T E N D E R S P E C I F I C A T I O N

NO: BHE/PW/PUR/BHI-CLE/1093

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, COMMISSIONING AND HANDING OVER OF CONTROL & INSTRUMENTATION AND ELECTRICAL WORKS FOR TUBO BLOWERS AND ITS AUXILIARIES, FOR **3x25MW SAIL BHILAI STEEL PLANT**

AT

STEEL AUTHORITY OF INDIA LTD (SAIL)

BHILAI STEEL PLANT, BHILAI

DIST. DURG, (CHHATISGARH)

CONSISTING OF:

- **Notice Inviting Tender**
- **Volume-IA : Technical Conditions of Contract**
- **Volume-IB : Special conditions of Contract**
- **Volume-IC : General conditions of Contract**
- **Volume-ID : Forms & Procedures**

Bharat Heavy Electricals Limited
(*A Government of India Undertaking*)
Power Sector - Western Region
345-Kingsway, Nagpur-440001

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Tender Specification Issue Details

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, COMMISSIONING AND HANDING OVER OF CONTROL & INSTRUMENTATION AND ELECTRICAL WORKS FOR TUBO BLOWERS AND ITS AUXILIARIES, FOR **3x25MW SAIL BHILAI STEEL PLANT**

AT

STEEL AUTHORITY OF INDIA LTD (SAIL)

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DIST. DURG, (CHHATISGARH)

EARNEST MONEY DEPOSIT: Refer Notice Inviting Tender

LAST DATE FOR TENDER SUBMISSION : Refer Notice Inviting Tender .

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

M/s. ……

…….

PLEASE NOTE:
THESE TENDER SPECS DOCUMENTS ARE NOT TRANSFERABLE.

For Bharat Heavy Electricals Limited

AGM (Purchase)
Place: Nagpur
Date :

1093

NOTICE INVITING TENDER

(Document No PS:MSX:NIT:Rev 01 dated 1st Jun 2012)

Bharat Heavy Electricals Limited

Ref: BHE/PW/PUR/BHI-CLE/1093 Date: 31.01.2013

NOTICE INVITING TENDER (NIT)

NOTE: BIDDER MAY DOWNLOAD FROM WEB SITES OR PURCHASE TENDERS FROM THIS OFFICE ALSO

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To

Dear Sir/Madam

Sub: NOTICE INVITING TENDER

Sealed offers in two part bid system are invited from reputed & experienced bidders (meeting PRE QUALIFICATION CRITERIA as mentioned in Annexure-I) for the subject job by the undersigned on the behalf of BHARAT HEAVY ELECTRICALS LIMITED as per the tender document. Following points relevant to the tender may please be noted and complied with.

1.0 Salient Features of NIT

SL NO	ISSUE	DESCRIPTION	
i	**TENDER NUMBER**	**BHE/PW/PUR/BHI-CLE/1093**	
ii	**Broad Scope of job**	HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, COMMISSIONING AND HANDING OVER OF CONTROL & INSTRUMENTATION AND ELECTRICAL WORKS FOR TUBO BLOWERS AND ITS AUXILIARIES, FOR 3x25MW SAIL BHILAI STEEL PLANT	
iii	**DETAILS OF TENDER DOCUMENT**		
a	Volume-IA	*Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc*	*Applicable*
b	Volume-IB	*Special Conditions of Contract (SCC)*	*Applicable*
c	Volume-IC	*General Conditions of Contract (GCC)*	*Applicable*
d	Volume-ID	*Forms and Procedures*	*Applicable*
e	Volume-II	*Price Schedule (Absolute value).*	*Applicable*

iv	**Issue of Tender Documents**	*1. Sale from BHEL PS WR office at NAGPUR :* ***Start: 31/01/2013:*** ***Closes: 20/02/2013, Time : 16.00 Hrs*** **2. From BHEL website (www.bhel.com)** Tender documents will be available for downloading from website till due date of submission	*Applicable/* *~~Not applicable~~*
v	**DUE DATE & TIME OF OFFER SUBMISSION**	***Date : 21/02/2013 , Time : 15.00 Hrs*** ***Place : BHEL PS Regional office at :Nagpur*** Tenders being submitted through representative shall be handed over to any of the following BHEL officials after making entry/registration at the reception: RK Ranade/ Sr. Manager (Purchase) Saravana Kumar/Engineer(Purchase)	*Applicable*
vi	**OPENING OF TENDER**	***Date : 21/02/2013, Time : 16.30 Hrs*** *Notes:* *(1) In case the due date of opening of tender becomes a non-working day, then the due date & time of offer submission and opening of tenders get extended to the next working day.* *(2) Bidder may depute representative to witness the opening of tender*	*Applicable*
vii	**EMD AMOUNT**	***Rs 1,50,000/- (Rs One Lakh Fifty Thousand Only)***	*Applicable*
viii	**COST OF TENDER**	***Rs 2000/-. (Rs Two Thousand only)***	*Applicable*
ix	**LAST DATE FOR SEEKING CLARIFICATION**	*Atleast 5 days before the due date of offer submission* *Along with soft version also, addressing to undersigned & to others as per contact address given below*	*Applicable*
x	**SCHEDULE OF Pre Bid Discussion (PBD)**	*Date :*	*~~Applicable~~/Not applicable.*
xi	**INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)**	----	*~~Applicable~~/Not Applicable*
xii	**Latest updates**	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com -->Tender Notifications →View Corrigendums) **and not in the newspapers**. Bidders to keep themselves updated with all such information	*Applicable*

2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly signed & stamped on each page, as part of offer. **Rates/Price including discounts/rebates, if**

any, mentioned anywhere/in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.

3.0 Unless specifically stated otherwise, bidder shall remit cost of tender and courier charges if applicable, in the form of Demand Draft drawn in favour of Bharat Heavy Electricals Ltd, payable at Power Sector Regional HQ at Nagpur issuing the Tender, along with techno-commercial offer. Bidder may also choose to deposit the Tender document cost by cash at the Cash Office as stated above against sl no iv of 1, on any working day; and in such case copy of Cash receipt is to be enclosed with the Techno Commercial offer. Sale of tender Documents shall not take place on National Holidays, holidays declared by Central or State Governments and BHEL PS HQ at NAgpur, Sundays and second/ last Saturdays

4.0 Unless specifically stated otherwise, bidder shall deposit EMD through Demand Draft/Pay Order in favour of Bharat Heavy Electricals Ltd, payable at Nagpur. For other details and for 'One Time EMD' please refer General Conditions of Contract.

5.0 **Procedure for Submission of Tenders**: The Tenderers must submit their Tenders to Officer inviting Tender, as detailed below:

- PART-I consisting of 'PART-I A (Techno Commercial Bid)'& 'PART-I B (EMD/COST of TENDER)' in two separate sealed and superscribed envelopes (ENVELOPE-I & ENVELOPE-II)
- PART-II (Price Bid) – in sealed and superscribed envelope (ENVELOPE-III)
- One set of tender documents shall be retained by the bidder for their reference

6.0 The contents for ENVELOPES and the superscription for each sealed cover/Envelope are as given below. **(All pages to be signed and stamped)**

Sl no	Description	Remarks
	Part-I A	
	ENVELOPE – I superscribed as : PART-I (TECHNO COMMERCIAL BID) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**:-	
i.	Covering letter/Offer forwarding letter of Tenderer.	
ii.	Duly filled-in `No Deviation Certificate' as per prescribed format to be placed after document under sl no (i) above. **Note:** a. In case of any deviation, the same should be submitted separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be placed after document under sl no (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. b. BHEL reserves the right to accept/reject the deviations without assigning any reasons, and BHEL decision is final and binding. i). In case of acceptance of the deviations, appropriate loading shall be done by BHEL ii). In case of unacceptable deviations, BHEL reserves the right to reject the tender	
iii.	Supporting documents/ annexure/ schedules/ drawing etc as required in line with Pre-Qualification criteria.	

	It shall be specifically noted that all documents as per above shall be indexed properly and credential certificates issued by clients shall distinctly bear the name of organization, contact ph no, FAX no, etc.	
iv.	All Amendments/Correspondences/Corrigenda/Clarifications/Changes/ Errata etc pertinent to this NIT.	
v.	Integrity Pact Agreement (Duly signed by the authorized signatory)	If applicable
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification/NIT	
vii.	Notice inviting Tender (NIT)	
viii.	Volume – I A : Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	
ix.	Volume – I B : Special Conditions of Contract (SCC)	
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	
xiii.	Any other details preferred by bidder with proper indexing.	

	PART-I B	
	ENVELOPE – II superscribed as: PART-I (EMD/COST of TENDER) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**:-	
i.	1. Earnest Money Deposit (EMD) in the form as indicated in this Tender **OR** Documentary evidence for 'One Time EMD' with the Power Sector Region of BHEL floating the Tender 2. Cost of Tender (Demand Draft or copy of Cash Receipt as the case may be)	

	PART-II	
	PRICE BID consisting of the following shall be enclosed	
	ENVELOPE-III superscribed as: PART-II (PRICE BID) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**	
i	Covering letter/Offer forwarding letter of Tenderer enclosed in Part-I	
ii	Volume II – PRICE BID (Duly Filled in Schedule of Rates – rate/price to be entered in words as well as figures)	

	OUTER COVER	
	ENVELOPE-IV (MAIN ENVELOPE / OUTER ENVELOPE) superscribed as: TECHNO-COMMERCIAL BID, PRICE BID & EMD TENDER NO: NAME OF WORK: PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING:**	
i	o Envelopes I o Envelopes II o Envelopes III	

SPECIAL NOTE :All documents / annexure's submitted with the offer shall be properly annexed and placed in respective places of the offer as per enclosure list mentioned in the covering letter. BHEL shall not be responsible for any missing documents.

7.0 Deviation with respect to tender clauses and additional clauses/suggestions in Techno-commercial bid / Price bid shall NOT be considered by BHEL. Bidders are requested to positively comply with the same.

8.0 BHEL reserves the right to accept or reject any or all Offers without assigning any reasons thereof. BHEL also reserves the right to cancel the Tender wholly or partly without assigning any reason thereof. Also BHEL shall not entertain any correspondence from bidders in this matter (except for the refund of EMD).

9.0 Assessment of Capacity of Bidders:
Bidders capacity for executing the job under tender shall be assessed 'LOAD' wise and 'PERFORMANCE' wise as per the following:

I. **LOAD**: Load takes into consideration **ALL** the contracts of the Bidder under execution with BHEL Regions, irrespective of whether they are similar to the tendered scope or not. The 'Load' is the sum of the unit wise identified packages (refer Table-1) for contracts with BHEL Regions. The cut off month for reckoning 'Load' shall be the month, two (2) months preceding the month corresponding to the 'latest date of bid submission', in the following manner:

(Note: For example if latest bid submission is in Aug 2011, then the 'load' shall be calculated upto and inclusive of June 2011)

i). Total number of Packages

Total number of Packages in hand = P
Where

- Pis the sum of all unit wise identified packages under execution with BHEL Regions as of the cut off month defined above, including packages yet to be commenced.

ii) Weightage "A" assigned to bidders based on Total number of Packages 'P':

a) If 'P' = 0-9, : "A" will be equal to '4'
b) If 'P' = 10-18, : "A" will be equal to '3'
c) If 'P' = 19-36, : "A" will be equal to '2'
d) If 'P' = 37-60, : "A" will be equal to '1'

e) If 'P' is above 60 : "A" will be equal to '0'

II. **PERFORMANCE**: Here 'Monthly Performance' of the bidder for all the packages (**under execution**/ executed during the 'Period of Assessment' in all the Power Sector Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced shall be taken into consideration. The 'Period of Assessment' shall be 6 months preceding the cut off month. The cut off month for reckoning 'Period of Assessment' shall be the month two (2) months preceding the month corresponding to the 'latest date of bid submission', in the following manner:

(Note: For example if 'latest date of bid submission' is in Aug 2011, then the 'performance' shall be assessed for a 6 month period upto and inclusive of June 2011, for all the unit wise identified packages (refer Table I)

i). Calculation of Overall 'Performance Rating' for 'similar Package/Packages' for the tendered scope under execution at Power Sector Regions:

