - 1 /3 phase - 5A, 15A 3 phase - 10A, 20A.

k) Primary injection kit - 0-5000 A.

l) Secondary injection kit - 0-5A.

m) HV Test kit - 50 KV AC 400kVA.

n) Wheat stone bridge - 0.05 m ohm - 100 ohm.

o) Oscilloscope

p) Air compressor.

q) Oil Tank for transformer oil filtration

- r) Vacuum pump.
- s) Phase sequence meter - 110V - 450V - 25 to 65Hz.
- t) Frequency meter - 0 - 115 - 230 - 4500 - 45 - 601/s.
- u) Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A.
- v) Tachometer etc.
- x) mA Source
- y) Standard pressure gauges
- z) Temperature oil bath
- aa) Oil specific gravity and PPM measuring equipment
- bb) Micro ohm meters for measuring contact resistance
- cc) Event recorders with micro second accuracy

B) RECOMMENDED LIST OF TOOLS AND TACKLES / INSTRUMENTS FOR C&I WORKS

S. 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	02 No.
	0 to 5/6 Kg/Sq.cm	02 No.
	0 to 10 Kg/Sq.cm	02 No.
	0 to 16 Kg/Sq.cm	02 No.
	0 to 25 Kg/Sq.cm	02 No.
	0 to 60 Kg/Sq.cm	02 No.
	0 to 100 Kg/Sq.cm	02 No.
	0 to 250 Kg/Sq.cm	02 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	01 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	04 Nos.
09	Portable air compressor with drier and regulator rated for 10 Kg/Sq.cm	02 No.
10	Vacuum pump with standard vacuum gauge	02 No.
11	Standard Milliamps Source (Digital)	10 Nos.
12	Standard Millivolts Source (Digital)	05 Nos.
13	Mercury Manometer different range	04 Nos.

C) RECOMMENDED LIST OF TOOLS & PLANTS REQUIRED FOR ELECTRICAL/ C&I WORKS

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

ANNEXURE VI- C

ACCURACY REQUIREMENT OF TESTING INSTRUMENTS

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY
1	Power Pack	0 to 50V DC, 3A	$\pm 2\%$
2	Analog Multimeter	Voltage 2.5 to 2500V AC	$\pm 1.0\%$
		Current 100 mA to 10A AC	$\pm 2.0\%$
		Current 250 micro A to 1A DC	$\pm 1.5\%$
		Resistance upto 100 ohms	$\pm 3.0\%$
		Voltage 2.5V to 2500V DC	$\pm 1\%$
3	Digital Multimeter	Voltage 200mV to 1000 V DC	$\pm 1\%$ + 1 digit
		Philips Voltage 200mV to 1000 V AC	$\pm 1\%$ + 1 digit
		Hcl Current 200mA to 20 A AC	$\pm 0.8\%$ + 1 digit
		Philips Current 20 mA to 20 A AC	$\pm 0.8\%$ + 1 digit
		Resistance (Hcl) 2120 200* to 200M*	$\pm 0.5\%$ + 1 digit
		Resistance (Hcl) 2105 200* to 200M*	$\pm 0.25\%$ + 1 digit
		Hcl Voltage 200mA to 750 V	$\pm 0.8\%$ + 1 digit
		Philips Current 20 mA to 20 A DC	$\pm 0.5\%$ + 1 digit
		Hcl Current 200 mA to 010 A AC	$\pm 1\%$ + 1 digit
4	Vibration Measuring Equipments	Velocity upto 50 mm/sec.	$\pm 0.5\%$ mm/sec
		Displacement upto 300 microns	± 2 microns
5	Secondary Injection Kit	Upto 5A	$\pm 0.5\text{mA}$
6	Motor operated Megger	Upto 200 Ohms	$\pm 5\%$ at Centre scale
7	Tongue tester	0/300/600A AC	$\pm 5\%$
		0 to 300A DC	$\pm 5\%$
8	Tachometer (Hand held)	0 to 4000 rpm	$\pm 5\%$
9	Phase Sequence Meter		N/A
10	Three Phase Variac	15 A Capacity	N/A

SI. No	INSTRUMENT / TOOL	RANGE	ACCURACY
11	Feeler gauges	300 mm long and 100 mm long	± 2 microns
12	Dial gauges	Q	± 0.01 mm
13	Hand operated Megger 500 V / 1000V	Upto 200 M Ohms	$\pm 5\%$ at Centre Scale $\pm 10\%$ at end of Scale
14	Motorised Megger 2.5 KV	Upto 200 M Ohms	$\pm 5\%$ at Centre Scale $\pm 10\%$ at end of Scale
15	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	$\pm 5\%$ at Centre Scale range
16	AC tongue Tester	0 to 300A AC	$\pm 3\%$
17	DC Tongue Tester	0 to 300A DC	$\pm 5\%$
18	High Voltage test Kit	Upto 50 KV AC	$\pm 10\%$
		Upto 70 KV DC	$\pm 10\%$
19	Tacho Generator (Mech)	0 to 4000 rpm	$\pm 0.25\%$
20	DC Ammeter	0 to 300 A	$\pm 10\%$
21	DC Voltmeter	0 to 500 V	$\pm 10\%$

OTHER REQUIREMENTS OF CONTRACTOR'S INSTRUMENTS & T&P

- a. The contractor shall arrange all the above T&P, equipment and instruments as indicated except testing instruments which are proprietary in nature.
- b. Any other tools and plants instruments and equipment required in addition to the above other than propriety type T&P/Instruments for the successful completion of this job shall be arranged by the contractor at his cost.
- d. Necessary accessories for the above shall also be provided by the contractor.
- e. The above instruments/equipment shall be sent for testing and calibration wherever from time to time and maintained by contractor as required by BHEL.
- f. List of such agencies and periodicity of calibration required for different instruments shall be furnished by BHEL at site.
- 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.

APPENDIX - VI D

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

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

NOTE

01. Minimum Number of persons to be indicated monthwise.
02. Above deployment plan shall be discussed with BHEL Site Engineer and necessary changes shall have to be made by the contractor as per discussion. If required, any additional deployment during execution of the work shall 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.

APPENDIX - VI E

DEPLOYMENT PLAN FOR MAJOR TOOLS AND PLANTS / INSTRUMENTS

S.NO	CATEGORY	MONTHS	PRESENT LOCATION
		1 2 3 4 5 6 & SO ON	
01	Welding Generators		
02	Welding Transformer		
03	TIG Welding sets (air cooled)		
04	Insulation Tester a. Motorized Megger 1000 & 5000 V Grade b. Hand operated Megger 500 & 1000 V Grade		
05	Earth resistance Megger		
06	Transformer oil testing kit		
07	Torque wrench		
08	Volt Meter/Ammeter/ Avometer/other instrument		
09	Multimeter/Test lamps/ Field telephone sets/ different gauges		
10	High vac steam line filter of 6000/4500 LPHfor transformer dryout		

S.N O	CATEGORY	MONTHS	PRESENT
		1 2 3 4 5 6 & SO ON	LOCATION
11	3 phase/Single phase Variac 15 Amps		
12	Primary and Secondary Injection testing kits.		
13	HV test kit		
14	Resistance measurement unit		
15	Oscilloscope		
16	5 Amps DC Power Supply unit		
17	Crimping Tools with various sizes of dyes.		

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 shall be discussed with the site engineer and necessary changes shall have to be made by the contractor as per discussions. If required, an additional deployment during execution of work shall have to be made by the contractor for meeting various schedules/targets set by BHEL without any additional compensation.

BHEL PS:SR

Format No. CP: FEX

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

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:1333 are true and complete to the best of my knowledge. I have gone through the specifications, conditions, stipulations in detail and agree to comply with the requirements and intent specifications.

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

TENDERER'S NAME & ADDRESS

**AUTHORISED REPRESENTATIVE'S
SIGNATURE WITH NAME & ADDRESS**

SECTION VIII

APPENDIX - III

TENDER SPECIFICATION NO BHEL:PSSR:SCT:1333

**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 : 1333

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 (as per appendix enclosed) : YES/NO
9. Time required for mobilization of site organization and start of work : YES/NO
10. Whether list of tools and Plants available with the contractor and proposed to be deployed for this work enclosed : YES/NO
11. Whether all the Pages are read understood and signed. : YES/NO
12. Deviations, if any Pointed out : YES/NO
13. Whether PF exemption No. is allotted by RPFC of your area if so, indicate number : YES/NO

SIGNATURE OF THE TENDERER

SECTION VII
RAICHUR TPS UNIT 8 (1 X250 MW)
GENERAL TECHNICAL REQUIREMENT AND
GUIDELINES FOR ERECTION, TESTING & COMMISSIONING

7.1.0 INSTALLATION, TESTING & COMMISSIONING IN GENERAL:

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

Completion

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

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

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

7.2.0 SITE TESTS AND CHECKS

a) General

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

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

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

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

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

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

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

b) Trial Run Test

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

c) Acceptance Test

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

7.3.0 TRANSFORMERS (AS APPLICABLE FOR VFD/ ESP TRANSFORMERS)

7.3.1 TOP UP OIL FILLING

The following procedure is recommended.

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

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

7.3.2 EQUIPMENT FOR OIL-FILLING UNDER VACUUM

- (i) High-vacuum 2 storage oil filtration plant provided with thermostat-controlled oil heaters and vacuum-proof hoses with dependent vacuum pumping system for tank evacuation. Capacity:6000 lph
- (ii) Oil-storage tanks provided with silica-gel breathers and inlet/outlet valves for oil circulation. Recommended capacity 20KL
- (iii) Vacuum gauges provided in filtration plant.
- (iv) Equipment for measurement of electric strength (BDV) of oil - 100 kv set.
- (v) Equipment for moisture content of oil.
- vi) Equipment for measurement of Resistivity and Tan delta at 90 C.
- vii) Transparent vacuum-proof tubes for checking of oil-level during oil filling.
- ix) Valves, fitting, gaskets etc.
- (x) Dry nitrogen cylinders.

7.3.3 COMMISSIONING

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

COMMISSIONING CHECKS

SL NO	DESCRIPTION
1.	Breather Silica gel (Blue when dry)
2.	Oil in the Breather housing cup.

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

INSULATION RESISTANCE TEST

Sl.No	Description	Date	Time in Hrs	Megger	IR Value	Temp	Remarks
							(not less than 500 V)

Main Winding

- a) HV/E
- b) LV/E
- c) HV/LV

Note :-

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

Oil Characteristics.

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

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

Tests on CT

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

Potential Transformer Tests

1. IR test of primary winding by HV megger between windings
2. IR test of secondary winding by LV megger between winding and winding to earth
3. Checking of voltage ratio
4. Verification of terminal markings and polarity
5. Checking of oil level if applicable
6. Checking of continuity and IR values for cables from PT to M

7. Checking tightness of earthing connection.
8. Checking of insulator for cracks
9. Checking output on charging of the system with connected meter

7.4.0 GUIDELINES FOR ERECTION OF LT SWITCHGEAR PANELS, CONTROL PANELS AND DISTRIBUTION BOARDS

7.4.1 Erection

1. The base frames will be supplied normally along with the boards. These will have to be aligned, levelled and grouted in position as per approved drawings. Wherever the base channels are not available, the same will have to be fabricated and painted at site. Base frames shall be grouted on the openings which shall be made on the floor during the time of casting. All necessary concrete chipping and finishing works are to be completed.
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.
3. All the panels/board shall be placed on its foundation or supporting structures and shall be assembled as required. All panels should be installed with parallel, horizontal and vertical alignment by skilled craftsmen
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.

7.4.2 Checks during erection (as applicable)

1. Layout of foundation channels.
2. Floor level covered by the panel with respect to main floor level.
3. Location and serial no. of panels.
4. Positioning of panels.
5. Verticality of switchgear panels within the limit specified.
6. Freeness of Breaker Truck and modules in housing and its manual operation.
7. Earthing of panels and breaker truck to station earth.
8. Lugs for termination of LT cables.

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

7.4.3 LT 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) Measurement of resistance of the closing and tripping coil of breaker

- f) Checking the close trip operation at 70% and 100% of the rated auxiliary D.C. Voltage.
- g) Checking of interlocks provided and tripping of breaker through relays
- h) Space heater operation check
- i) Opening and closing time check
- j) Control and metering circuit checks.
- 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
- o) Test to prove inter changeability of similar parts (including breaker module)
- p) Testing of relays as per supplier's commissioning manual.
- q) Operation of all relays by secondary injection method.
- r) Testing of CT polarities and CT ratio by primary injection test.
- s) Measurement of kneepoint voltage and secondary resistance for CTs used for differential protection
- t) IR and voltage ratio test for PTs
- u) Functional test of all circuit components for each panel / feeder
- v) Test to prove closing/tripping operation at minimum and maximum specified voltage in test and service position
- w) Check for drawout test and service position of breakers for all feeders
- x) Check for covering of all openings in the panel - check for continuity and operation of aux. contacts of breaker.

7.5.0 GUIDELINE FOR INSTALLATION OF C & I EQUIPMENTS

- 7.5.1 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.
- 7.5.2 Maintenance platforms & approach facilities shall be provided for all sensing & primary devices wherever possible.
- 7.5.3 Instruments shall be located in weather proof enclosures and wherever required suitable canopy shall be provided.
- 7.5.4 High & Low pressure impulse lines shall not be grouped and run together. Also impulse lines for explosive & inert gases shall not run together.
- 7.5.5 Impulse lines of high pressure steam, harmful gases, etc. shall not be brought into the control room, as far as possible.
- 7.5.6 Intrinsically safe circuits shall be used for explosion hazardous areas.
- 7.5.7 Separate cable routing shall be followed for high and low voltage lines.
- 7.5.8 All electrical equipments shall meet the requirements of Indian Electricity Rules.
- 7.5.9 Wherever severe vibrations are expected, shock absorbers shall be provided.
- 7.5.10 Before and after regulating/control valves, straight pipe lengths of 10mm dia on either side must be ensured.
- 7.5.11 Installation of instruments with radio-active isotopes, mercury and other toxic substances shall be as per statutory regulations provided by authorities.
- 7.5.12 Compensating cables should be connected directly to instruments, i.e. no junction boxes shall be used.

- 7.5.13 Orifice plates or flow nozzles must be provided with atleast 10D upstream and 5D downstream straight length of pipe from bends tees, branch pipes & control valves.
- 7.5.14 Control valves shall be installed after orifice plates.
- 7.5.15 Pressure gauges shall be provided with snubbers, syphons (for more than 100°C), 3 way valve manifolds wherever applicable.
- 7.5.16 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.
- 7.5.17 Correct level (height) between detecting element and tapping point and transmitter shall be maintained.
- 7.5.18 The equipment shall maintain its normal posture (level, perpendicular, front and back).
- 7.5.19 Connection between detecting element/tapping point and transmitter shall be maintained at short distances wherever practicable to avoid any time lag.
- 7.5.20 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.
- 7.5.21 For details of installing each measuring instruments, instruction manual issued by the respective manufacture of instruments may be referred to, wherever necessary.
- 7.5.22 The drain pipes shall be terminated in a common closed header and finally the common header shall be connected to plant open drain.
- 7.5.23 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.

7.6.0 GUIDE LINE FOR ERECTION OF IMPULSE LINES

- 7.6.1 All impulse lines burrs and air lines shall be thoroughly cleaned and any foreign matter by cleaning with compressed air shall done before installation.

- 7.6.2 The routing of pipe lines shall include sufficient flexibility near tapplings to allow for thermal expansion of the process equipment. Typical routing of impulse pipes and installation of various instruments shall be as per drawings enclosed with this tender.
- 7.6.3 The pipes shall be cold bent using hydraulic bending machines only.
- 7.6.4 The horizontal impulse lines shall be laid with proper slopes towards the tapping point.
- 7.6.5 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' |
- 7.6.6 All impulse line welding shall be done through welding generator/rectifier and only structural welding could be done through welding transformer.
- 7.6.7 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.
- 7.6.8 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.
- 7.6.9 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.
- 7.6.10 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.

- 7.6.11 Alternatively hose assembly - S.S. flexible may be used for connection between tapping point and impulse pipe.
- 7.6.12 The expansion bends are to be avoided as far as possible, as these act as air/sedimentation traps hampering the system performance.
- 7.6.13 Impulse piping shall be arranged as short as possible with a minimum of bends.
- 7.6.14 Horizontal piping shall be avoided and 1/10 slope shall be maintained.
- 7.6.15 Pipes shall not be laid parallel to high temperature process piping.
- 7.6.16 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.

7.6.17 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 atleast of 300 mm before a change of direction is made.

- 7.6.18 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.
- 7.6.19 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 as shown in the figure.

7.6.20 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 minimum as possible. A suitable condensing chamber as shown in

the figure can be arranged which will eliminate the condensate or any blocking in the impulse pipe.

7.6.21 Impulse Piping for Steam and Water System

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

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

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

7.6.24 In case 2 way manifold used and connected with nipple and coupling, it is necessary to provide tee with plug for purging or venting, as shown in the figure. 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.

7.6.25 Some supplier recommends capillary type tube for transmitter connection from the impulse pipe to instrument by using S.S. tube and compression fittings.

7.6.26 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.

7.6.27 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.

7.6.28 Bending

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

7.6.29 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.

7.6.30 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.

7.6.31 Large bending shall be so made as to form smooth curve.

7.6.32 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.

7.6.33 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 as shown in the figure.

7.6.34 Testing

On completion of pipeline, installation, the pipe lines 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.

7.7.0 GUIDELINES FOR INSTALLATION OF PNEUMATIC LINE

- 7.7.1 Copper tubing shall be connected with Olive type of compression fittings,
- 7.7.2 When two or more lines run together, the joint in the adjacent alternate line shall be a offset.
- 7.7.3 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.
- 7.7.4 Multi-core copper tubing shall not to be bend less than 10 deg and D is the OD if the multi-core copper.
- 7.7.5 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.
- 7.7.6 The joints shall be screwed with teflon tapping wherever the pipes are frequently to be removed for cleaning and other purposes and suitable union fittings shall be used.
- 7.7.7 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.
- 7.7.8 Instrument airline should not be routed where severe vibration, high temperature exists and adequate space should be available for maintenance.
- 7.7.9 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.

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

7.7.11 The location 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.

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

7.7.13 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 ps1 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 ps1, and checked with soap solution for leak.

7.8.0 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).

7.8.1 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).

- 7.8.2 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.
- 7.8.3 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.
- 7.8.4 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.
- 7.8.5 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.
- 7.8.6 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.

7.9.0 GENERAL NOTES ON INSTALLATION OF LOCAL INSTRUMENT RACK AND JB FRAME

- 7.9.1 In cases where the local instrument stands are to be installed on a concrete foundation. It shall be fixed by anchor bolts.
- 7.9.2 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 as shown in the figure. However, in cases where there is a probability for removal of stand is likely to arise, it shall be fixed by bolts, as shown in the figure.
- 7.9.3 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.
- 7.9.4 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 grinded or floor grinded, as per safety norms.