This shall be obtained by summing up the 'Monthly Performance Evaluation' scores obtained by the bidder in all Regions for all the similar Package/packages', divided by the total number of Package months for which evaluation should have been done, as per procedure below:

a) P_1, P_2, P_3 , P_4 , P_5 , …. P_N etc be the packages (**under execution**/ executed during the 'Period of Assessment' in all Regions) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions = $\mathbf{P_T}$ (ie$P_T = P_1 + P_2 + P_3 + P_4 + .. P_N$)

b) Number of Months 'T_1' for which 'Monthly Performance Evaluation' as per relevant formats, should have been done in the 'Period of Assessment' for the corresponding similar package P_1. Similarly $T_2$for package P_2,$T_3$for package P_3, etc for the tendered scope. Now calculate cumulative total months '$\mathbf{T_T}$' for total similar Packages '$\mathbf{P_T}$' for all Regions (i.e$\mathbf{T_T} = T_1 + T_2 + T_3 + T_4 + .. T_N$)

c) Sum 'S_1' of 'Monthly Performance Evaluation' Scores ($S_{1\text{-}1}$, $S_{1\text{-}2}$, $S_{1\text{-}3}$, $S_{1\text{-}4}$, $S_{1\text{-}5}$,…. $S_{1\text{-}N}$) for similar package P_1, for the 'period of assessment' 'T_1' (i.e $S_1 = S_{1\text{-}1} + S_{1\text{-}2} + S_{1\text{-}3} + S_{1\text{-}4} + S_{1\text{-}5} + \ldots S_{1\text{-}N}$). Similarly S_2 for package P_2 for period T_2, S_3 for package P_3 for period T_3, etc for the tendered scope for all Regions. Now calculate cumulative sum 'S_T' of 'Monthly Performance Evaluation' Scores for total similar Packages '$\mathbf{P_T}$' for all Regions (i.e 'S_T'$= S_1 + S_2 + S_3 + S_4 + S_5 + \ldots S_N$.)

d) **Overall Performance Rating 'R_{BEHL}' for the similar Package/Packages** (**under execution**/ executed during the 'Period of Assessment') in all the Power Sector Regions of BHEL)**:**

Aggregate of Performance scores for all similar packages in all the Regions

= ----------

Aggregate of months for each of the similar package for which performance should have been evaluated in all the Regions

$\mathbf{S_T}$

$$= \frac{\text{-------}}{T_T}$$

e) Bidders to note that the risk of non evaluation or non availability of the 'Monthly Performance Evaluation' reports as per relevant formats is to be borne by the Bidder

f) Table showing methodology for calculating 'a', 'b' and 'c' above

Sl no	Item Description	Details for all Regions							Total
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
1	Similar Packages for all Regions →	P_1	P_2	P_3	P_4	P_5	…	P_N	Total No of similar packages for all Regions = **P_T** ie Sum (Σ) of columns (iii) to (ix)
2	Number of Months for which 'Monthly Performance Evaluation' as per relevant formats should have been done in the 'period of assessment for corresponding similar Package (as in row 1)	T_1	T_2	T_3	T_4	T_5	…	T_N	Sum (Σ) of columns (iii) to (ix) = **T_T**
3	Monthly performance scores for the corresponding period (as in Row 2)	S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, … S_{1-T1}	S_{2-1}, S_{2-2}, S_{2-3}, S_{2-4}, … S_{2-T2}	S_{3-1}, S_{3-2}, S_{3-3}, S_{3-4}, … S_{3-T3}	S_{4-1}, S_{4-2}, S_{4-3}, S_{4-4}, … S_{4-T4}	S_{5-1}, S_{5-2}, S_{5-3}, S_{5-4}, … S_{5-T5}	.. … … … …	S_{N-1}, S_{N-2}, S_{N-3}, S_{N-4}, … S_{N-TN}	---------
4	Sum of Monthly Performance scores of the corresponding Package for the corresponding period (as in row-3)	S_1	S_2	S_3	S_4	S_5	…	S_N	Sum (Σ) of columns (iii) to (ix) = **S_T**

ii) Weightage "B" assigned to bidders based on Overall Performance Rating (R_{BHEL}) at Power Sector Regions, for the respective Package:

a) If $\mathbf{R_{BHEL}}$ is ≥ 80%, "B" will be equal to '6'
b) If $\mathbf{R_{BHEL}}$ is ≥ 75% < 80%, "B" will be equal to '5'
c) If $\mathbf{R_{BHEL}}$ is ≥ 70% < 75%, "B" will be equal to '4'
d) If $\mathbf{R_{BHEL}}$ is ≥ 65% < 70%, "B" will be equal to '3'
e) If $\mathbf{R_{BHEL}}$ is ≥ 60% < 65%, "B" will be equal to '2'
f) If $\mathbf{R_{BHEL}}$ is < 60%, "B" will be equal to '0'

III. 'Assessment of Capacity of Bidder' to be Qualified for the tender:

Shall be based on the sum of the weightages obtained in 'LOAD' (A) and 'PERFORMANCE' (B) as below:

a) If the sum (A+B) is 6 or above for each of the applicable Package, then the Bidder is considered 'Qualified' for the tender
b) If the sum (A+B) is less than 6 for any of the applicable Package, then the Bidder is considered 'NOT Qualified' for the tender

IV. **Explanatory note**:

a) Similar package means Boiler or ESP or Piping or Turbine or Civil or Structure or Electrical or CI, etc at the individual level irrespective of rating of Plant, and irrespective of whether the subject tender is a single package or as part of combined/composite packages. Normally Boiler, ESP, Piping, Turbine, Electrical, CI, Civil, Structure, etc is considered individual level of package. For example in case the tendered scope is a Boiler Vertical Package comprising of Boiler, ESP and Power Cycle Piping (i.e the 'identified packages as per Table-1 below), the 'PERFORMANCE' part against sl no II above, needs to be evaluated considering all the identified packages (ie Boiler, ESP and Power Cycle Piping) and finally the Bidder's capacity to execute the tendered scope is assessed in line with III above
b) Identified Packages (Unit wise)

Table-1

	Civil	Electrical & CI	Mechanical
	i). Enabling works ii). Pile and Pile Caps iii). Civil Works including foundations iv). Structural Steel Fabrication & Erection v). Chimney vi). Cooling Tower vii). Others (Civil)	i). Electrical ii). CI iii). Others (Elec& CI)	i). Boiler & Aux (All types including CW Piping if applicable) ii). Power Cycle Piping/Critical Piping iii). LP Piping iv). ESP v). Steam Turbine Generator set & Aux vi). Gas Turbine Generator set & Aux vii). Hydro Turbine Generator set & Aux viii). Turbo Blower (including Steam Turbine) ix). Material Handling x). Material Management xi). Material Handling & Material Management xii). Others (Mechanical)

c) Vendors who are first timers to any BHEL Region, may be considered subject to satisfying other tender conditions. Eligibility of the party for the next tender of any package in that Region, shall be subject to the bidder satisfying the 'Assessment of Capacity of Bidder' for a period of first **nine months** after commencement of work or contract duration whatever is lesser.

In case the first timer is executing any other packages in any BHEL Region, then the performance evaluation will be based on the data available for the other packages though not similar, for the 'Period of assessment', for the purpose of 'Assessment of Capacity of Bidder'

d) Vendors who are not first timers and who have not been executing any package or packages similar to the packages under the tender in the 'Period of assessment', shall be considered qualified subject to them satisfying all other tender conditions.

e) In the unlikely event of all bidders shortlisted against Technical and Financial Qualification criteria not meeting the criteria on 'Assessment of Capacity of Bidders' detailed above, OR leads to a single tender response on applying the criteria of 'Assessment of Capacity of Bidders', then BHEL at its discretion, reserves the right to consider the further processing of the Tender based on the **Overall Performance Rating** '$\mathbf{R_{BHEL}}$**'** only**.**

f) 'Under execution' shall mean works in progress as per the following:

i. upto Boiler Steam Blowing in case of Steam Generator and Auxilliaries

ii. upto Synchronisation in case of all other works excepting sl no (i) and (iii)

iii. upto execution of at least 75% of anticipated contract value (unit wise), in case of Enabling works or Civil & Structures.

Note : BHEL at its discretion can extend (or reduce in exceptional cases in line with Contract conditions) the period defined against (i), (ii) and (iii) above, depending upon the balance scope of work to be completed.

g) Performance evaluation in CL 9 above is applicable to Prime bidder and consortium partner (or Technical tie up partner) for their respective scope of work

10.0 Since the job shall be executed at site**,** bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.

11.0 For any clarification on the tender document, the bidder may seek the same in writing or through e-mail, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.

12.0 BHEL may decide holding of pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.

13.0 In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail.

14.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.

15.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), **if applicable**, along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. **The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (1) above.**

16.0 The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the Pre Qualification Criteria specified in this NIT as per Annexure-I (as applicable), past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right not to consider offers of parties under HOLD.

17.0 In case BHEL decides on a `Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful/Disqualified bidders under intimation to the respective bidders.

18.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise.

19.0 BHEL reserves the right to decide the successful bidder on the basis of Reverse Auction process. In such case all qualified bidders will be intimated regarding procedure/ modality for Reverse Auction process prior to Reverse Auction and price will be decided as per the rules for Reverse Auction. .

However, if reverse auction process is unsuccessful as defined in the RA rules/procedures, or for whatsoever reason, then the sealed 'PRICE BIDs' will be opened for deciding the successful bidder. BHEL's decision in this regard will be final and binding on bidder.

20.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.

21.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.

22.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.

23.0 Consortium Bidding (or Technical Tie up) shall be allowed only if specified in Pre Qualifying Requirement (PQR) criteria, and in such a case the following shall be complied with:

23.1 Prime Bidder and Consortium Partner or partners are required to enter into a consortium agreement with a validity period of six months initially. In case the consortium is awarded the contract, then the Consortium Agreement between the Prime Bidder and Consortium Partner or partners shall be extended till contractual completion period including extension periods if any applicable.

23.2 'Stand alone' bidder cannot become a '**Prime Bidder' or a 'Consortium bidder' or 'Technical Tie up bidder' in a consortium (or Technical Tie up) bidding**. Prime bidder shall neither be a consortium partner to other prime bidder nor take any other consortium partners. However, consortium partner may enter into consortium agreement with other prime bidders. In case of non compliance, consortium bids of such Prime bidders will be rejected.

23.3 Number of partners for a consortium Bidding (or Technical Tie up) shall be as specified in the PQR

23.4 Prime Bidder shall be as specified in the Pre Qualification Requirement, else the bidder who has the major share of work

23.5 In order to be qualified for the tender, Prime Bidder and Consortium partner or partners shall satisfy (i) the Technical 'Pre Qualifying Requirements' specified for the respective package, (ii) "Assessment of Capacity of Bidder' as specified in clause 9.0

23.6 Prime Bidder shall comply with additional 'Technical' criteria of PQR as defined in 'Explanatory Notes for the PQR'

23.7 Prime Bidder shall comply with all other Pre Qualifying criteria for the Tender unless otherwise specified

23.8 In case customer approval is required, then Prime Bidder and Consortium Partner or partners shall have to be individually approved by Customer for being considered for the tender.

23.9 Prime Bidder shall be responsible for the overall execution of the contract

23.10 In case of award of job, Performance shall be evaluated for Prime Bidder and Consortium Partner or partners for their respective scope of work(s) as per prescribed formats

23.11 In case the Consortium partner or partners back out, their SDs shall be encashed by BHEL. In such a case, other consortium partner or partners meeting the PQR have to be engaged by the Prime Bidder, and if not, the respective work will be withdrawn and executed on risk and cost basis of the Prime Bidder. The new consortium partner or partners shall submit fresh SDs as applicable.

23.12 In case the prime Bidder withdraws, the whole contract shall be considered cancelled and short closed.

23.13 After execution of work, the work experience shall be assigned to the Prime Bidder and the consortium partner or partners for their respective scope of work. After successful execution of two similar works with the same consortium partner or partners under direct orders of BHEL, the Prime Bidder shall be eligible for becoming a 'stand alone' bidder for similar works, subject to certification from BHEL about the active involvement of the Prime Bidder for satisfactory execution of the works.