- 7.9.5 Proper care should be taken to ensure that welding of the stand on any structure or Beam is fully welded.

7.10.0 GENERAL GUIDELINE ON FLOW INSTRUMENTS INSTALLATION

- 7.10.1 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.
- 7.10.2 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.
- 7.10.3 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.
- 7.10.4 Always 3/4" to 1" pipe is recommended for free flow condensate. Gate valve shall be used for the tapping and pipe should be insulated upto condensing pot.
- 7.10.5 The Measuring instrument shall be located close to the flow sensing element. The speed of response is reduced if there is a long run,
- 7.10.6 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.

- 7.10.7 Location of Flow element should have clear straight run of 10D in upstream and 5D in downstream.
- 7.10.8 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.
- 7.10.9 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 and facility shall be provided for checking the 'O' calibration.
- 7.10.10 If the flow of any dry gases are to be measured, the location of instrument can be kept above or below the tapping points.
- 7.10.11 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 as shown in the figure.
- 7.10.12 The condenser Pot should be located nearer to the tapping point and both condenser chamber should be at the level of upper tapping,
- 7.10.13 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.
- 7.10.14 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.
- 7.10.15 In an installation where the instruments must be located above the tapping points and the condensing chamber should be equally located above the

instruments as shown in the figure, the pipeline upto the condensing pot should be insulated.

- 7.10.16 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.
- 7.10.17 The commonly used sealing liquid includes water, light oil, glycerol, ethylene glycol and mixtures of the last two with water.
- 7.10.18 The sealing chambers, in each pressure pipe, should be installed at the same level and as close as possible to the pressure tapings.
- 7.10.19 The general arrangement for pressure tapings from the Sealing Chamber to the instrument is shown in the sketch.
- 7.10.20 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.

7.11.0 GENERAL GUIDELINE ON INSTALLATION OF VALVES

- 7.11.1 Primary isolating valves (root valves) must be located at the tapping which can be of globe valves.
- 7.11.2 These valves shall be installed where access is possible.
- 7.11.3 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.
- 7.11.4 For pressure more than exceeding 40 kg, 2 isolating valves shall be provided.
- 7.11.5 In the case of heavy duty isolating valves, suitable support shall be provided to avoid any loading on the stubs.
- 7.11.6 In viscous fluids, suitable steam tracing shall be provided.
- 7.11.7 These valves are always located as nearer to the measuring device as possible.

7.11.8 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 gun metal '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.

7.12.0 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).

7.13.0 GUIDELINES FOR CABLE LAYING AND TERMINATION

- 7.13.1 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.
- 7.13.2 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.
- 7.13.3 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.
- 7.13.4 GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.

- 7.13.5 In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy-duty PVC pipes shall be provided.
- 7.13.6 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.
- 7.13.7 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.
- 7.13.8 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.
- 7.13.9 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.
- 7.13.10 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.
- 7.13.11 Wherever direct heat radiation exists, heat isolating barriers (subject to customers approval), for cabling system shall be adopted.
- 7.13.12 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.
- 7.13.13 If required, a few number of cables in exceptional areas may be directly buried into the earth.
- 7.13.14 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.

- 7.13.15 At certain places where hazardous fumes/gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.
- 7.13.16 In corrosive atmosphere, PVC conduits shall be used for cables.
- 7.13.17 Single core cables, when pulled individually shall be taken through PVC pipes only.
- 7.13.18 Laying and installation of power, control and special cables shall generally conform to IS : 1255
- 7.13.19 The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
- 7.13.20 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.
- 7.13.21 Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.
- 7.13.22 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.
- 7.13.23 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.
- 7.13.24 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.

- 7.13.25 Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material.
- 7.13.26 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.
- 7.13.27 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.
- 7.13.28 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.
- 7.13.29 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).
- 7.13.30 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.
- 7.13.31 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.

7.13.32 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.

7.13.33 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.

7.13.34 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.

7.13.35 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.

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

7.13.37 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.

7.13.38 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.

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

7.13.40 Support Spacings & Clampings

Support spacing and clamping suitably provided and as required

7.13.41 Laying of cables directly buried in ground

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

7.13.42 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.

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

- 7.14.1 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.
- 7.14.2 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.
- 7.14.3 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.
- 7.14.4 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.

- 7.14.5 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.
- 7.14.6 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way or maintenance of adjacent equipment.
- 7.14.7 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.
- 7.14.8 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.
- 7.14.9 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.
- 7.14.10 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.
- 7.14.11 Bends of GI pipes/conduits shall be made without causing damage to the pipes/conduits.
- 7.14.12 Occupancy of conduits shall not be greater than 40%.
- 7.14.13 The adopter for coupling rigid GI pipe/conduits and flexible conduit shall be of aluminium or galvanised steel.
- 7.14.14 Transportation and storage of cable drums
- Transportation and storage of cable drums shall generally conform to the requirements of IS : 1255
- 7.14.15 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.

7.14.16 The cable drums shall be transported on wheels to the place of work.

7.15.0 GUIDELINES FOR CABLE TERMINATION AND JOINTING

7.15.1 Contractor shall carry out cable terminations at various electrical and electronic equipment terminals.

7.15.2 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.

7.15.3 Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the contractor. Looping of cores/wires at terminals shall be done as shown in interconnection diagrams.

7.15.4 All cable entries in the equipment shall be sealed after glanding the cables.

7.15.5 Adequate length of cables shall be pulled inside the switch boards, control panels, terminal boxes etc. as per near termination of each core/conductor.

7.15.6 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.

7.15.7 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.

7.15.8 Screened control cables of 0.5 sq. mm cross-sectional area shall be terminated by means of wire rapping system.

7.15.9 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.

- 7.15.10 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.
- 7.15.11 Termination and jointing of aluminium/copper conductor power cables shall be done by means of compression method using compression type aluminium/tinned copper lugs.
- 7.15.12 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.
- 7.15.13 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.
- 7.15.14 Junction boxes shall be used, wherever required, for jointing of control cables.
- 7.15.15 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.

7.16.0 TESTING OF CABLES:

- 7.16.1 The contractor shall submit to the Engineer a checklist for testing and commissioning and the activities shall be carried out in accordance with the checklist.
- 7.16.2 Testing and electrical measurement of cable installations shall conform to IS : 1255
- 7.16.3 Prior to installation, cables shall be tested for :
- a) Continuity of conductors
 - b) Insulation resistance between conductors & earth

c) Insulation resistance between conductors.

7.16.4 After installation cables shall be tested for :

a) Insulation resistance between conductors & iron

b) Insulation resistance between conductors & earth

c) Conductor resistance

e) Capacitance between conductors & earth (for cables above 7C.1.3KV grade)

f) DC high voltage test (for LT power cables of higher sizes interconnecting PCCs & MCC)

g) Absence of cross phasing

h) Firmness of terminations.

7.17.0 EARTHING INSTALLATION

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

7.17.2 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.

7.17.3 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.

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

- 7.17.5 Earthing connections shall be free from tinning scale, paint, enamel, grease, rust or dirt at the time of making joint.
- 7.17.6 Metallic sheaths, screens/shields and armour of all multicore cables shall be bonded and earthed.
- 7.17.7 Earthing conductors along with their run on columns, beams, walls etc., shall be supported by suitable cleats at intervals of 750 mm.
- 7.17.8 Conduits shall be bonded together and grounded at all switchgear and control centres.
- 7.17.9 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.
- 7.17.10 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.
- 7.17.11 It is not the intent to specify completely herein all details of design and construction of equipment. The equipment shall conform in all respects to high standard of quality design and workmanship and be capable of performing in continuous commercial operation, upto the guarantee period in a manner acceptable to BHEL who will interpret the meaning of drawings and specifications and shall have the power to reject any of the materials work which in his judgement, are not in full accordance therewith.

7.18.0 DESIGN REQUIREMENTS ITEMS OF SUPPLY FOR CABLING INSTALLATION WORK (IF COVERED IN CONTRACTOR SCOPE).

- 7.18.1 The supply of below listed items shall be considered to be part of cabling installation and Termination work for which no separate rate shall be given. The contractor has to supply the following listed items at no extra cost.

7.18.2 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 upto 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.

7.18.3 Self Locking Clamps (if required)

- 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.

7.18.4 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.

7.18.5 Tags

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

7.18.6 PVC Tapes, Special Tapes and supporting arrangements.

7.19.0 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 at least 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.

7.20.0 GUIDELINES FOR LANDING AND STORAGE OF ELECTRONIC CUBICLES/SUB-ASSEMBLISES/LOOSE ITEMS.

- 7.20.1 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 dropped or slid along the floor under any circumstances. Suitable fork lift 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.
- 7.20.2 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.
- 7.20.3 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, sulphurdioxide etc.
- 7.20.4 After opening the case, all supports provided for transport are to be removed with due care.
- 7.20.5 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.

7.21.0 TESTS FOR THE EQUIPMENT ERECTED BY MECHANICAL CONTRACTOR

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

a) Generator :

Generator set with all auxiliaries and controls shall be assembled and tested to verify compliance with the guaranteed technical particulars and for satisfactory performance. Relevant standards shall be followed as guideline for testing. All the tests shall be witnessed by customer or its representative. The commissioning tests shall be carried out at site under normal service conditions.

Following tests shall be carried out on the generators :

1. Insulation resistance test and determination of polarization index value of:
 - **Generator**
 - **Exciter**
 - **Resistance temperature detectors**
2. Dielectric test
3. No load characteristics
4. Short circuit characteristics
5. Temperature rise at rated voltage, current, power factor and frequency.
6. Over-speed test
7. Calculation of efficiency
8. Phase sequence/voltage balance/current balance checks.