23.14 The consortium partner shall submit SD equivalent to 2% of the total contract value in addition to the SD to be submitted by the prime Bidder for the total contract value. In case there are two consortium partners, then each partner shall submit SD equivalent to 1% of the total contract value in addition to the SD to be submitted by the prime Bidder for the total contract value.

23.15 In case of a Technical Tie up, all the clauses applicable for the Consortium partner shall be applicable for the Technical Tie up partner also

24.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements' duly self certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.

25.0 The bidder may have to produce original document for verification if so decided by BHEL.

26.0 Order of Precedence

In the event of any ambiguity or conflict between the Tender Documents, the order of precedence shall be in the order below:

a. Amendments/Clarifications/Corrigenda/Errata etc issued in respect of the tender documents by BHEL
b. Notice Inviting Tender (NIT)
c. Price Bid
d. Technical Conditions of Contract (TCC)—Volume-1A
e. Special Conditions of Contract (SCC) —Volume-1B
f. General Conditions of Contract (GCC) —Volume-1C
g. Forms and Procedures —Volume-1D

for BHARAT HEAVY ELECTRICALS LTD

AGM/Purchase

Enclosure

01 Annexure-1: Pre Qualifying criteria.
02 Annexure-2: Check List.
03 Annexure-4: Important Info
04 Other Tender documents as per this NIT.

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, COMMISSIONING AND HANDING OVER OF CONTROL & INSTRUMENTATION AND ELECTRICAL WORKS FOR TURBO BLOWERS AND ITS AUXILIARIES, FOR **3x25MW SAIL BHILAI STEEL PLANT**
TENDER NO	**BHE/PW/PUR/BHI-CLE/1093**

SL NO	PRE QUALIFICATION CRITERIA	Bidders claim in respect of fulfilling the PQR Criteria	
		Name and Description of qualifying criteria	Page no of supporting document. **Bidder must fill up this column as per applicability**
A	Submission of Integrity Pact duly signed (if applicable)	**NOT APPLICABLE**	
B	**Technical** Bidder must have executed following works i.e. Bidder must meet **{** (B.1.1 **or** B.1.2) **And** (B.2.1) **And** (B.3.1 **or** B.3.2 **or** B.3.3) **}** in the last seven (7) years as on latest date of bid submission:- B.1.1) Executed CI works for **BTG/GT 'OR' CI** works consisting of **DCS/ DDC/ Station C&I**, in a Power Plant against single work order. ***OR*** B.1.2) Executed atleast **one contract of CI** works consisting of **DCS/DDC/Station C&I,** in any industry with its executed value of **Rs.30 Lakhs or more** against single work order. **AND** B.2.1) Executed Electrical works in a power Plant consisting of **a. LT Bus Ducts** **b. LT Switch Gear** **AND** B.3.1) Executed atleast **One C & I and Electrical** work of value not less than **Rs.80 Lakhs** against single work order.	APPLICABLE	

	OR B.3.2) Executed atleast **Two C & I and Electrical** work of value not less than **Rs.50 Lakhs** against single work order. ***OR*** B.3.3) Executed atleast **Three C & I and Electrical** work of value not less than **Rs.40 Lakhs** against single work order.		

FOR QR: {(B.1.1 OR B.1.2) AND (B.2.1)} BIDDER SHALL SUBMIT *"WORK ORDER"* COPY ALONG WITH RESPECTIVE *"BILL OF QUANTITY & SCOPE OF WORK"* INCLUDING *"RELEVANT DOCUMENT FOR WORK COMPLETION"* FOR THE RESPECTIVE WORK ORDER IN SUPPORT OF THE TECHNICAL QR.

FOR QR: (B.3.1 OR B.3.2 OR B.3.3) BIDDER SHALL SUBMIT *"WORK ORDER"* COPY ALONG WITH RESPECTIVE *"BILL OF QUANTITY & SCOPE OF WORK"* INCLUDING *RELEVANT DOCUMENT FOR WORK COMPLETION"* & *"WORK EXECUTED VALUE"* DOCUMENTS FOR THE RESPECTIVE WORK ORDER IN SUPPORT OF THE TECHNICAL QR.

IN ABSENCE OF ABOVE SAID DOCUMENTS, OFFER OF THE BIDDER WILL NOT BE CONSIDERED FOR EVALUATION.

C-1	**Financial Turnover** Bidders must have achieved an average annual financial turnover (Audited) of **Rs.30 Lakhs** or more over last three Financial Years (FY) i.e. 2009-2010, 2010-2011, 2011-12	APPLICABLE	
C-2	NETWORTH (only in case of Companies) Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive	APPLICABLE	
C-3	PROFIT Bidder must have earned cash profit in any one of the three Financial Years as applicable in the last three Financial Years defined in 'C-1 above based on latest Audited Accounts.	APPLICABLE	
D	Assessment of Capacity of Bidder to execute the work as per sl no 9 of NIT	APPLICABLE	By BHEL
E	Approval of Customer	NOT APPLICABLE	BY BHEL
F	Price Bid Opening Note: Price Bids of only those bidders shall be opened who stand qualified after compliance of criteria A to E	APPLICABLE	BY BHEL
F	Consortium criteria	NOT APPLICABLE	
	Explanatory Notes for the PQR (unless otherwise specified in the PQR): 1. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated against C-1 above along with all annexures		

2. In case audited Financial statements have not been submitted for all the three years as indicated against C-1 above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e total divided by three.
3. C-2:-NETWORTH : Shall be calculated based on the latest Audited Accounts as furnished for C-1 above. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated in case of companies)
4. C-3:- PROFIT : shall be NET profit (PAT + Non cash expenditure viz depreciation) earned during any one of the three financial years as in C-1 above
5. 'Additional' Criteria in respect of 'Technical' criteria of PQR (as in 'B' above) for Civil, Electrical, CI, unless otherwise specified :
    1. Bidder should have executed similar work of any one of the following:
        a. One (1) work of value not less than Rs XXX
            OR
        b. Two (2) works of not less than Rs YYY
            OR
        c. Three (3) works of not less than Rs ZZZ
        (Value XXX, YYY, ZZZ shall be as indicated by BHEL
    2. 'Similar' work for criteria 5 above means
        a. Civil or Structures or Civil & Structures or Chimney respectively as applicable to the tendered scope in respect of 'CIVIL' Works
        b. Electrical works in respect of 'ELECTRICAL'
        c. CI works in respect of 'CI' Works
        d. Material Handling and/or Management works in respect of 'MM' works

6. Time period for achievement of the 'Technical' criteria of PQR (as in 'B' above) will be the last 7 years ending on the 'latest date' of Bid submission
7. 'EXECUTED' means the Vendor should have achieved the criteria specified in the Technical criteria of PQR (as in 'B' above) even if the Contract has not been completed or closed
8. Unless otherwise specified, for the purpose of 'Technical' criteria of PQR (as in 'B' above), the word 'EXECUTED' means:
    1. "BOILER LIGHT UP" in respect of Boiler & Aux and ESP
    2. "SYNCHRONISATION" in respect of STG/GTG and 'SPINNING' in case of HTG
    3. "STEAM BLOWING COMPLETION" in respect of at least Main Steam Line of Power Cycle Piping
    4. "HYDRAULIC TEST" of the system in respect of Structures, Pressure parts/IBR Piping
    5. "CHARGING" in respect of power Transformers, Bus ducts, HT/LT switchgears
    6. "Completion of RCC Shell and liner (steel or brick as per tendered scope) up to the HEIGHT specified using slip form" in case of RCC Chimney.
    7. Achievement of physical Quantities as per respective PQRs in respect of Civil & Structures and Piling Works
    8. 'Readiness for coal Filling" in respect of Bunker Structure Work.
9. Boiler means HRSG or WHRB or any other types of Steam Generator
10. Critical/Power Cycle piping means Main Steam, Hot Reheat, Cold Reheat, HP Bypass, LP Bypass lines
11. For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5TPH where ever rating of HRSG/BOILER is mentioned in MW. Similarly, where ever rating of Gas Turbine is mentioned in terms of Frame size, ISO rating in terms of MW shall be considered for evaluation.
12. In case the experience/PO/WO certificate enclosed by bidders do not have separate break up prices for the E&C portion of Electrical and CI Works, (i.e. the certificates enclosed are for composite order for supply and erection of Electrical & CI and other works if any), then value of Erection and Commissioning for the Electrical & CI portion shall be considered as 15% of the supply & erection of Electrical & CI, unless otherwise specifically indicated in the PQR.
13. Scope for capital overhaul of STG shall cover Bearing Inspection work and overhauling of all cylinders of the Turbine unless otherwise specifically indicated in the PQR.
14. In case the tendered scope is not a Pulverised Fuel Boiler, experience of Oil/Gas Fired Boilers also can be considered unless otherwise specifically indicated in the PQR.

BIDDER SHALL SUBMIT ABOVE PRE-QUALIFICATION CRITERIA FORMAT, DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

ANNEXURE - 2

CHECK LIST

NOTE:- Tenderers are required to fill in the following details and no column should be left blank

1	Name and Address of the Tenderer		
2	Details about type of the Firm/Company		
3	Details of Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Fax No:	
4	EMD DETAILS	DD No: Date : Bank : Amount: Please tick (√) whichever applicable:- ONE TIME EMD / ONLY FOR THIS TENDER	
5	Validity of Offer	TO BE VALID FOR SIX MONTHS FROM DUE DATE	
		APPLICABILITY	BIDDER REPLY
6	Whether the format for compliance with **PRE QUALIFICATION CRITERIA** (ANNEXURE-I) is understood and filled with proper supporting documents referenced in the specified format	Applicable	YES / NO
7	Audited profit and Loss Account for the last three years	Applicable/Not Applicable	YES/NO
8	Copy of PAN Card	Applicable/Not Applicable	YES/NO
9	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable/Not Applicable	YES/NO
10	Integrity Pact	Applicable/Not Applicable	YES/NO
11	Declaration by Authorised Signatory	Applicable/Not Applicable	YES/NO
12	No Deviation Certificate	Applicable/Not Applicable	YES/NO
13	Declaration confirming knowledge about Site Conditions	Applicable/Not Applicable	YES/NO
14	Declaration for relation in BHEL	Applicable/Not Applicable	YES/NO
15	Non Disclosure Certificate	Applicable/Not Applicable	YES/NO
16	Bank Account Details for E-Payment	Applicable/Not Applicable	YES/NO
17	Capacity Evaluation of Bidder for current Tender	Applicable/Not Applicable	YES/NO
18	Tie Ups/Consortium Agreement are submitted as per format	Applicable/Not Applicable	YES/NO
19	Power of Attorney for Submission of Tender/Signing Contract Agreement	Applicable/Not Applicable	YES/NO
20	Analysis of Unit rates	Applicable/Not Applicable	YES/NO

NOTE : STRIKE OFF 'YES' OR 'NO', AS APPLICABLE

DATE :
AUTHORISED SIGNATORY **(With Name, Designation and Company seal)**

ANNEXURE 4: IMPORTANT INFORMATION

1. The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site (www.bhel.com ---> Tender Notification -→ List of Banned Firms)

1093

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CONTENTS

1.0	**Project Information**
1.1	**INTROUCTION** **STEEL AUTHORITY OF INDIA LTD (SAIL)** IS HAVING ONE OF THEIR STEEL PLANT AT BHILAI DIST DURG, CHHATTISGARH, INDIA. CUSTOMER IS SETTING UP 3 X TURBO BLOWER STATIONS (PKG 012) UNDER THEIR 7.0 MTPA CRUDE STEEL EXPANSION PROGRAMME AT BHILAI STEEL PLANT, BHILAI. THE SITE IS INSIDE THE PREMISES OF EXISTING BHILAI STEEL PLANT. BHEL HAS BEEN AWARDED TURBO BLOWER PACKAGE COMPRISING OF DESIGN, ENGINEERING, MANUFACTURE, SUPPLY, TRANSPORTATION, COMPREHENSIVE INSURANCE, ERECTION, TESTING AND COMMISSIONING, AND CONDUCTING PERFORMANCE GUARANTEE (PG) TEST OF THE UNITS AND HANDING OVER OF THE PROJECT WITHIN 27 MONTHS FROM ZERO DATE / 11.11.2010. **SITE INFORMATION** a) LOCATION : AT. BHILAI DIST DURG STATE CHHATTISGARH b) LONGITUDE : 81° 26' E c) LATITUDE : 21° 13' N d) NEAREST RAILWAY STATION : BHILAI POWER HOUSE & DURG e) NEAREST TOWN : BHILAI DIST DURG STATE CHHATTISGARH f) NEAREST SEAPORT : g) NEAREST AIRPORT : RAIPUR, 25 KILOMETERS h) ACCESS ROAD : WELL CONNECTED WITH NH - 6
1.2	**CLIMATIC CONDITIONS** 1. **SEISMIC DATA** a. SEISMIC INTENSITY : AS PER IS: 1893-2002 b. ZONE : II **2. TEMPERATURE** a. MINIMUM **10**° C, MAXIMUM45° C

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

2.0 SCOPE OF WORK

Part –A

Control and Instrumentation:

Contractor may tie up with separate suitable agency/agencies for carrying out Electrical Package work.
However before deploying such agencies on job, the Contractor shall obtain approval of BHEL Construction Manager in writing.

2.0.0 Scope of work involving Erection, Testing, Commissioning, and Calibration.

2.1.1

The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship, engineering and construction management. The contractor should ensure timely completion of work. The contractor must have adequate quantity of tools, measuring instruments, calibrating equipment etc. in his possession. He must also have on his rolls adequately trained qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor should match requirement of sophistication involving microprocessor-based maxDNA systems.

2.1.2

The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

2.1.3

All the work shall be carried out as per the 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.

2.1.4

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

2.1.5

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

2.1.6

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

2.1.7

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

2.1.8

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

2.1.9

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

2.1.10

The contractor's scope of work is further described in the clauses hereafter:

2.1.11

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

use. Necessary drying oven / portable oven shall be provided by the contractor at his cost.

2.1.12

The scope of work under this tender specification covers transportation, calibration, erection, testing and commissioning, etc. of control / instrumentation and electrical equipments of the following packages.

A. Turbo blower Control & Instrumentation and its auxiliaries

Digital distributed microprocessor based maxDNA system panels consist of EHTC protection and monitoring,

B. Station C&I / Balance of Plant

Digital Distributed microprocessor based maxDNA system panels for Balance of Plant controls, consisting of Open Loop and Closed Loop controls, interlock and protection systems for various HT, LT, pneumatic, hydraulic drives, remote multiplexed signal acquisition, alarm processing, MMI including computers and accessories, computer furniture, control desk, instrumentations, cabling, etc, etc.

2.1.13

Equipments /instruments required to be erected for this work, though not limited to but are generally as per rate schedule. For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However the payment of these items/class of work shall be regulated as per the General Condition of the contract.

Contractor shall provide necessary resources for completion of such work within the stipulated time schedule. Value of such work shall be included while computing the total value of work finally executed for all contractual purposes, particularly for contract variation purpose.

2.2.0 Collection of materials

2.2.1.1

The contractor shall take delivery of equipment, materials from the storage yard/ stores/sheds of BHEL/customer. He shall also make arrangements for verification of equipment, safe custody, watch and ward of equipment after it has

been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should note that the transport of equipments to erection site, assembly yards etc. should be done by the prescribed route in the most professional manner without disturbing other ongoing works of various contractors. Special equipments such as laboratory equipments, measuring and control equipments, gauges, panels, console inserts, switches, transmitters, controllers, power cylinders, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions. The contractor should also note that while taking delivery of materials from BHEL stores (open/closed), it may be necessary to handle other items which could be blocking the exit route of the materials. *This aspect shall be taken care of in the quoted rates and no extra payment shall be done in this regard*. It shall be the contractor's responsibility to arrange necessary cranes/tractors, trailer, trucks, slings, labour, etc., etc., for transport of equipment.

2.2.1.2

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

2.2.1.3

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

2.2.2

Void

2.2.3

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

2.2.4

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

2.2.5

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

2.2.6

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

2.2.7

The contractor shall collect all scrap materials periodically from various levels of power house, working area of the power station, auxiliary and piping around power station and collect the same at one place earmarked for the same. Loads of scraps are to be shifted to a place earmarked by BHEL. 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. **1% value of each RA bill will be earmarked against compliance of the above, to be released only on satisfactory collection and deposit of scrap as stated above. In case of failure of contractor to comply with this requirement, BHEL will make suitable arrangement at contractor's risk and cost. In such case, any expenditure over and above the withheld 1% amount will also be recovered suitably from the RA bills of vendor.**

2.2.8

All the surplus, damaged, unused materials, package materials, containers, special transporting frames, gunny bags etc. shall be returned to the BHEL stores/customer's stores by the contractor.

2.2.9

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

2.2.10

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

2.2.11

Contractor shall plan and transport equipments/components from storage yard/sheds to erection site and erect them in such a manner and in a sequence that material accumulation at site should not lead to congestion. Materials shall be stacked neatly, preserved and stored in the

contractor's shed and work areas in an orderly manner. It may be specifically noted that the space available for putting up the thermal power plant is limited and accumulation of material may lead to the necessity of shifting and restacking the materials to enable other agencies to carry on with their work or to comply with customer's requirements. If required, the contractor shall arrange shifting of surplus material expeditiously failing which the same will be arranged by BHEL and all charges together with departmental charges at 30% will be recovered from his bills.

2.2.12

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

2.2.13

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

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

2.2.14 <u>Troubleshooting during plant operation</u>

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

2.2.15.0 Pre-commissioning / commissioning and post commissioning activities

2.2.15.1

The work is also inclusive of various commissioning activities of the turbine package along with its auxiliaries and BOP package. The various activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer/consultant/ statutory authorities like boiler inspector, electrical inspector etc.

2.2.15.2

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

2.2.15.3

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

2.2.15.4

The pre-commissioning activities will start prior to rolling of turbine and various trials, commissioning operations shall continue till the unit is handed over to customer. Simultaneous commissioning activities will be in progress in various

areas, checking of equipments erected, making ready for trial runs, alkali flushing, chemical cleaning, mass flushing etc. All these works need specialised gangs including electricians/instrument mechanics in each area. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted.

The mobilisation of these commissioning gangs shall be such that planned activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T&P are not arranged then BHEL shall make alternate arrangements and necessary recoveries with overhead cost will be made from the bills of the contractor.

2.2.15.5

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

2.2.15.6

In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning or at any stage, the same has to be rectified by the contractor at his cost. If any improvement /repair /rework/rectification/ fabrication/ modification due to design improvement/ requirement are 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 Special Conditions of Contract.

2.2.15.7

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

2.2.15.8

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

2.2.15.9 Commissioning

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

2.2.15.10

It shall be specifically noted that contractor manpower may have to be engaged round the clock simultaneously at different areas and hence considerable number of personnel and their overtime payment may be involved. This aspect must be considered by the contractor while quoting their rate. No additional compensation by for the same shall be payable, irrespective of number of persons engaged or number of working hours per day.

2.2.15.11

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

2.2.15.12

Certain systems may be supplied with portable programming units, which are to be connected at various locations during pre-commissioning to handing over. Necessary cabling interconnecting the programming units and other connected panels has to be carried out by the contractor and are to be dismantled after

work. For the purpose of testing, monitoring, commissioning, etc., these programming units will have to be repeatedly connected and disconnected at various locations. These will be considered as part of commissioning activities and no separate payment will be entertained for the above.

2.2.15.13 Calibration, Testing & Commissioning

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

A. <u>Calibration</u>

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

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

- Preparation of computerised calibration certificates in the formats specified by BHEL Engineers and getting those signed by the customer is in the scope of the contractor.

B. Erection

- Drawl of material from store, verification, inspection as per shipping list, drawings and documents.
- Preservation, up keeping, safe custody of the erected equipments till handing over to the customer.
- Verification of installation as per drawing and document for the correctness of cabling, JBs, impulse pipe, various field device, panels, instruments etc.
- Continuity check and IR value check of cables.
- Verification of correction of cable termination with respect to instrument, electrical hook-up diagram, panel interconnection diagram, JB schedule.
- Checking earthing of the equipments and cable shield wire continuity.
- Energizing the functional group control panels and field devices.
- Flushing of impulse pipe before making the instruments process connections through.
- Any leakages, damages to impulse pipe, field device connections, air connections etc. Shall be fully attended by contractor.
- All cable glands/piping/tubing to be fixed as per installation requirement before commissioning.

C. Testing, Commissioning & Trial Operation

- Checking/verification of binary/analogue input and output signal from field and panel and up to recording/indicating instrument/HMI monitors.
- Adjustment, testing, calibration of pneumatic drive (control valve, trip valve, power cylinder for gate/dampers), electrical actuator operated valve/gate/dampers of other functional elements.

- Checking the operating electrical/pneumatic drive through functional group panel, remote control desk, HMI, CRT operation and repeatability and smooth operation to be checked.
- Checking the interlock, protection and alarm for various processes by simulation of field devices/process changes.
- Functional check of sub-loop control, sub group control and auto loop and fine tuning.
- Adjustment of limit switches/feed back position transmitter checking the actuator for correct Limit switch operation for correct position indication and repeatability shall be ensured.
- Bearing/winding RTD checking, providing assistance for trial run of motor which includes monitoring temperature rise winding/bearing during trial run.
- Contractor shall prepare calibration/testing report/protocols.
- During trial run of various systems, if the performance of any instrument is found erratic, un-satisfactory and requires re-adjustment, re-calibration etc., and the defect shall be attended by contractor.
- Observing and checking the performance of the various devices on load/process variation. Any deficiencies/defect noticed during the variable load conditions, the same should be attended properly.
- Observe the proper functioning of sub-group/sub-loop control.
- Check the operation of various controls in manual/auto mode for smooth functioning.
- Clearing of all bad / invalid signals noticed during commissioning.
- Providing necessary assistance for **Trial Operation** of the unit is in scope of this specification. Trial Operation shall be considered successful on completion of operation of the respective units for a continuous period of 720 hours at maximum available load. Out of this period, 72 hours shall be at full rated load of the unit. Smooth operation and availability of all instrument/controls of the systems installed under the scope herein, shall be ensured by the contractor. Contractor shall provide adequate number

of skilled manpower and T&P for this purpose. Interruption in Trial Operation for reasons attributable to the Contractor shall result in re-start of the Trial Operation all over again, consequential extension in Time Schedule / Contract Period shall be to the contractor's account.

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

D. Post-commissioning

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

E. PG Test Assistance

In case PG test is to be conducted, laying of impulse pipes, cables, etc. and installation of instrument tapping points shall be done by the contractor. Payments will be made as per item rates of comparable similar or identical items in the rate schedule. Such temporary installations shall have to be dismantled and returned to BHEL Stores, after the completion of PG Test for which no separate payment is admissible.

2.3.0 Brief description of work

2.3.1 Installation of Cable trays/cable ducts

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

2.3.1.2

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

2.3.1.3

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

2.3.1.4

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

2.3.1.5

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

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

2.4.1

Cable laying includes cutting to the required length, laying in overhead/underground cable trench/through pipes/flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JBs,

providing PVC numerical/alphabetical / printed ferrules, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, providing identification PVC/aluminium cable tags (at both the ends and at 15 m intervals throughout the route length and also at each bend), continuity checking, insulation resistance checking, high voltage test on HT cables.

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

2.4.2

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

2.4.3

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

2.4.4

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

2.4.5

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

2.4.6

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

2.4.7

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

2.4.8

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

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

2.4.9

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

2.4.10

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

2.4.10.1

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

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

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

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

2.4.11 Terminal Connections:

The types of cable terminations are generally as detailed below:

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

1) All field cables in SG package are crimp type of different sizes.

2) All JBs are both side screw type.

3) All console tiles wiring: screwed or plug-in type to be fabricated at site.

2.5.0 Junction Boxes:

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

2.6.0

Laying of pipes and tubes (impulse pipe & instrument air pipe)

2.6.1

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

2.6.2

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

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

2.6.3

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

2.6.4

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

2.6.5

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

2.6.6

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

2.6.7

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

2.6.8

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

2.7.0 Structural steel for fabrication and installation

2.7.1

Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied in running meters and same shall be used for fabrication of panel base frame, cable tray supports, canopies, instrument and junction box frames, impulse pipe/instrument air pipe supports and instruments etc.