Note :

1. Vibration tests in the factory to be taken at 100% of synchronous speed and at 120% during overspeed test.
2. Vibration test at site to be taken at 100% of synchronous speed of the complete generator with its driver.

9. Instantaneous short circuit test (Optional).
10. Noise measurement test.
11. Response of voltage and frequency with sudden shedding of 25%, 50%, 75% and 100% of rated load respectively.
12. Temperature detector test
13. Measurement of DC resistance of winding
14. Inter turn insulation test of stator winding with induced voltage 130% of rated value for 5 minutes (if applicable).
15. Measurement of shaft voltage.
16. Tan Delta test for generator bushing. (if required).

b) AC Motors

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

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

c) DC Motors

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

7.22.0 CODES AND STANDARDS

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

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

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

IS 3043 Code of practice for earthing

IS 3072 Installation and maintenance of switchgear

IS 5133 Box for enclosure of electrical equipment

IS 5216 Guide for safety procedure and practice in electrical work

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

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

IS 800 Code of practice for use of structural steel

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

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

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

NOTE :

The test specified above for all the electrical equipment are not exhaustive. Any other pre-commissioning and field tests not included in the above list but necessary as per relevant standards, Electricity rules, code of practice and instructed by the manufacturer of the equipment shall also have to be carried if deemed necessary shall be carried out as per requirement either at free of cost or at additional cost. Decision of Engineer in charge will be the final regarding additional cost for testing. The contractor shall take the full responsibility of testing, commissioning, trial run and successful operation of the equipment under overall guidance of BHEL engineer

DATA SHEET

SPECIFIC TECHNICAL REQUIREMENTS

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.

**RAICHUR TPS UNIT 8 (1 X250 MW)
 DETAILED BILL OF MATERIALS FOR
 ERECTION, TESTING AND COMMISSIONING OF
 ELECTRICAL / C&I PACKAGE**

SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.1.0	FUEL OIL SYSTEM	
A.1.1	PD Type Flow meter (including erection of 1 No. Pulse Amplifier, 15 Mtrs of shielded signal cable, condensing pots etc.)	2 sets*
A.1.2	DP Gauges	3 Nos.
A.1.3	DP Switches	6 Nos.
A.1.4	Pressure Gauges	54 Nos.
A.1.5	Pressure Switches	32 Nos.
A.1.6	Temperature Gauges	10 Nos.
A.1.7	Temperature Switches	6 Nos.
A.1.8	Flame Scanner Head Assembly with fibre optic cable of length 110", Lens Barrel Assembly, Miniature 6 way Junction Box etc.	20 sets*
A.1.9	Microprocessor based flame scanner amplifier 5 Nos. of 19" Racks of size 482 x 263 x 134 (W x D x H) to be mounted in Flame Scanner Panel supplied by EDN.	1 set*
A.1.10	FSSS Local Oil Gun Maintenance Switch Box	12 Nos.
A.1.11	H.E.A. Excitor box and advance/retractor assembly along with flexible spark rod, spark tip, flexible cable assembly, S.S. Hose (1 Mtr long, 6.35 mm ID), Air Filter Regulator etc.	12 sets*
A.1.12	Limit Switches	10 Nos.
A.1.13	Speed Regulator/ Air Lock Valves/ Air sets	16 sets*
A.1.13	OD 8 mm Copper Tube	100 Mtrs
A.1.16.0	COMMISSIONING OF THE FOLLOWING	
A.1.16.1	Limit Switches (checking only).	20 Nos. \$

* Lump sum rate to be quoted

\$ Erection is not in the scope of this contract. Rate to be quoted for checking / commissioning only.

SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.1.16.2	Pneumatic Valves: On/Off Type	13 Nos. \$
A.1.16.3	Pneumatic Valves: Regulating Type	11 Nos. \$
A.2.0	AIR & FLUE GAS SYSTEM	
A.2.1	Pressure Gauges	9 Nos.
A.2.2	Pressure Switches	6 Nos.
A.2.3	DP Gauges	7 Nos.
A.2.4	DP Switches	4 Nos.
A.2.5	Air Filter Regulators- SADC	8 Nos.
A.2.6	¼" OD PVC Sheathed Copper Tube	2,150 Mtrs
A.2.7	¼" size Teflon Hose of 2M	56 Nos.
A.2.8	1" size Teflon Hose of 3M	4 Nos.
A.2.9	Burner Tilt Shear Pin Failure Indication Box (Dimension: 340 x 200 x 300 mm; weight 12 kg each)	4 Nos.
A.2.10	Heavy Duty Limit Switch (for Burner Tilt Shear Pin Failure Indication Purpose)	12 Nos.
A.2.11.0	PNEUMATIC POWER CYLINDERS (REGULATING TYPE)	
A.2.11.1	FD Fan Vane Control Actuator (Weight 50 kg each)	2 Nos.
A.2.11.2	Cold Air Damper Control Actuator (Weight 90 kg each)	6 Nos.
A.2.11.3	Hot Air Damper Control Actuator (Weight 170 kg each)	6 Nos.
A.2.11.4	PA Fan Vane Regulating Actuator (Weight 50 kg each)	2 Nos.
A.2.11.5	ID Fan Inlet Damper Control Actuator (Weight: 1000 kg each)	2 Nos.
A.2.11.6	Power Cylinders for SADC (Approx. weight 10 kg each)	56 Nos.
A.2.11.7	Burner Tilt Power Cylinders (Approx. Weight 150 kg each)	4 Nos.
A.2.11.8	Dynavane Filter Bleed Air Damper (Approx. weight : 70 kg)	1 No.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.2.12.0	PNEUMATIC POWER CYLINDERS (ON/OFF TYPE)	
A.2.12.1	Scanner Air Emergency Damper (Wt 20 kg)	1 No.
A.2.13.0	COMMISSIONING OF THE FOLLOWING	
A.2.13.1	Furnace Temperature Probe (Cr-Al Thermocouples) <i>Pneumatic Actuators (On/Off Type)</i>	2 Nos. [§]
A.2.13.2	Hot Air Shutoff Gate	6 Nos. [§]
A.3.13.3	Seal Air to Mill Damper	6 Nos. [§]
A.2.13.4	Seal Air to Mill Discharge Valve	6 Nos. [§]
A.2.13.5	Feeder Outlet Gate	6 Nos. [§]
A.3.0	PULVERISER SYSTEM	
A.3.1	DP Gauges	6 Nos.
A.3.2	DP Switches	25 Nos.
A.3.3	Pressure Gauges	8 Nos.
A.3.4	Pressure Switches	4 Nos.
A.3.5	Temperature Gauges	6 Nos.
A.3.6	Temperature Switches	12 Nos.
A.3.7	Pneumatic Pressure Controller including 1 No. Pneumatic Transmitter, 2 Nos. Air Filter Regulators etc.	1 set*
A.3.8	Air Filter Regulators (for Mill)	6 Nos.
A.3.9	Purge Meters cum DP Regulators	12 Nos.
A.3.10	Gravimetric Feeder Panel Gravimetric Feeder Remote Power Cabinet, including keyboard and display Size: 1200 x 600 x 2315 mm; weight: 650 kg each	6 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.3.11.0	COMMISSIONING OF THE FOLLOWING	
A.3.11.1	Calibration/ Commissioning of Gravimetric Feeder comprising of Feeder Mounted C&I Equipment like motion monitor sensor, micro switches, etc. along with Feeder Integral Cabinet, 2 Nos. LT Motors etc.	6 Nos. §
A.3.11.2	Limit Switches (Only checking)	12 Nos. §
A.4.0	STEAM & WATER SYSTEM	
A.4.1	Pressure Switch	1 No.
A.4.2	Pressure Gauges	19 Nos.
A.4.3	Temperature Gauges	10 Nos.
A.4.4	ERV Controller with Pressure Switch	4 Nos.
A.4.5	Thermocouple Assembly consisting of 2 Nos. Cr-Al thermocouples along with transmitter, integral terminal box for Smart Soot Blowing System	32 sets*
A.4.6	Electronic Water Level Indicator EWLI comprising of the following: <ul style="list-style-type: none"> – 12 Port pressure vessel with loose supplied electrodes – 1 No. of Ascetor Cabinet of size 600 x 350 x 600 mm; 40 kg – 2 Nos. of Remote Display Units (at UCB and Operating Floor) of size 100 x 80 x 200 mm – 1 No. Local Indication Box – Approx. 30 Mtrs of 10 P x 6 sq.mm PTFE probe cable (interconnecting Ascetor box and electrodes) 	2 sets*
A.4.7.0	<i>Chromel-Alumel Thermocouples</i>	
A.4.7.1	MTM T/Cs of OD 6 mm and route length 12 Mtrs	16 Nos.
A.4.7.2	MTM T/Cs of OD 6 mm and route length 14 Mtrs	22 Nos.
A.4.7.3	MTM T/Cs of OD 6 mm and route length 16 Mtrs	26 Nos.
A.4.7.4	MTM T/Cs of OD 6 mm and route length 18 Mtrs	39 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.4.7.5	MTM T/Cs of OD 6 mm and route length 20 Mtrs	15 Nos.
A.4.7.6	MTM T/Cs of OD 6 mm and route length 22 Mtrs	4 Nos.
A.4.8.0	<i>Junction Boxes/ RJCBs/ PDBs</i>	
A.4.8.1	12 Channel RJCBs	7 Nos.
A.4.8.2	18 Channel RJCBs	7 Nos.
A.4.8.3	24 Channel RJCBs	7 Nos.
A.4.8.4	Wall Mounted Power Distribution Board for 240V AC UPS	3 Nos.
A.4.9.0	Commissioning of the following	
A.4.9.1	Direct Water Level Gauges (Fixing of bulbs, holders, wiring and commissioning)	2 Nos. §
A.5.0	CONTROL PANELS/ STARTER BOXES	
A.5.1	110 V AC Control Supply Panel Dimension: 2200 x 800 x 2365 mm, despatched in suitable shipping sections Approx. Weight: 3000 kg	1 No.
A.5.2	220V DC Control Supply Panel Dimension: 1000 x 800 x 2365 mm, despatched in suitable shipping sections Approx. Weight: 2000 kg	1 No.
A.5.3	230 V AC UPS Distribution Panel Dimension: 1200 x 600 x 2365 mm; Approx. Weight: 2000 kg	1 No.
A.5.4	Scanner Air Fan DC Motor Starter Box 900 X 375 X 1120 mm; 75 kg	1 No.
A.5.5	Local Starter Box for Furnace Temperature Probe Dimension: 600 x 300 x 1000 mm; Weight: 50 kg	2 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.6.0	HARDWARE LIST	
A.6.1.0	CABLES (PVC, FRLS, Armoured)	
A.6.1.1	Flame Scanner Cable	3,500 Mtrs
A.6.1.2	2P X 0.5 sq.mm cable	4,400 Mtrs
A.6.1.3	2P X 1.5 sq.mm cable	5,000 Mtrs
A.6.1.4	4P X 0.5 sq.mm cable	14,500 Mtrs
A.6.1.5	8P X 0.5 sq. mm cable	12,600 Mtrs
A.6.1.6	16P X 0.5 sq. mm shielded cable	500 Mtrs
A.6.1.7	2 Pair, compensating cable	500 Mtrs
A.6.1.8	2C X 1.5 sq. mm control cable	700 Mtrs
A.6.1.9	2C X 2.5 sq. mm control cable	3,800 Mtrs
A.6.1.10	4C X 1.5 sq. mm control cable	6,400 Mtrs
A.6.1.11	5C X 1.5 sq. mm control cable	6,400 Mtrs
A.6.1.12	7C X 1.5 sq. mm control cable	6,400 Mtrs
A.6.1.13	10C X 1.5 sq. mm control cable	12,100 Mtrs
A.6.1.14	19C X 1.5 sq. mm control cable	2,100 Mtrs
A.6.2.0	CABLE TRAYS	
A.6.2.1	Perforated Cable Tray, 100 mm wide	1700 Mtrs
A.6.2.2	Perforated Cable Tray, 150 mm wide	1300 Mtrs
A.6.3.0	JUNCTION BOXES	
A.6.3.1	Junction Box (12 way)	29 Nos.
A.6.3.2	Junction Box (24 way)	83 Nos.
A.6.3.3	Junction Box (36 way)	9 Nos.
A.6.3.4	Junction Box (48 way)	6 Nos.
A.6.3.5	2 PB/ 3PB Push Button Boxes	18 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
A.	BHEL-TRICHY SCOPE	
A.6.4.0	<i>IMPULSE PIPES</i>	
A.6.4.1	CS Pipe, ½” SCH 80	500 Mtrs
A.6.4.2	CS Pipe, 1” SCH 80	1500 Mtrs
A.6.5.0	<i>STRUCTURAL STEEL</i>	
A.6.5.1	Structural Steel for fabrication of supports consisting of angles, channels (ISA 50x50x6, ISMC 100x50x6,ISA 35x35x3, ISA 40x40x5, ISMC 100x50)	10 Tonnes
A.7.0	<i>COMMISSIONING OF MOTORS/ ACTUATORS</i>	
A.7.1	Soot Blowers, including commissioning of 2 Nos. motors, setting of limit switches etc.	76 sets* \$
A.7.2	LT Motors (Unidirectional)	16 Nos. \$
A.7.3	HT Motors	12 Nos. \$
A.7.4	Electric Actuators for Valves/ Dampers	75 Nos. \$