2.7.2

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

2.7.3

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

2.7.4

Frame installation/cable tray accessories' installation at site may involve mounting either on concrete floor by grouting/using anchor fasteners or on steel

structure by welding etc. All consumables including anchor fasteners shall be arranged by the contractor**.**

2.7.5

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

2.7.6

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

2.8.1 Installation of panels

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

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

2.8.2

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

2.8.3

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

2.8.4

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

2.8.5

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

2.8.6

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

2.8.7

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

2.8.8

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

2.8.9

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

2.8.10

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

2.9.0 Control panels

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

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

2.10.0

Field instrumentation

2.10.1

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

2.10.2

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

2.10.3

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

2.10.4

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

2.10.5

Wherever thermowells are supplied along with temperature gauges, thermocouples, temperature switches, thermostats, etc., the contractor has to co-ordinate with the mechanical contractor for identification and fixing of thermowells on the pipeline. However actual fixing of thermowells on pipeline and seal welding shall be done by mechanical contractor and is not a part of instrument installation.

2.10.6

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

2.10.7

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

2.10.7.1

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

2.10.8

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

Recalibration Charges = 60% of the Percentage Stage Payment for Calibration as per split-up defined in Terms of Payment (Chapter-7)

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

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

2.10.9

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

2.10.10

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

2.11.0 Unit control desk and components

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

Console Inserts shall be supplied either mounted on console grid or supplied loose. Also, the items (indicators, pushbuttons, etc.) of the console insert may be supplied mounted in the console insert or may be supplied loose. The lump sum rates quoted for console inserts should take the above into consideration. No separate payment will be done for the erection of individual components of console inserts. However, for the other items like recorders, indicators, etc., unit

rate shall be applicable. Alarm facia on the control desk may be supplied mounted or loose. Mounting these, if required, will not attract any extra payments. The commissioning of these will constitute a part of the panel commissioning from where the alarm is driven.

2.11.2

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

2.11.3

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

2.11.4

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

2.12 Final painting

A. The contractor shall provide all the primer, paint, and other consumables like brush, cleaning agents etc. All T&P, manpower, supervision is in contractor's scope. Painting shall be carried out as per colour scheme approved by BHEL/ BHEL customer.The quoted rates should be inclusive of all these including supply of paints and consumables.

B. All metal parts of the equipment including supports, structures, etc., as applicable shall be painted after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc, by wire brush, scrapping, sand blasting/ shot Blasting (**as applicable**) etc; as specified in relevant erection documents. Primer and paint

shall be sourced only from the following manufacturers or any other manufacturers approved by BHEL.

Berger Paints (I) Ltd.
Asian Paints ltd.
GoodlassNerolac Paint Ltd.
Jenson & Nicholson Ltd.
Shalimar paints Ltd.

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

C. All the fabricated frames, instrument racks, Junction box frame, trays / impulse pipes, supports, panel base frame, etc., wherever applicable shall be first painted with one coat of primer paint (metal red oxide) and then two coats of synthetic enamel paint of approved shade (decided by BHEL Engineer). All the weld joints of GI cable trays and GI structural members shall be applied with a coat of cold galvanising zinc paint. Paint, etc shall be arranged by contractor at his cost.

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

2.13.0 Misc. Other instrument/equipment erection, calibration and commissioning.

2.13.1

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

2.13.2

The copper tubing work from the instrument line header to the powercylinder and the internal connection to be carried out by the contractor as per site requirement. Necessary security against pilferage is to be arranged by contractor.

2.13.3

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

2.13.4

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

2.13.5

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

2.13.6 VOID

2.13.7

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

2.13.8

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

2.14.0 Guidelines for erection

2.14.1 Impulse Pipelines

2.14.1.1

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

2.14.1.2

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

2.14.1.3

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

2.14.1.4

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

2.14.1.5

Supports for piping and tubing shall be adequate and in no case exceed limits shown below:-

A) 1/4" OD / 3/8" OD copper	continuous
B) 1/2" NB pipe/tube	5 ft.
C) 3/4" NB pipe/tube	5 ft.
D) 1" NB pipe/tube	8 ft.

2.14.1.6

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

2.14.1.7

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

2.14.1.8

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

2.14.1.9 Testing

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

2.14.1.10

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

2.14.1.11 Air Piping

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

2.14.1.12 Pneumatic Signal Lines

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

2.15.1 Electrical cabling /wiring

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

2.15.1.1

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

2.15.1.2

Insulation test of the various circuits shall be done.

2.15.1.3

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

2.15.1.4

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

2.15.1.5

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

2.15.1.6

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

2.15.1.7

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

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

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

2.15.1.8

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

2.15.1.9

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

2.15.1.10

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

2.15.1.11

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

2.15.1.12

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

2.15.1.13

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

2.15.1.14

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

2.15.1.15

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

2.15.1.16

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

2.15.1.17

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

2.15.1.18

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

2.15.2.0 Earthing installations

2.15.2.1

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

2.15.2.2

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

2.15.2.3

A continuous earthing conductor shall be installed in all cable trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run in parallel, a continuous earthing conductor shall be provided on trays only with tap offsto the control cable trays. All valve and damper motors and rapping motors will be earthed to this conductor.

2.15.2.4

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

2.15.2.5

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

2.15.2.6

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

2.15.2.7

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

2.15.2.8

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

2.16.0 Instruments and equipments

2.16.1

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

2.16.2

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

2.16.3

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

2.16.4

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

2.16.5

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

2.16.6

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

2.16.7

Contractor shall arrange for own fire fighting equipments for the materials stored under contractor's custody.

2.17.0

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

2.17.1

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

2.17.2

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

2.17.3

Cases should be opened/unpacked using correct nail pullers. While opening the planks, care should be taken to see that equipment inside is not damaged. Cases should not be unpacked in areas where they are exposed to rain, water/liquid splashing, dust or other harmful materials like chlorine gas, sulphur dioxide etc.

2.17.4

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

2.17.5 Hinged frames should not be opened when equipment is not securedto floor as this is likely to cause it to topple over. The hinged frame can be opened only if the equipment is still fixed on to bottom wooden pallet.

2.18.0 Storage

2.18.1

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

2.18.2

The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinkinginto around and to circulate air under the stored equipment. This will also help in lifting packing with fork-lifter.

2.18.3

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

2.18.4

Due care should be taken to ensure that the equipment is not exposed to fumes, gases etc., which can affect electrical contacts of relays and terminal boards.

2.18.5

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

2.18.6

All the equipments, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site engineer.

2.18.7

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

2.19.0

Sub-assemblies

2.19.1

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

2.19.2

Subassemblies should have a protective cover in case it is stored without wooden packing/case to prevent accumulation of dust. Silica gel packets should also be kept along with it.

2.19.3

Subassemblies should not be stacked one above the other.

2.20.0 Loose items

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

2.21.0 Guidelines for handling of electronic modules

2.21.1 All the modules shall be handled by qualified persons only.

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

2.21.3

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

2.21.4

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

2.21.5

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

2.21.6

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

2.21.7

Soldering irons and any other tools used must be grounded.

2.21.8

All modules using CMOS components are packed in antistatic bags when transported loose to avoid ESD failures. The antistatic bags must always be used to transport modules at site from one place to the other.

PART –B

Electrical:

3.0 **SCOPE OF WORK**

The scope of work under the specification broadly covers the receipt of materials from BHEL/customer stores/storage yard, handling at stores/storage yard, transportation to site of work, preassembly, erection, testing, pre-commissioning tests and checks and handing over of **Main Plant Electrical System**& Associated items .

LT Switchgear, Cabling package and associated equipments & Associated Auxiliaries for the following: -

1. CABLE TRAY.
2. LT POWER CABLES (Generally Unarmoured),LT CONTROL CABLES (Generally Unarmoured, Screened or Unscreened).
3. JUCTION BOXES AND PUSH BUTTON.
4. STRUCTURAL STEEL.
5. SWITCHGEARS / MCC /PCC
6. STARTER PANEL/LOCAL STARTER BOXES/POWER DISTRIBUTION BOXES /MARSHALLING BOXES..
7. ONLY TESTING & COMMISSIONING.

8. OTHERS EQUIPMENTS.

2.1 GENERAL REQUIREMENTS

2.1.1
The intent of specification is to procure services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the contractor of the responsibility of providing such facilities to complete the work without any extra compensation.

2.1.2
The contractor must have the experience of erection of identical work in the past as specified in the tender documents and must have executed contract of similar nature. The contractor must furnish enough evidence to establish his capacity in erection, testing & commissioning of similar equipments covered under this specification

2.1.3
The contractor will have following valid certificates.

A) The contractor should have a very good engineering background and capability of carrying out erection & commissioning work as specified in this tender document.

2.1.4
The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, erection, calibration, testing, air flushing, pre commissioning tests, commissioning of systems, trial run of various auxiliaries and equipments, achieving various milestones till handing over of the unit to BHEL's customer. The work shall conform to dimensions and tolerances specified in various drawings that will be provided during the erection. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by engaging other agencies or departmentally and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges.

2.1.5
The terminal points decided by BHEL shall be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.

2.1.6
The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's customer, customer's consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole.

2.1.7
The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful & timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, modern / latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.

2.1.8
Contractor shall erect, align and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL engineer's decision regarding correctness of the work and method of working shall be final and binding on the contractor. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods / sequences adopted in erection of similar sets elsewhere.

2.1.9
All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory authorities are to be arranged by the contractor expeditiously at his cost in time to ensure smooth progress of work.

2.1.10
The work shall conform to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to contractor's fault, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the contractor's bills towards expenditure incurred including cost of materials and 30%departmental overheads of BHEL.

2.1.11
BHEL reserves right to recover from the contractor any loss, which arises out of undue delay/discrepancy/shortage/damage or any other causes due to contractor's lapse during any stage of work. Any loss to BHEL due to contractor's lapse shall have to be made good by the contractor.

2.1.12
All transport equipment, handling equipment, tools, tackles, fixtures, equipment, materials, manpower, supervisors/engineers, consumables etc., except otherwise specified as BHEL scope of free issue, required for this scope of work shall be provided by the contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies.

2.1.13
During the course of erection, testing and commissioning certain rework / modification / rectification / repair / fabrication etc., may become necessary on account of feedback / revision of drawing. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repair etc., promptly and expeditiously. Daily log sheets signed by BHEL engineer and indicating the details of work carried out, man-hours etc. shall be maintained by the contractor for such reworks.

2.1.14
All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc., as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rates.

2.1.15
The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work (excepting those specifically included in BHEL scope). However, necessary steel will be provided from the scrap / surplus materials available at site.

2.1.16
The contractor shall take delivery of the components, equipments, chemicals, lubricants etc from the BHEL stores/ storage area after getting the approval of BHEL engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically.

2.1.17
Contractor shall plan and transport equipments, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly,

preserved and stored in the contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas/ site to enable other agencies to carry out their work or for any other reason, contractor shall do it most expeditiously. No claim for extra payment for such work will be entertained.

2.1.18
The contractor shall take delivery of equipment, materials from the storage yard/ stores/sheds of BHEL/customer. He shall also make arrangements for verification of equipment, transportation up to site of work, 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 the customer. The contractor should note that the transport of equipments to erection site, assembly yards etc. should be done by the prescribed route without disturbing the other works and contractors and in the most professional manner. Special equipments such as measuring and control equipments, panels, electronic items, SF6 breakers, switches, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions.

2.1.19
Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.

2.1.20
The services, tests and support to be provided by the agency for the work mentioned in various sections of this tender are indicative and not exhaustive, and not limited to these for completion of the work in all respects.

2.1.21
The weight & dimension as mentioned against the individual items in Price Bid /Rate Schedules or elsewhere in the tender specification are indicative approximate and there may be variation in dimension & weight in actual supply of equipment. No rate variation shall be considered on this account.

2.1.22
The scope of work & description of system / equipment as given in the various clauses of this tender specification and rate schedule are only for understanding the system requirement, contractor shall note this point and assess the volume of work prior to submit the offer.

2.1.23
The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on

completion of work as per BHEL engineer's instructions. The machined surfaces/finished surfaces should be greased and covered.

2.1.24
At all stages of work, equipments/materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL.

2.1.25
The contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipments from theft/fire/pilferage and any other damages and losses.

2.1.26
The contractor shall collect all scrap materials periodically from various levels of powerhouse, working area of the power station, auxiliary and piping around power station and collect the same at one place earmarked for the same. Loads of scraps are to be shifted to a place earmarked by BHEL. 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. **1% value of each RA bill will be earmarked against compliance of the above, to be released only on satisfactory collection and deposit of scrap as stated above. In case of failure of contractor to comply with this requirement, BHEL will make suitable arrangement at contractor's risk and cost. In such case, any expenditure over and above the withheld 1% amount will also be recovered suitably from the RA bills of vendor.**

2.1.27
The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores by the contractor.

2.1.28
The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/excess utilization of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.

2.1.29
For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL.

2.1.30

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

2.1.31
The contractor shall handover all parts/materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirements, BHEL reserves the right to recover the cost of parts/materials used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

2.1.32
The contractor should take all reasonable care to protect equipment and materials under his custody either in his stores or at site. Copper tubing, brass fittings, brass valves etc.Forming an integral part of equipment or system are liable to greater damages/pilferages /theft / losses. It will be responsibility of contractor to arrange for adequate security round the clock for protection from such damages/pilferages/theft/losses.

2.1.33
The contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are erected in position.

2.1.34
Overhauling, cleaning, revisioning, servicing of equipments during erection and commissioning stages will be arranged by the contractor. All equipments shall be preserved and protected before and after erection as per the advice of BHEL engineer.

2.1.35
Substantial portion of cable laying & termination shall be done by other agencies for the equipment covered under this tender specification. The glands & lugs shall be supplied either loose or fitted with the equipments. Contractor shall take care of this aspect at the time of receipt of the equipment from BHEL stores. Contractor shall account for the quantities received with equipments and shall hand over the same to cabling agency under intimation to BHEL Engineer. Contractor shall extend all necessary help & co-ordinate with the cabling agency during the course of work.

2.1.36

Contractor will be required to maintain in his site office at least one PC along with minimum accessories like printer, etc to enable him to carry out site activities in a planned, well coordinated and smooth manner.

2.1.37
Contractor shall prepare Marked-Up drawings incorporating modifications and deviations from original drawings or prepare fresh sketch for actual installation / connection details if need be, that can be converted to "As-built" drawing.

2.2 TESTING, PRE-COMMISSIONING, AND POST COMMISSIONING:

2.2.1
The contractor shall perform various activities during pre-commissioning, integrated testing, post-commissioning stages of equipment covered under this tender specification. It is responsibility of contractor to arrange tools & plants, test equipments, experienced engineers and technicians. Contractor shall earmark separate manpower for respective commissioning areas and they shall not be disturbed /diverted for other work. The contractor's commissioning group shall work as per the instruction of BHEL Engineer and they shall coordinate day-to-day activity with other agency and BHEL/ Customer. The testing activity may have to be repeated till satisfactory results are obtained and also to satisfy the requirement of Customer / statutory Authority.

2.2.2
The contractor shall simultaneously start testing & commissioning activities for equipments to match the mile stone activities of the project.

2.2.3
The mobilization of these commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and work undertaken round the clock if required. It is responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools & tackles / testing equipments with BHEL Engineers and arrange for the same. If at any time the requisite manpower, consumables, testing equipments etc are not arranged then BHEL shall make alternative arrangements and necessary recoveries with overhead cost will be made from the running bills.

2.2.4
Contractor shall cut/open work, if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.

2.2.5

It shall be specifically noted that the contractor may have to work round the clock and in shifts during the pre-commissioning and commissioning period along with or without BHEL engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.

2.2.6
In case any rework/ repair / rectification/ modification / fabrication etc is required because of contractor's faulty workmanship which are noticed during the commissioning of, at any stages, the same shall be rectified by the contractor at his cost. If during the commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement is required, the same shall be carried out by the contractor promptly and expeditiously.

2.2.7
During the commissioning activities and carrying out various tests, if any of temporarily work such mounting of test equipments / cabling etc are required, the contractor shall carry out such work without any extra cost. The same shall be removed after completion of the activity.

2.2.8
During this period, though BHEL/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required Tools & Plants, Consumables, Scaffolding and approaches etc., till such time the commissioned unit is taken over for trial operations.

2.2.9
The contractor shall carry out any other tests as desired by BHEL engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the contractor.

2.2.10
The pre-commissioning activities will start in a phased manner to meet the various milestones and shall continue till equipments are commissioned fully with all connected equipment / devices or handed over to customer for regular operation. In this duration other erection activities such as cabling etc., shall be carried out by other agencies even though equipments are partially commissioned / charged. In order to co-ordinate the work such as issue of safety permit, normalization and compliance of other requirement, contractor shall keep team of experienced engineer, supervisor, technician and helper in each shift as decided by BHEL Engineer. The team shall take instruction from BHEL Engineer for day-to-day work and shall not be diverted for other work. No extra payment shall be made for their services.

2.3 WELDING, NON-DESTRUCTIVE TESTING ETC.

A) Installation of equipment involves good quality welding, NDE checks etc.

B) Welder deployed for aluminium welding shall have experienced and approved by BHEL and BHEL's Customer after due qualification process/testing.

C) Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.

D) All the welders shall be tested and approved by BHEL engineer/ Customer's quality engineer before they are actually engaged on work though they may possess IBR/other certificate. BHEL reserves the right to reject any welder without assigning any reason.

E) The welded surface shall be cleaned of slag and painted with primer paint to prevent corrosion. For this paint will be supplied by the contractor.

F) Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.

G) Certain types of coated welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the coated welding electrodes have to be carried in portable ovens.

2.4 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

2.4.1
For all payment purposes, measurement shall be made on the basis of the actual execution of work in line with drawings/documents/site requirements. Physical measurements shall be made by the contractor in the presence of the Engineer.

2.4.2
The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc., shall be made on the basis of length actually laid.

2.4.3
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.

2.4.4
All materials returned to stores should carry aluminium tag indicating the size and type. Cables more than 15 meters length is 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.

2.4.5

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 reconciliation shall be done and allowable scrap quantity calculated as per wastage allowance percentage specified above. 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.

2.4.6

For all site-fabricated steel items such as supports, racks, frame, 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.

2.4.7

Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard Performa prescribed for this purpose by the site in charge.

2.4.8

Same as clause no.: 2.4.10.1 of Part –A, Control and Instrumentation

2.4.9

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

2.4.10

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 and the type of cable required for various destinations, the cable drums shall be suitably selected for cable laying. Any jointing shall have to be approved by BHEL engineer. All the cut pieces/bits of cables, which are not used, shall be returned to the purchaser for accounting towards wastage. The cables damaged by the contractor shall have to be replaced by the contractor at his own cost.

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

Non - Salvageable scrap means the lengths of tubes, pipes, multi core cables, cables

etc., and they are from cut-pieces of tubes, pipes, multi core cables, cables etc., that cannot be used at all one time or other.

2.4.11
The rate of laying for LT power, control and signal cable is inclusive of glanding and termination at both ends. Glands & Lugs above 4sq mm shall be supplied by BHEL Lugs up to 4 sq mm shall be in vender's scope. **The LT Power Cable straight through Jointing Kit (if required) shall be in Vendor's scope of supply. The rate for erection will be part of laying rates. No separate rate is applicable on this account.**

The unit rates for the HT cable termination are exclusive of unit rates for laying of HT cables. Glands & termination kits for HT cables (3.3KV and above) shall be supplied by BHEL.

2.5 FINAL PAINTING

A. The contractor shall provide all the primer, paint, and other consumables like brush, cleaning agents etc. All T&P, manpower, supervision is in contractor's scope. Painting shall be carried out as per colour scheme approved by BHEL/ BHEL customer.

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

Berger Paints (I) Ltd.
Asian Paints ltd.
GoodlassNerolac Paint Ltd.

Jenson & Nicholson Ltd.
Shalimar paints Ltd.

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

C. All the fabricated frames, racks, supports, panel base frame etc. wherever applicable shall be painted with two coats of primer and followed by two coats of paint as specified earlier herein. In case of G I Structure, The cold galvanizing paint to be applied as touch up where ever needed. This is to be done as per instruction of BHEL engineer. The Paint required for this purpose is in scope of Contractor
D. Touch-up painting of LT MCC \ Control Panels or any other equipment /devices wherever necessary.
E. The primer shall be compatible with the final coat paint schedule.
F. Full (Spray) painting of transformers, bus ducts with two coats of paint as per specification
G. Supply of paint, primers, other consumables etc for above and any other scope in these specifications shall be in Contractor's scope.
H. Irrespective to scopes of painting & supply of paint mentioned elsewhere it is to be noted that supply of paint, primers, other consumables etc for all primer/painting works to be done by the contractor, shall be in Contractor's scope. No dispute shall be entertained on the above matter.
I. Colour Banding, Legend and Identification Marking, Direction marking etc. shall be in scope of the contractor.

2.6

Same as clause no 2.2.13 of Part –A Control and Instrumentation

2.6 Troubleshooting during plant operation

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

2.7

Equipments / instruments etc., under the above scope of erection and commissioning are generally dispatched from BHEL's manufacturing units / vendor's works at site well before start of erection. Sometimes, such dispatched materials may get stuck up with transporters/railways. The contractor shall provide support / manpower for necessary chase up for removal of such

bottlenecks in transportation. Also, for smaller items, it could be necessary to depute his person to personally carry certain items from works to site. Requirement of such activities, which will be decided by BHEL engineer and chase up activities, if required, shall be performed under authorization by BHEL. The above services shall be provided within the quoted rates.

2.8 STATUTORY CLEARANCES

1.Contractor should have / Obtain valid Electrical Contractor-ship License to carry out the Erection, Testing & Commissioning work on High / Low Voltage electrical equipments from the appropriate statutory authority of concern state or Central Electricity Authority, as the case may be. All fees and expenses in this regard shall be in the contractor's account.

2.Contractor shall arrange inspection of concerned Statutory Authority for the installation, testing & commissioning of High / Low voltage equipment covered under this tender specification and obtain their approval in appropriate format prior to charging of the equipments.

3. Contractor shall be responsible for all necessary liasioning work with Statutory Authority towards the certification of installation / works. BHEL shall reimburse Statutory Fees as per actual on submission of original receipt, however all incidental expenses shall be borne by Contractor. BHEL/ BHEL's Customer shall be providing technical assistance, drawing & document for submission to Statutory Authority. Contractor shall provide all logistics services in this regard.

4. The installation of all electrical equipments shall be carried out only by persons holding valid certificates of Competency for the voltage classes as defined in this tender specification, issued by appropriate state or central Statutory Authority. Contractor shall submit the particulars of Licenses held by him.

5. The contractor has to arrange electrical license to work of the concerned state where the project being executed within a 6 weeks of mobilization at site for carrying out the works covered under this contract. Failure to arrange the requisite license shall invite levy of non refundable penalty at the rate of Rs 1.0 Lakh per month deductable from running bills till it is obtained.

2.9 The contractor's scope of work is further described in the clauses hereafter:

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

2.9.1 CABLE TRAYS/CABLE DUCTS

A Various types of sheet metal, galvanized cable tray, i.e. perforated, ladder type, sheet metal duct, solid bottom trays, pre-fabricated structural trays etc., will be

supplied in standard lengths along with accessories and hardware viz; coupler plate, tray covers and tray clamps etc.

B Installation of cable tray/cable duct shall include cutting, laying, jointing, fixing tee/reducers/ bends/clamps, fixing of tray covers, hardware, welding of tray supports as per tray route layout etc.

C **Fabrication of bends/tee/ reducers from straight length of tray is within the scope of work and rate quoted shall be inclusive in unit rate (in running meter)**. All site welds of cable trays shall be painted with approved primer and cold galvanizing paint, which shall be arranged by the contractor.

D **I**n case structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.

E Cable trays/duct etc may have to be routed underground in cable trench, over head on structure, along the walls, floors etc.