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
B.	BHEL-RANIPET SCOPE	
B.1.0	ESP	
B.1.1.0	ESP CONTROL PANELS/ ASH LEVEL INDICATOR	
B.1.1.1	Electronic Controller along with BAPCON Size: 700 x 650 x 2,000 mm Approximate Weight : 300 kg	28 sets*
B.1.1.2	Rapper Control Panel along with 2 Nos. RAPCONs. Size: 1000 x 650 x 2,000 mm Approximate Weight : 300 kg	2 sets*
B.1.1.3	Ash level indicator, along with accessories like 15 m each of flexible conduit, cable, wire, electronic unit and probe assembly Size: 900 x 100 x 100 mm; Weight: 10 kg each	56 sets*
B.1.2.0	HEATING ELEMENTS	
B.1.2.1	Testing and Termination and dressing of Heating Elements for Hopper	672 sets*
B.1.2.2	Testing Heating elements for support insulator heater	112 sets*
B.1.2.3	Testing Heating elements for shaft insulator heater	28 Nos.
B.1.2.4	Testing Thermostats for hopper heaters.	14 sets*
B.1.2.5	Testing Thermostat for support insulators	4 Nos.
B.1.3.0	JUNCTION BOXES/ LOCAL START STOP PUSH BUTTONS	
B.1.3.1	Local Start Stop Push Buttons Size: 180 x 100 x 250 mm;	60 Nos.
B.1.3.2	Junction Boxes for hopper heaters Approximate Size: 400 x 150 x 315 mm; 12 kg per JB	22 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
B.	BHEL-RANIPET SCOPE	
B.1.3.3	Junction Boxes for support insulator heaters, shaft insulator heaters Approximate Size: 400 x 150 x 315 mm; 12 kg per JB	40 Nos.
B.1.4.0	STRUCTURAL STEEL FOR SUPPORT	
B.1.4.1	Structural Steel for fabrication of supports (ISMC 75 x 40, ISA 50 x 50 x 6 etc.)	3.0 Tonnes
B.1.5.0	COMMISSIONING OF THE FOLLOWING	
B.1.5.1	LT Drives of ESP/Ranipet	60 Nos. ^{\$}
B.1.5.2	Hoists	2 Nos. ^{\$}
B.1.5.3	H.V. Rectifier transformers(70 kV/1400 mA) with disconnecting switch including oil filtration, calibration of instruments, testing etc.	28 Nos. ^{\$}
B.2.0	AIR PRE-HEATERS	
B.2.1	Pressure Gauges	12 Nos.
B.2.2	Temperature Gauges (with thermowell)	2 Nos.
B.2.3	Temperature Elements (Pt 100 RTD- Duplex)	4 Nos.
B.2.5	Pressure Switches	4 Nos.
B.2.6	Thermocouple Assembly consisting of 6 nos. Cr-Al thermocouples	4 sets*
B.2.7	Rotor Stoppage Alarm Box- including sensors, interconnecting cables etc. Approx. Size: 340 x 170 x 300 mm; 12 kg each	2 sets*
B.2.8	ON/OFF Switch including light assembly and interconnecting cable	2 sets*
B.2.9.0	COMMISSIONING OF THE FOLLOWING	
B.2.9.1	Solenoid Valves	2 Nos. ^{\$}

* Lump sum rate to be quoted

\$ Erection is not in the scope of this contract. Rate to be quoted for checking / commissioning only.

SL. NO.	DESCRIPTION	QTY
B.	BHEL-RANIPET SCOPE	
B.2.9.2	<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* ^{\$}
B.3.0	INSTRUMENTS FOR FANS	
B.3.1	Fan Bearing RTDs	16 Nos.
B.3.2	Fan Bearing Temperature Indicators	16 Nos.
B.3.3	Fan Motor Bearing Temperature Indicators. (Removal, calibration and refixing only)	12 Nos.
B.3.4	Fan Motor Bearing/ Winding RTDs (checking of healthiness only)	84 Nos. ^{\$}

* Lump sum rate to be quoted

\$ Erection is not in the scope of this contract. Rate to be quoted for checking / commissioning only.

SL. NO.	DESCRIPTION	QTY
B.	BHEL-RANIPET SCOPE	
B.3.5	<p>Lub Oil Skids For FD/ID/PA 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 together is given below:</p> <p>LT Motors - 12 Nos. Temperature Gauges – 20 Nos. Pressure Gauges – 20 Nos. DP Switches with Indicator – 6 Nos. Pressure Switches - 26 Nos. Flow Switch cum Indicators – 4 Nos. Level Switches - 2 Nos. DP Gauges - 2 Nos.</p>	6 sets*

* Lump sum rate to be quoted

§ Erection is not in the scope of this contract. Rate to be quoted for checking / commissioning only.

SL. NO.	DESCRIPTION	QTY
C.	BHEL- PIPING CENTRE SCOPE	
C.1.0	S. G. PACKAGE	
C.1.1	Pressure Gauges	67 Nos.
C.1.2	Temperature Gauges	57 Nos.
C.1.3	Pressure Switches	2 Nos.
C.1.4	Level Switches (float type)	2 Nos.
C.1.5	Level Transmitter	2 Nos.
C.2.0	IMPULSE PIPES	
C.2.1	½” CS SCH 80 pipe	50 Mtrs
C.3.0	INSTRUMENT AIR PIPING FOR SG & TG	
C.3.1	GI Pipes NB 15 x 3.2	1200 Mtrs
C.3.2	GI Pipes NB 25 x 4.0	300 Mtrs
C.3.3	GI Pipes NB 50 x 4.5	100 Mtrs
C.3.4	GI Pipes NB 80 x 4.8	225 Mtrs
C.4.0	CONTROL PANELS	
C.4.1	Supervisory Local Control Panel for Dosing System Size: 800 x 700 x 1500 mm; 400 kg	1 No.
C.5.0	COMMISSIONING OF THE FOLLOWING:	
C.5.1	LT Motors (Unidirectional)	4 Nos. \$
C.5.2	Electrical actuators for Valves	4 Nos. \$
C.5.3	Flow Indicators	47 Nos. \$
C.5.4	Control Valves	1 No. \$

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
C.	BHEL- PIPING CENTRE SCOPE	
C.5.5	HP Dosing Skid Pressure Gauges: 4 Nos. Level Switches: 4 Nos. Pressure Switches: 2 Nos.	1 set* ^{\$}

* Lump sum rate to be quoted

\$ Erection is not in the scope of this contract. Rate to be quoted for checking / commissioning only.

SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
D.1.0	VFD FOR ID FANS	
D.1.1	VFD transformers 1700 KVA, 6.6/ 2.3 KV, 3f, ONAN, Dd0/Dyn11, transformer with HV, LV cable boxes, radiators etc. Approximate dimensions Overall dimensions : 3050 x 3100x 2850 mm Weight of Transformer Components: Core Coil Assembly 2100 Kg Oil weight 1250 Kg Oil quantity 1410 Ltrs Total weight 6825 Kg Shipping weight 5800 Kg Untanking height 3625 mm <i>* Lump sum rate to be quoted including Final painting.</i>	4 sets*
D.1.2	DC Air core Reactor Floor/channel mounting type 3.6 KV grade, 18.0 mH, 625 A rated air core DC reactor housed in 3mm thick Aluminium cubicle with suitable input/output terminals Dimension: 2350 x 2250 x 1975 mm , Weight: 1400 kg	4 sets*
D.1.3	LCI Drive Panel: Comprising Control and Excitation Panel, Fan and Filter Panel with air duct for exhausting air, Bridge Panels-1&2 etc Size: 3700 x 1450 x 2420 mm; Weight: 3000 kg, dispatched in suitable shipping sections	4 sets*
D.1.4	Adaptor Cubicle Size: 580 x 1450 x 2330 mm; weight: 200 kg	4 Nos.
D.1.5	Control Panel for VFD Drives Size: 800 x 1450 x 2330 mm; weight: 400 kg	2 Nos.

* Lump sum rate to be quoted

\$ Erection is not in the scope of this contract. Rate to be quoted for checking / commissioning only.

SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
D.1.6	6.6 kV, Indoor, Vacuum Circuit Breaker Size: 820 x 1640 x 2300 mm;	4 Nos.
D.1.7	Junction Box (12 way)	2 Nos.
D.1.8.0	LT CONTROL CABLES. 1.1 KV, PVC insulated, PVC inner sheath, unarmoured with overall FRLS, PVC outer sheath Cu conductor cables	
D.1.8.1	2 C X2.5 sq mm	1150 Mtrs
D.1.8.2	4 C X 1.5 sq mm	150 Mtrs
D.1.8.3	14 C X 1.5 sq mm	200 Mtrs
D.1.8.4	2 C X1.5 sq mm	3300 Mtrs
D.1.9.0	SCREENED CABLES PVC/FRLS, Armoured, Type 'F' (individually and overall shielded) CU cables	
D.1.9.1	2P x 0.5 sqmm cable	800 Mtrs
D.1.9.2	4P x 0.5 sqmm cable	3300 Mtrs
D.1.9.3	12P x 0.5 sqmm cable	1100 Mtrs
D.1.9.4	14P x 0.5 sqmm cable	800 Mtrs
	Type 'G' (Overall shielded) Cables	
D.1.9.5	2P x 0.5 sqmm cable	1680 Mtrs
D.1.9.6	4P x 0.5 sqmm cable	2380 Mtrs
D.1.9.7	8P x 0.5 sqmm cable	2440 Mtrs
D.2.0	S. G. PACKAGE	
D.2.1.0	PANELS	
D.2.1.1	Single Cubicle (CJF07, CJF34) Of size 750 x 750 x 2415 mm; Approximate weight- 400 kg	2 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
D.2.1.2	Twin Cubicles (CAF 16&17, CJF20&21) of size 1500 x 750 x 2415 mm; Approximate weight- 800 kg	2 Nos.
D.2.1.3	Suite of Three Cubicles (CJF23, CJF24 &CAF20, CJF25, CJF26 & CAF21, CJF27, CJF28 & CAF22) of size 2250 x 750 x 2415 mm; Approximate weight-1200 kg	3 Nos.
D.2.1.4	Suite of Four Cubicles (CJF 51,52,66&67) of size 3000 x 750 x 2415 mm; Approximate weight-1600 kg	1 No.
D.2.1.5	AC Distribution Board, dispatched in suitable shipping sections Dimension: 6000 x 450 x 2345 mm; Weight 3000 kg	1 No.
D.2.2.0	CONSOLES INSERTS (to be mounted on Control Desk)	
D.2.2.1	Console Insert for FSSS (Unit, Oil, Mill) Size: 660 x 420 x 350 (D) mm; Weight: 15 kg	1 set*
D.2.2.2	Console Insert for HP Bypass Size: 372 x 324 x 350 (D) mm; Weight: 10 kg	1 set*
D.2.2.3	Prefab cables, 32 Pair x 0.5 sq. mm for Console Inserts	800 Mtrs
D.2.3.0	LOOSE SUPPLIED ITEMS FOR SG PACKAGE FOR SADC	
D.2.3.1	Pressure Switch	14 Nos.
D.2.3.2	DP Switch	1 No.
D.2.3.3	DP Transmitter	2 Nos.
D.2.3.4	Air Filter Regulator	14 Nos.
D.2.3.5	I/P Converter	14 Nos.
D.2.3.6	CS Impulse Tube of dia. 14 mm and thickness 2.9 mm	500 Mtrs

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SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
	FOR APRDS	
D.2.3.7	Pressure Transmitters	6 Nos.
D.2.3.8	Air Filter Regulator	6 Nos.
D.2.3.9	I/P Converter	6 Nos.
D.2.3.10	K Type Thermocouple/Thermowell Assembly	4 Nos.
D.2.3.11	Thermocouple Extension Cable, 1 Pair x 16 AWG	600 Mtrs
D.2.3.12	¼" OD, PVC sheathed Cu Tube	300 Mtrs
D.2.3.13	Junction Box, 12 way	2 Nos.
	FOR HP BYPASS	
D.2.3.14	Pressure Transmitter	6 Nos.
D.2.3.15	Junction Box, 18 way	10 Nos.
D.2.3.16	Junction Box, 36 way	3 Nos.
D.2.3.17	AS Impulse Tube of dia. 14 mm and thickness 2.9 mm	200 Mtrs
D.2.3.18	1 Pair x 16 AWG, Thermocouple Extension Cable	1200 Mtrs
D.2.3.19	4 Pair x 0.5 sq. mm, PVC/ FRLS cable	600 Mtrs
D.2.3.20	K Type Thermocouple/Thermowell Assembly	6 Nos.
D.3.0	AVR	
D.3.1.0	PANELS/ CONSOLE INSERTS	
D.3.1.1	Digital AVR comprising of Regulation Cubicle, Thyristor cubicle, Field Suppression Cubicle along with loose supplied items. Overall dimension: 3050 x 750 x 2295 mm Total Weight: 1000 kg	1 Set*
D.3.1.2	Console Insert for DAVR Size: 180 x 250 x 325 mm; 35 kg	1 No.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
D.3.2.0	CABLES	
D.3.2.1	3 C x 50 sq. mm, FRLS, PVC screened Copper cable	300 Mtrs
D.3.2.2	3 C x 2.5 sq. mm, FRLS, PVC screened copper cable	300 Mtrs
D.3.2.3	24 C x 0.5 sq. mm, Cu cable (for DAVR console)	300 Mtrs
D.4.0	TG C&I PACKAGE	
D.4.1.0	PANELS / INSTRUMENTS	
D.4.1.1	Single Cubicle of size 750 x 750 x 2415 mm; Approximate weight- 200 kg (Panel No. CCA12)	1 No.
D.4.1.2	Single Cubicle of size 750 x 750 x 2415 mm; Approximate weight- 400 kg (Panel No. CJJ01, CJJ02, CJJ08, CJJ41)	4 Nos.
D.4.1.3	Twin Cubicles of size 1500 x 750 x 2415 mm; Approximate weight- 800 kg (CJJ03 & 04, CJJ11 & 12, CCA01 & 02, CCA03 & 04, CCA05 & 06, CCA10 & 11)	6 Nos.
D.4.1.4	Suit of Three Cubicles of size 2250 x 750 x 2415 mm; Approximate weight- 1200 kg (Panel No. CJJ05, 06 & 07)	1 No.
D.4.1.5	Fire Protection Switch with Junction Box	2 Nos.
D.4.2.0	CONSOLE INSERTS (to be mounted on Control Desk)	
D.4.2.1	Console Inserts for Turbine Controls (CWA01) Approx. Size: 708 x 516 x 350 mm; 20 kg	1 No.
D.4.2.2	Console Insert for Turbine Controls (CWA02) Approx. Size: 546 x 516 x 350 mm; 17 kg	1 No.
D.4.2.3	Console Insert for Generator Controls (CWA11) Approx. Size: 372 x 276 x 350 mm; 10 kg	1 No.
D.4.2.4	Prefab cables, 32 Pair x 0.5 sq. mm for Console Inserts	500 Mtrs