2.9.2 CABLE LAYING - (POWER / CONTROL / INSTRUMENTATION SHIELDED CABLES / PLUG-IN CABLES / DATA HIGHWAY, ARMOURED / UN-ARMOURED, SINGLE / MULTI-CORE, PVC / HR PVC / FRLS / TEFLON / XLP INSULATION)

1. Cable laying includes cutting to the required length, laying in overhead Cable racks / underground cable trenches, pipes, flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JBs, **providing printed ferrules (ferrule printing machines to be provided by contractor for printing necessary cross ferruling details) / PVC numerical / alphabetical ferrules (where printed ferrules not possible at all) machine engraved ferrules sleeve/ ferrule,** termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, crimp and soldered termination, plug-in connections with insert type crimping, providing identification cable tags of PVC/aluminium at both the ends and at appropriate interval (Approximately 30meters) throughout the route length, continuity checking, insulation resistance checking, high voltage test on HT cables. Contractor to arrange adequate numbers of his own ferrule printing machines.
2. Entry to the panels, JB's may be at top, side or bottom. All cable are required be supported and clamped near to the panel.
3. Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, cables may have to be lifted inside the panel by making large cut-out in gland plate and providing 4 or 6 inch PVC pipe coupling glands. These pipe coupling glands shall be supplied by contractor within the quoted rates of cable lying.

4. Copper tinned lugs of various types up to 4 sq mm conforming to IS: 694 (pin, ring, fork, snap-on) for cables, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/metal as per site requirement, clamping and dressing material such as suitable cable ties/ clamps etc with hardware, PVC sleeves etc. shall be supplied by contractor within the quoted rate for cable laying. **However trefoil clamps with hardware for Single core power cable shall be supplied by BHEL.** The quality and make of cable lugs shall be got approved from BHEL engineer prior to their use on job.
5. All care should be taken to avoid abrasion, tension, twisting, kinking and stretching of cables during installation.
6. Cable shielding – all signal cables are supplied with bare shielded copper wire/with braided wire shield. Generally, shield wire is kept isolated at instrument/field device end and continuity is maintained through JBs and earthed at panel end only. While terminating the shield wire in either panel or JBs, PVC sleeves are to be used to avoid two-point earthing.
7. Spare holes in the panels / Instruments / Actuators / Motors / JB's etc shall be sealed by suitable method by contractor. (The cost of work and Materials such as aluminium sheet or Adhesive tape / Plugs etc shall be within the quoted rates for laying of cables).
8. Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed. After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc. at his cost.
9. Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagram is to be done by contractor at no extra cost.
10. Contractor shall carefully plan the cutting schedule of each cable drum in consultation with BHEL site engineer such that wastages are minimized. Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.
11. **Unit rate quoted for cable lying shall include the activities as defined above from Sl. No. 1 to 11.**

2.9.3 JUNCTION BOXES/PUSH BUTTONS

1. Checking of installation for correctness.
2 Functional checking/ adjustment of JB / PBfor their system.

2.9.4 STRUCTURAL FABRICATION AND INSTALLATION

A INSTRUMENT/ JUNCTION BOX FRAME/ PANEL BASE FRAME / CABLE TRAY & MISC STRUCTURES FABRICATION

1. Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied in running meter and the same shall be used for misc fabrication if required and the same shall be used for fabrication of panel base frame, cable tray supports, Canopies for instruments/panels/ drives/JB's/Push Buttons etc., Instrument/Junction box frames, Impulse Pipe/Instrument Air Pipe supports and instruments etc.

2. This shall include cutting to size, contouring of ends for connections if required, welding, grinding of excess weld deposits/burrs, drilling of holes for mounting of device/instrument, installation at location, leveling, alignment, providing bracings and painting etc. No gas cut holes will be permitted.

3. All the fabricated supports/frames for instruments, trays, pipes, electrical equipments, etc., shall be epoxy painted after sand blasting / shot blasting (as applicable) and surface preparation as per painting specifications. Paints and other associated items are in the scope of the contractor.

4. Frame installation at site may involve mounting either on concrete floor by grouting / using anchor fasteners or on steel structure by welding etc. All consumables including anchor fasteners shall be arranged by the contractor. Where required, as part of work, concrete floors may have to be chipped out to reinforcement depth for anchoring the frames. Wherever grouting is required, contractor shall arrange all the required material including cement / grout mix, shuttering etc., necessary labour and meet all other requirements as part of work.

5. In case, structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.

6. In certain packages, members of frames/rack for mounting of junction boxes/ instruments may be supplied readymade. These have to be assembled prior to installation. The installation rate as quoted shall include assembly of the frames.

7. **Gas cutting of tray/impulse pipe support and holes in frame is not permitted. Only hacksaw cutting/ drilled hole shall be permitted.**

2.9.5 MCC & DC DISTRIBUTION BOARD ETC

1. Checking of installation for correctness.

2. Mechanical functional checking/ adjustment of individual breaker.
3. Measurement of Insulation resistance of individual breaker, complete switchgear board and combined insulation resistance of individual breaker with cable connected to drives.
4. Testing of Protection Relay, Thermal over relay, Power transducers, Energy/ Ammeters, Voltmeters, Power factor, frequency, tri-vector meters & metering etc. in static & dynamic condition relay.
5. Conducting test such as Insulation Resistance measurement, Ratio, polarity, magnetization characteristic, winding resistance on CT and PT.
6. Calibration of energy meters, tri-vector meters, voltmeters, ammeters, power current & voltage transducers etc.
7. Provide assistance for checking the electrical operation of individual breakers from remote panels / MMI package (max DNA system).
   Other than the above, minor testing / checks will also be involved in the generator area, which are also in the scope of the contractor. Any instruments / tools etc required for carrying out the above shall be arranged by the contractor within the quoted rates.

2.9.6 INSTALLATION OF PANELS (STARTER PANEL/LOCAL STARTER BOX/POWER DISTRIBUTION BOX / MARSHALLING BOX / CONTROL PANELS)

1. Electrical control panels, electronic control panels, 415 volt LT MCC's, are normally supplied in suit of either one/two/three or loose shipping sections with integral base frame or loose base frame. These panels may have to be installed as stand-alone or in-group consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.

2. The panels shall be transported from stores to the place of installation in vertical position. Care shall be taken such that the switches, lamps, instruments etc. mounted on the panel do not get damaged during transit.

3. Installation of panel shall include fixing of base frame, leveling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubical interconnection hardware, interconnection of bus bar /bus bar jointing, wiring interconnection, welding and grouting of panels and base frames, mounting of panel canopy wherever supplied as part of panel, drilling of gland plates, sealing of panels/ cable entries. Where the base frame is not supplied as part of panel supply, the contractor shall fabricate the base frame from structural items at site. Payment for such fabrication will be effected on measured quantity at the rate applicable for structural steel fabrication and installation. Proper sealing of all the holes and cable entries (even if the cable has been laid by others) in the panel is in the contractor's scope.

4. Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. This shall be a part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per

shortest route etc. Panels have to be erected at different locations and elevation in power house building, LT & HT switchgear room, unit control room etc.

5. Panel and instruments once erected in position should be properly protected using necessary care to prevent ingress of dust/moisture and rainy water. This will have to be periodically cleaned and surroundings have to be kept tidy.

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

7. **Normally the panels shall be supplied with meters, relays, electronic modules, and contactors, pushbuttons etc mounted and pre-wired. However, if such devices are supplied loose/separately for safety in transit, contractor shall mount the same as part of panel installation work and terminating the wires on devices. No extra payment shall be made for this.**

8. Supplier's instruction manuals, packing slips, door keys etc. received along with the panels will be handed over to BHEL's engineer on opening of the panels and record of receipt of such things shall be maintained by contractor.

9. Regular cleaning of the panels as per the instruction of BHEL engineer till handing over of the set to customer is to be carried out by the contractor free of cost.

10. Interposing Relays (24 / 48 Volt DC) along with mounting base shall be supplied separately for mounting in the various feeders of 11KV / 6.6 KV HT switchgear boards and 415 Volt MCC Board for uni-directional / bi-directional drives, solenoid valves. 2 Nos. interposing relay are required to be mounted in each feeder. Internal wiring for these relay shall be pre-wired in the feeders, wires to be terminated on relay terminals. Approximately quantity is 1700 Nos. Contractor shall mount the same and terminate the wire as part of panel installation work and no extra payment shall be made for this work.

2.9.7 SCOPE OF ABOVE GROUND EARTHING

2.9.7.1

The contractor shall carry out above ground earthing for all Electrical equipment, which may be erected by him, or some other agency. Different type of earthing materials shall be supplied and the contractor shall lay and connect the earthing materials as per site requirement and as detailed in drawings. Unit rate for earthing material shall be paid on running meter basis.

2.9.7.2

All equipment shall be earthed by two separate and distinct connections. Earthing

terminals will be available in all the equipment supplied by BHEL.

2.9.7.3

Generally risers are provided near the structure / equipment foundation, In case risers are not visible and buried below the foundation level, contractor shall carry out necessary earth excavation for connecting the above ground earthing strips. Wherever welding is involved necessary protective coating shall be applied on weld joints.

2.9.7.4

The earthing conductors shall be mild steel/G.I. strips/wires. All connections from the equipment to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the successful bidder.

2.9.7.5

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.

2.9.7.6

If the equipment is not available at the time of earthing conductor laying tap connections from the main earthing conductor shall be brought out up to slab equipment foundation level with at least 200 mm spare length left for further connections to equipment earthing terminals.

2.9.7.7

Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/IS code of practice IS 3043-1947 and Indian Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits.

2.9.7.8

Parts of all electrical equipment and machinery not intended to be live shall have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules and apparatus rated 240 V and below may have single earth connections.

2.9.7.9

If any outer shops and buildings as well as the electrical sub-stations and electrical rooms are also in contractor's scope, a ring main earthing system will be provided. Ring main earthing systems shall again be interconnected as a network to power plant main earthing mat. Internal earthing ring in the electrical equipment room provided by

the contractor whether equipment of the area is in their scope of not.

2.9.7.10

For different floors in a building, localized internal earthing ring shall be formed and connected to the ground earthing through vertical risers. The earthing mat shall be common to both power and lighting installations.

2.9.7.11

A minimum of two spare earth rings will be provided in each floor of the building for earthing future building.

2.9.7.12

Each RCC steel column of the building will be interconnected to the floor-earthing grid in basement/ground floor.

For protective earthing separate conductor shall be used for flow of earth fault current as elaborated below:

2.9.7.13

Contractor shall carry out minor civil i.e. chipping of floor (where earth strip is to be laid on floor), removal of topsoil for laying earth strip in switchyard area etc.

2.9.7.14

It is the responsibility of contractor to provide skilled manpower for periodic maintenance after the initial commissioning till handing over the system to customer. During this period the activities are to be carried out such as checking the electrolyte & specific gravity of individual battery, topping up of electrolyte, cleaning etc.

2.9.8 ELECTRICAL ACTUATORS:

The scope of Testing and Commissioning of electrically operated actuators for valves, dampers, gates, soot blowers etc., will include meggering, providing loop wire on actuator terminal block, adjustments of mechanical/ electrical or electronic position transmitters, setting of limit/torque switches, cable checking, internal wiring checking, local/remote operation from MCC & MMI package (maxDNA system), replacement of limit/torque switches if required.