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
D.4.3.0	CABLES	
D.4.3.1	2 pair x 0.5 sq. mm PTFE cable	4000 Mtrs
D.4.3.2	4 pair x 0.5 sq. mm PTFE cable	1000 Mtrs
D.4.3.3	5 Core x 1.5 sq. mm PTFE cable	500 Mtrs
D.4.3.4	2 Pair x 0.5 sq. mm NiCr-Ni or NiAl compensating cables	2000 Mtrs
D.4.3.5	2 Pair x 0.5 sq. mm CuCu-Ni compensating cables	400 Mtrs
D.4.4.0	JUNCTION BOXES	
D.4.4.1	64 way Junction Box (SUV 12)	33 Nos.
D.4.4.2	Thermocouple Junction Box for K-type Thermocouple (NiCrNi)	20 Nos.
D.4.4.3	Thermocouple Junction Box for T-type Thermocouple (CuCuNi)	4 Nos.
D.4.5.0	CABLE DUCTS WITH COVERS – GI SOLID BOTTOM	
D.4.5.1	60 x 60 x 1000 mm	180 Nos.
D.4.5.2	180 x 100 x 1000 mm	60 Nos.
D.4.5.3	250 x 100 x 1000 mm	50 Nos.
D.4.6.0	MOUNTING FRAMES	
	<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.4.6.1	MWK100 (1100 x 300 x 765 mm)	2 Nos.
D.4.6.2	MWL100 (1100 x 1515)	2 Nos.
D.4.6.3	MFA150 (1600 x 718 x 1700 mm)	2 Nos.
D.4.6.4	MFC150 (1600 x 858 x 1700 mm)	2 Nos.
D.4.6.5	MWG250 (2600 x 470 x 1700 mm)	2 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
D.	BHEL-EDN SCOPE	
D.5.0	HMI PACKAGE	
D.5.1	Computer Stations Pentium IV PCs along with 24" widescreen TFT monitor, and other loose supplied items like keyboard, mouse, printer, interconnecting power and communication cables etc. The PCs are for various specific functions like 'Engineering/ Storian', 'Operator' Workstations, 'Link' Station etc. The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.	10 sets*
D.5.2	Power Distribution Boards	10 Nos.
D.5.3	Network Panels/ Power Distribution Panels Size: 750 x 750 x 2415 mm; weight: 400 kg each Network Cables	2 Nos.
D.5.4	Ethernet Cable	9,000 Mtrs
D.5.5	Power Cables: 3 C x 1.5 sq. mm cables	300 Mtrs

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
E.	BHEL-HYDERABAD SCOPE	
E.1.0	PUMPS (BFP/CEP)	
E.1.1.0	INSTRUMENTS	
E.1.1.1	RTDs along with thermowells	68 Nos.
E.1.1.2	Reverse Rotation Monitoring System for BFP consisting of 1 No. reverse rotation monitor (to be mounted in Panel), Probes, probe fixtures, JBs & communication cable with conduit, etc.	3 sets*
E.1.2.0	IMPULSE TUBES	
E.1.2.1	Impulse Tube, Dia 16 x 2.6, CS	765 Mtrs
E.1.3.0	JUNCTION BOXES	
E.1.3.1	Electrical Junction Box, 24 way	6 Nos.
E.1.4.0	CABLES/ CABLE TRAYS	
E.1.4.1	Perforated cable tray, 50 mm wide	60 Mtrs
E.1.4.2	Perforated cable tray, 150 mm wide	50 Mtrs
E.1.4.3	4 Pair, 0.5 sq. mm cable	560 Mtrs
E.1.4.4	4 Triad, 0.5 sq. mm cable	100 Mtrs

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SL. NO.	DESCRIPTION	QTY
E.	BHEL-HYDERABAD SCOPE	
E.1.5.0	LOCAL GAUGE BOARD (LGB) / LOCAL INSTRUMENT RACK (LIR)	
E.1.5.1	<p>LGB Assembly for Feed Water and Sealing Cooling Water Service for BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JB's.</p> <p>Approximate Size: 1400 x 550 x 1900 mm; Weight = 300 kg each</p> <p>Approximate qty of instruments per LGB is as follows: Pressure Gauges : 6 Nos. DP Gauge : 1 No. Pressure Switch: 1 No. Temperature Gauges: 8 Nos.</p> <p>The scope of work includes removal, calibration and re-fixing of the LGB Mounted Instruments also.</p>	3 Nos.
E.1.5.2	<p>LGB Assembly for Oil Service of BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JB's.</p> <p>Approximate Size: 1400 x 550 x 1900 mm; Weight = 300 kg each</p> <p>Approximate qty of instruments per LGB is as follows: Pressure Gauges: 7 Nos. Temperature Gauges: 4 Nos.</p> <p>The scope of work includes removal, calibration and re-fixing of the LGB Mounted Instruments also.</p>	3 Nos.
E.1.5.3	<p>LGB Assembly for 2 Nos CEPs including instruments, tubing, valves, fittings, junction boxes & wiring from switches to JB's</p> <p>Approximate Size 1400 x 550 x 1900 mm ; Weight = 300 kg each.</p> <p>The quantity of instruments per set is Pressure Gauges: 4 Nos. DP Gauge: 2 Nos. Temperature Gauges: 2 Nos.</p>	1 No.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
E.	BHEL-HYDERABAD SCOPE	
E.1.5.4	LIR Assembly for 3 BFPs including Pressure/ DP Transmitters, tubing, fittings, junction boxes, manifold valves, and wiring from JB's to transmitters Approximate Size 2000 x 650 x 1900mm; 250 kg each Approximate qty of instruments in LIR is as follows: Pressure Transmitters : 3 Nos DP Transmitters : 3 Nos. The scope of work includes removal, calibration and re-fixing of the LIR Mounted Instruments also.	1 No.
E.1.5.5	LIR Assembly for 3 BFPs including Pressure/ DP Transmitters, tubing, fittings, junction boxes, manifold valves, and wiring from JB's to transmitters Approximate Size 2000 x 650 x 1900mm; 250 kg each Approximate qty of instruments in LIR is as follows: Pressure Transmitters : 6 Nos The scope of work includes removal, calibration and re-fixing of the LIR Mounted Instruments also.	1 No.
E.1.5.6	Local Instrument Rack (LIR) assembly for CEP-A, & B pumps including Transmitters, tubing, fittings, JB's, Manifolds Valves and wiring from JB's to transmitters Approximate Size:2000 x 650 x 1900 mm; 200 kg each The quantity of instruments per set is Pressure transmitters: 4 Nos. DP transmitters: 2 Nos.	1 No.
E.1.6.0	SUPPORT MATERIALS	
E.1.6.1	Fabrication Material (Angle 45 x 45, Channel 100 x 50 x 7.5 etc.)	0.5 MT

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SL. NO.	DESCRIPTION	QTY
E.	BHEL-HYDERABAD SCOPE	
E.1.7.0	CHECKING AND COMMISSIONING OF THE FOLLOWING	
E.1.7.1	HT Motors	5 Nos. ^{\$}
E.1.7.2	Bearing RTDs of BFP motors (Checking healthiness only)	6 Nos. ^{\$}
E.1.7.3	Hydraulic Coupling of BFP The scope of work covers A) Removal, calibration & refixing of instruments. The approximate quantity of instruments is as follows. Pressure Gauges: 2 Nos. DP Gauge: 1 No. Temperature Gauges: 10 Nos. Pressure Transmitters: 2 Nos. Level Switch: 1 No. DP Transmitter: 1 No. RTDs (Checking only): 16 Nos. B) Fixing of I/P converters, Air filter, copper tubing & feedback transmitter, adjustment and calibration of scoop mechanism etc. C) Commissioning of Speed Indicator etc.	3 sets* ^{\$}
E.2.0	PULVERISER INSTRUMENTS	
E.2.1	RTDs along with thermowell	36 Nos.
E.2.2	Mill Motor Bearing Temperature Indicators. (Removal, calibration and refixing only)	12 Nos.
E.2.3.0	COMMISSIONING OF FOLLOWING	
E.2.3.1	Mill Motor RTDs - bearing/ winding (Checking healthiness only)	84 Nos. ^{\$}

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SL. NO.	DESCRIPTION	QTY
E.	BHEL-HYDERABAD SCOPE	
E.2.4.2	<p>Pulveriser Lub Oil Skid</p> <p>Removal, calibration and re-fixing of following instruments, meggering, improving IR value of motors, checking of wiring from skid junction box to equipment in lub oil skid</p> <p><i>Equipment per set</i></p> <p>DP Switch – 1 No. Pressure Switch – 2 Nos. Level Switches – 2 Nos. Temperature Switches- 6 Nos. Temperature Gauges- 2 Nos. Flow Switch cum Indicator- 2 Nos. Pressure Gauge- 3 Nos. DP Gauge – 1 No. LT Motors – 2 Nos. <i>Pneumatic Actuators (On/Off Type)</i></p>	6 sets* [§]
E.2.4.3	Mill Discharge Damper	24 Nos. [§]
E.3.0	DEAERATOR INSTRUMENTS	
E.3.1	Level Switches	11 Nos.
E.3.2	Pressure Gauges	3 Nos.
E.3.3	Temperature Gauges	4 Nos.

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SL. NO.	DESCRIPTION	QTY
F.	BHEL-PEM SCOPE	
F.1.0	INSTRUMENTS	
F.1.1	Pressure Gauges	143 Nos.
F.1.2	Temperature Gauges with Thermowell	75 Nos.
F.1.3	Pressure Switches	6 Nos.
F.1.4	DP Switches	2 Nos.
F.1.5	Level Switches	2 Nos.
F.2.1	PLC panel for Tube Cleaning system, along with monitor, keyboard etc. Approximate size: 1200 x 600 x 1800 mm; Weight: 600 kg	1 No.
F.3.0	COMMISSIONING OF THE FOLLOWING	
F.3.1	Rotameters	3 Nos. ^{\$}
F.3.2	Control Valves	20 Nos. ^{\$}
F.3.3	Motor Operated Valves	75 Nos. ^{\$}
F.3.4	LT Motors (Unidirectional)	10 Nos.. ^{\$}

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
G.	BHEL-HARDWAR SCOPE	
G.1.0	GENERATOR	
G.1.1	GENERATOR AUXILIARY CONTROL CABINETS	
G.1.1.1	Starter Cabinet for DC Seal Oil Motor, along with Resistance Box Dimension & weight: 1000 x 800 x 2200 mm; 450 kg Dimension & Weight of Resistance Box: 600 x 600 x 500 mm; 200 kg	1 No.
G.1.1.2	Generator Instrumentation Cabinet Dimension & weight: 1000 x 800 x 2200 mm; 450 kg	1 No.
G.1.1.3	Gas Analyser Cabinet including sensor, analyser etc. Dimension & weight: 1200 x 800 x 2200 mm; 450 kg	1 No.
G.1.1.4	Annunciation Cabinet Dimension & weight: 1000 x 800 x 2100 mm ; 400 kg	1 No.
G.1.2.0	GENERATOR INSTRUMENTS:	
G.1.2.1	Pressure Gauges	4 Nos.
G.1.2.2	Temperature Gauges	2 Nos.
G.1.2.3	Pressure Transmitters	4 Nos.
G.1.2.4	Pressure Switches	1 No.
G.1.2.5	Level Switches (capacitance type)	11 Nos.
G.1.2.6	RTDs (Temp. of CO2 vaporiser: 1 No. Temp for H2 side Seal Oil Drain : 2 Nos. Temp for Air side Seal Oil Drain :1 No. CW Inlet Temp to Air Cooler : 1 No. CW Outlet Temp of Air Cooler : 2 Nos. CW Temp to H2 Cooler : 1 No. CW O/L Temp of H2 Cooler : 4 Nos.)	12 Nos.

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SL. NO.	DESCRIPTION	QTY
G.	BHEL-HARDWAR SCOPE	
G.1.2.7	Triplex Thermocouples (NiCrNi) (Generator Bearing Temp:- 4 Nos. Exciter Bearing Temp: 2 Nos.)	6 Nos.
G.1.2.8	Gas Analyser	1 No.
G.1.2.9	Moisture Sensor Probes	1 No.
G.1.3.0	Removal, Calibration and Re-fixing of following Generator Instruments:	
G.1.3.1	Pressure Gauges	6 Nos.
G.1.3.2	Temperature Gauge	1 No.
G.1.3.3	Pressure Transmitters	5 Nos.
G.1.3.4	Pressure Switch	1 No.
G.1.3.5	Level Switches	2 Nos.
G.1.3.6	Flow Meters (checking only)	4 Nos.
G. 1.4.0	Checking the healthiness of the following RTDs/Thermocouples mounted on equipment	
G. 1.4.1	Thermocouple CuCuNi (Temperature- Stator Core)	24 Nos. ^{\$}
G. 1.4.2	Simplex RTDs (Temperature- Stator Winding)	24 Nos. ^{\$}
G. 1.4.3	Duplex RTDs (Temp- Cold Gas after Coolers: 6 Nos. Temp- Hot Gas before Coolers: 4 Nos. Temp- Cold Air to Main Exciter: 2 Nos. Temp- Hot Air after Main Exciter: 3 Nos. Temp- Hot Air after Rectifier Wheel: 2 Nos. Seal Oil Temp before SO Cooler: 1 No. Seal Oil Temp after Duplex filter: 4 Nos.)	22 Nos. ^{\$}

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SL. NO.	DESCRIPTION	QTY
G.	BHEL-HARDWAR SCOPE	
G.1.5.0	LOOSE ITEMS TO BE MOUNTED ON UCP	
G.1.5.1	Digital Indicators	6 Nos.
G.2.0	TURBINE C&I PACKAGE	
G.2.1.0	PANELS	
G.2.1.1	Starter panel for DC Jacking Oil Motor, along with Resistance Box Dimension & Weight: 1000 x 800 x 2200 mm; 450 kg Dimension & Weight of Resistance Box: 500 x 900 x 490 mm; 200 kg	1 set*
G.2.1.2	Starter Panel for DC Emergency Lub Oil Motor, along with Resistance Box Dimension & Weight: 1000 x 800 x 2200 mm; 450 kg Dimension & Weight of Resistance Box: 750 x 1300 x 950 mm; 200 kg	1 set*
G.2.2.0	TURBINE INSTRUMENTS	
G.2.2.1	Pressure Transmitters	34 Nos.
G.2.2.2	Diff. Pressure Transmitter	3 Nos.
G.2.2.3	Pressure Gauges	34 Nos.
G.2.2.4	Temperature Gauges	9 Nos.
G.2.2.5	Pressure Switches	39 Nos.
G.2.2.6	DP Switches	3 Nos.
G.2.2.7	Level Switches with amplifier, bar probe including interconnecting cable	4 sets*
G.2.2.8	Level transmitters with amplifier, bar probe	3 sets*
G.2.2.9	RTDs	14 Nos.
G.2.2.10	Thermocouples	62 Nos.
G.2.2.11	Speed Detectors	4 Nos.

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
G.	BHEL-HARDWAR SCOPE	
G.2.2.12	Position Transmitters (removal, calibration and refixing only)	24 Nos.
G.2.2.13	Limit Switches (checking only)	52 Nos ^{\$}
G.2.3	PRESSURE INSTRUMENTS RACKS (IR1 to IR8) 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 etc., necessary welding, fixing with fasteners and grouting. Approx. Total wt. of loose supplied items (for 8 Nos. racks): 2 Tonnes	8 Nos.
G.2.4.0	JUNCTION BOXES	
G.2.4.1	Junction Box (80 way)	2 Nos.
G.2.4.2	Junction Box (48 way)	2 Nos.
G.2.4.3	Junction Boxes (24 way)	2 Nos.
G.2.5.0	IMPULSE PIPES	
G.2.5.1	Alloy Steel tube D=13.5 x 2.6	425 Mtrs
G.2.5.2	Carbon Steel Tube, D=13.5 x 2.9	570 Mtrs
G.2.5.3	Carbon Steel Tube, D=17.2 x 1.8	325 Mtrs
G.2.6	Structural Steel (for both turbine and generator instruments)	2.0 Tonnes
G.2.7.0	Instruments for Heat Exchangers (Condenser, GSC, LP/ HP Heater, TOC, CFC)	
G.2.7.1	Level Switches	18 Nos.
G.2.7.2	Pressure Gauges	4 Nos.
G.2.7.3	Temperature Gauges with thermowell (capillary type)	15 Nos.

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SL. NO.	DESCRIPTION	QTY
G.	BHEL-HARDWAR SCOPE	
G.2.7.4	Temperature Gauges with thermowell (stem type)	8 Nos.
G.3.0	COMMISSIONING OF THE FOLLOWING	
G.3.1	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 Flow Switches – 2 Level Switches – 2 Diff. Pr. Switches – 2 Pressure Indicator Switches – 2 Temp. Indicators – 4 Flow Indicator Switch – 1 Temperature Controller – 2 Temperature Switch – 1	2 sets* [§]
G.3.2	Governing Rack (LR1) Removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc. The approximate quantity of instruments is as below: ▫ Pressure Gauges : 13 Nos. ▫ Pressure Switches : 4 Nos. ▫ Limit Switch : 13 Nos. ▫ Position Transmitter: 3 Nos.	1 set* [§]

* Lump sum rate to be quoted

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SL. NO.	DESCRIPTION	QTY
G.	BHEL-HARDWAR SCOPE	
G.3.3	<p>Hydraulic Power Supply Unit (HPSU)</p> <p>Removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc.</p> <p>The approximate quantity of instruments is as below:</p> <ul style="list-style-type: none"> ▫ Pressure Gauges : 6 Nos. ▫ Pressure Switches :3 Nos. ▫ DP Switches : 2 Nos. ▫ Flow Switches: 2 Nos. ▫ Level Transmitters: 4 Nos. ▫ Pressure Transmitters: 3 Nos. ▫ Temperature Transmitters: 2 Nos. 	1 set* ^{\$}
G.3.4	<p>Oil Centrifuge Unit</p> <p>Removal, calibration and refixing of all instruments mounted on centrifugal unit, checking and commissioning of motor etc.</p>	2 Nos. ^{\$}
G.3.5	Stroboscope	1 No. ^{\$}
G.3.6	CO2 vaporiser	1 No. ^{\$}
G.3.7	H2 Gas Drier	1 No. ^{\$}
G.3.8	Electrical Actuators for Valves	27 Nos. ^{\$}
G.3.9	LT Drives (Unidirectional)	34 Nos. ^{\$}
G.3.10	Solenoid Valves (only checking)	34 Nos. ^{\$}
G.3.11	NRV Valves, Stop Valves, Control Valves, HP/LP Bypass Valves	30 Nos. ^{\$}
G.3.12	250 MW Generator	1 No. ^{\$}

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