2.9.9

Equipments / instruments etc., under the above scope of erection and commissioning are generally dispatched from BHEL's manufacturing units / vendor's works at site well before start of erection. Sometimes, such dispatched materials may get stuck up with transporters/railways. The contractor shall provide support / manpower for necessary chase up for removal of such bottlenecks in transportation. Also, for smaller items, it could be necessary to depute his person to personally carry certain items from works to

site. Requirement of such activities, which will be decided by BHEL engineer and chase up activities, if required, shall be performed under authorization by BHEL. The above services shall be provided within the quoted rates

Sl. No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1	***ESTABLISHMENT***			
3.1.1	***FOR CONSTRUCTION PURPOSE****:*			
A	*Open space for office (as per availability)*	Yes		Location will be finalized after joint survey with owner
B	*Open space for storage (as per availability)*	Yes		Location will be finalized after joint survey with owner
C	*Construction of bidder's office, canteen and storage building including supply of materials and other services*		Yes	
D	*Bidder's all office equipments, office / store / canteen consumables*		Yes	
E	*Canteen facilities for the bidder's staff, supervisors and engineers etc*		Yes	
F	*Fire fighting equipments like buckets, extinguishers etc*		Yes	
G	*Fencing of storage area, office, canteen etc of the bidder*		Yes	
3.1.2	***FOR LIVING PURPOSES OF THE BIDDER***			
A	*Open space for labour colony (as per availability)*		Yes	
B	*Labour Colony with internal roads, sanitation, complying with statutory requirements*		Yes	
3.2.0	***ELECTRICITY***			
3.2.1	***Electricity For construction purposes****of Voltage 415/440 V*			FREE
A	*Single point source*	Yes		At a distance of 1000 M from site (Distance is only estimated, it may vary upto an extent depending on site condition)
B	*Further distribution including all materials, Energy Meter, Protection devices and its service*		Yes	
C	*Duties and deposits including statutory clearances if applicable*		Yes	
3.2.2	***Electricity for the office, stores, canteen etc of the bidder***			Chargeable as per standard rate
A	*Single point source*		Yes	
B	*Further distribution including all materials, Energy Meter, Protection devices and its service*			**NA**

Sl. No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
C	*Duties and deposits including statutory clearances if applicable*		Yes	
3.2.3	***Electricity for living accommodation of the bidder's staff, engineers, supervisors etc***			
A	*Single point source*		Yes	
B	*Further distribution including all materials, Energy Meter, Protection devices and its service*		Yes	
C	*Duties and deposits including statutory clearances if applicable*		Yes	
3.3.0	***WATER SUPPLY***			
3.3.1	***For construction purposes:***			FREE
A	*Making the water available at single point*	Yes		In case of inadequate supply / non-availability of construction water from customer, contractor shall have to arrange construction water at his own expenses.
B	*Further distribution as per the requirement of work including supply of materials and execution*		Yes	
3.3.2	*Water supply for bidder's office, stores, canteen etc.*			
A	*Making the water available at single point*		Yes	
B	*Further distribution as per the requirement of work including supply of materials and execution*			**NA**
3.3.3	***Water supply for Living Purpose***			
A	*Making the water available at single point*		Yes	
B	*Further distribution as per the requirement of work including supply of materials and execution*		Yes	
3.4.0	***LIGHTING***			
A	*For construction work (supply of all the necessary materials)* 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
B	*For construction work (execution of the lighting work/ arrangements)* 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	

Sl. No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
C	*Providing the necessary consumables like bulbs, switches, etc during the course of project work*		Yes	
D	*Lighting for the living purposes of the bidder at the colony / quarters*		Yes	
3.5.0	***COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER***			
A	*Telephone, fax, internet, intranet, e-mail etc.*		Yes	
3.6.0	***COMPRESSED AIR wherever required for the work***			
3.7.0	***Demobilization of all the above facilities***		**YES**	
3.8.0	***TRANSPORTATION***			
A	*For site personnel of the bidder*		Yes	
B	*For bidder's equipments and consumables (T&P, Consumables etc)*		Yes	

Sl. No	Description PART II 3.9.0 ERECTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.9.1	*Engineering works for construction:*			
A	*Providing the erection drawings for all the equipments covered under this scope*	Yes		
B	*Drawings for construction methods*	Yes	Yes	*In consultation with BHEL*
C	*As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes*		**YES**	”
D	*Shipping lists etc for reference and planning the activities*	Yes		”
E	*Preparation of site erection schedules and other input requirements*		Yes	”
F	*Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments*	Yes	Yes	”
G	*Weekly erection schedules based on SL No. e*		Yes	”
H	*Daily erection / work plan based on SL No. g*		Yes	”
I	*Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.*		Yes	
J	Preparation of preassembly bay		Yes	
K	*Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself*		Yes	
L	*Arranging the materials required for preassembly*		YES	

A. TOOL & PLANTS

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

SN	Description	Minimum Quantity
I.	**MMD (Instruments)**	
01	Dead weight tester rated 400 and 700 kg/cm2 with weights and test gauge facility. Make 'Budenberg or 'Ravika'	1 no. Each
02	Oil temperature bath suitable to calibrate the instruments range 0 – 200 deg. C with standard temperature gauges and thermostatic control	2 nos.
03	Muffle furnace – 800 deg. C with standard temperature gauges	1 no.
04	Standard Pressure Gauges 12" dial size make "Budenberg" or "H Guru" or "Odin"	
	Minus 1 to 0 kg/cm^2 pressure gauge (vacuum gauge) 0 – 5 or 6 kg/cm^2 pressure gauge 0 – 10 kg/cm^2 – do – 0 – 25 kg/cm^2– do – 0 – 60 kg/cm^2– do – 0 – 100 kg/cm^2–do – 0 – 250 kg/cm^2– do – 0 – 600 kg/cm^2– do – 0.2 to 1 kg/cm^2 -- do --	1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no.
05	Manometers (+/-) 1000 mm water column with hand bulb for lab and small manometers for field purpose.	2 nos.
06	Manometer (+/-) 500mm mercury column with hand bulb for lab and small manometer for field purpose.	1 no.
07	Inclined manometer (+/-) 300 mm water column	1 no.
08	Portable air compressor with drier and regulator make "Toshniwal" / "Khosla" rated for 7 to 10 kg/cm2	2 nos.
07	Soldering iron "Soldron" make 25 watt	6 nos.
09	Vacuum pump	1 no.
10	Multimeters	
A) B) C)	Digital, 3 1/2 digit Motwane/HIL/Fluke Analogue: Motwane make Digital, 4 1/2 digit Motwane/HIL/Fluke	10 nos. 2 nos. 4 nos.

SN	Description	Minimum Quantity
11	Standard milliamps / millivolts source of reputed make. Range 0 to 50 ma and 0 to 100 mv	3 nos.
12	Insulation tester hand operated 250V / 500V / 1000V rated mains/battery operated	1 no. Each
13	DC power supply 0-50 VDC, 5 A make “Aplab” or equivalent (variable source)	5 nos.
14	Single phase variac 250 V, 8 amp	1 no
15	3 phase variac rating 5 amps	1 no.
16	Glass thermometer 0-120 deg. C, 0-200 deg.c and 0-600 deg. C	1 no. Each
17	Tong tester AC 5/10 and 25/60/300 amp of reputed make	1 no. Each
18	Tong tester DC 30/60/300 amp	1 no.
19	Low pressure calibrator	1 No
20	Tarpaulin fire proof	10 nos.
21	DC shunt 400 amp 75 mv	1 no.
22	Tachometer non-contact type 0 to 4000 rpm	1 no.
23	Industrial type vacuum cleaner	1 no.
24	RTD/Pt 100 source	2 nos.
25	Decade resistance box	2 sets.
26	Tele-talk 2 wire system	6 sets
27	Equipment and consumables for LPI/MPI test on impulse pipes	1 set
28	Function generator	1 no

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

Tentative List of Major T&P and MME to be deployed by the Contractor

A. A T&P FOR ELECTRICAL WORKS

SL. NO.	DESCRIPTION	QUANTITY
01	TRANSFORMER OIL PURIFICATION PLANT WITH VACUUM PUMP FOR EVACUATION TRANSFORMER ALONGWITH ACCESSORIES & HOSES. A) CAPACITY 6000 LTR. PER HOUR	NOS.
02	PRIMARY INJECTION KIT UPTO 10000 AMPS WITH PAIR OF LEADS & CLAMPS FOR TESTING CTS	1 SET
03	SECONDARY INJECTION KIT WITH INTEGRAL TIMER FOR RELAY TESTING WITH CABLES LEADS & BANNA PLUGS SELECTIVE RANGE 5 AMPS & 1 AMPS RANGE (FOR RELAY TESTING)	1 SET
04	CFB & ZFB KIT OR EQVIVALENT FOR TESTING OF RELAY & DISTANCE PROTECTION	1 No. EACH
05	PPM TESTER FOR TRANSFORMER OIL	1 No.
06	METERS FOR TIME MEASUREMENT OF BREAKER OPENING & CLOSING TIME	1 No.
07	3 PHASE VARIAC 15 Amps	2 NO.
08	SINGLE PHASE VARIAC 28 AMPS	2 NO.
09	TRANSFORMER TURNS RATIO TEST KIT	1 NO.
10	HV TEST KIT AC, 0 –50 KV &DC, 0- 100 KV PREFERSBLY WITH DRY TYPE TRANSFORMER	1 NO. EACH
11	TRANSFORMER OIL BDV TEST KIT 0-100 KV WITH 2.5MM AIR GAP.	1 NO.
12	PORTABLE AIR COMPRESSOR WITH DRIER AND REGULATOR MAKE "TOSHNIWAL"/"KHOSLA" RATED FOR 7/10 KG/CM2	2 NO.
13	SOLDERING IRON "SOLDRON" MAKE 25 WATT	3 NOS.
14	VACUUM PUMP	1 NO.
15	MULTIMETRES	
16	DIGITAL "MOTWANE" MAKE 3.1/2 DIGIT OR HIL MAKE ANALOG MOTWANE MAKE DIGITAL 4.1/2 DIGIT Accuracy +/- 1% (HIL/MOTWANE/ Fluke make)	4 NOS. 4 NOS. 2NOS.

SL. NO.	DESCRIPTION	QUANTITY
17	STANDARD MILLI AMPS/MILLIVOLTS SOURCE MAKE RANGE 0 TO 60 mA AND 0 TO 100 mV	2 NO.
18	INSULATION TESTER MOTORISED OPERATED / ELECTRONIC WITH SELECTIVE RANGE 0F 1000 / 2500/ 5000 VOLT. Range 0.5 Mega ohms to 10000 Mega ohms	1 No.
19	INSULATION TESTER MAINS OPERATED/ ELECTRONIC 500 volt & 1000 Volts Range 0.5 Mega ohms to 1000 Mega ohms	3 NO.
20	VARIABLE DC POWER SUPPLY 0 TO 250 V DC, 10 A MAKE "APLAB" OR RQUIVALENT(VARIABLE SOURCE)	2NO
21	PHASE SEQUENCE INDICATOR	1 NO.
22	FREQUENCY SOURCE 45 TO 55 HZ WITH 110V	1 NO.
23	DIGITAL TONGUE TESTER A/C 5/10, 25/60/300 AMP RANGE AC KEW SNAP MAKE	1 NO. EACH
24	DIGITAL TONGUE TESTER D/C 30/60/300 AMS	1 NO.
25	DIGITAL TONGUE TESTER 0-1 / 5 AMPS AC	1 NO.
26	STOP WATCH	1 NO.
27	CONTAINER FOR TRANSFORMER OIL SAMPLING	10 NOS.
28	TARPOLIN FIRE PROOF	As required
29	DC SHUNT 400 AMS 75 MV	1 NO.
30	3 PHASE SHIFTER	1 NO.
31	INDUSTRIAL TYPE VACUUM CLEANER	1 NO.
32	MICRO OHM METER/DUCTER (mV volt Drop Test Kit) 0-200 A DC , 0-2000 Micro ohms with suitable calibrated cable leas for current injection & mv drop	1 NO.
33	CAPACITANCE METER HAVING RANGE 20 pf –100MFD +/- 1%	1 NO.
34	DECADE RESISTANCE BOX	2 NOS.
35	TELETALK 2 WIRE SYSTEM	6 SETS
36	PORTABLE BLOWER WITH HEATING ARRANGEMENT	1 NO.
37	TORQUE WRENCH (12-60Nm, 50-225 Nm)	1 NO EACH
38	WATTMETER AC/DC 0-125-250V, 0-5-10A	1 NO
39	OSCILLOSCOPE 100 MHZ	1 NO
40	TACHOMETER (NON CONTACT TYPE)	1 NO
41	CAPACITANCE & TAN DELTA TEST KIT 12 KV	1 SET
42	OIL SPECIFIC GRAVITY AND PPM MEASURING INSTRUMENT	1 NO
43	RHEOSTAT	3 NOS
44	POLARITY TEST KIT	1 NO

SL. NO.	DESCRIPTION	QUANTITY
45	NON – CONTACT TYPE DIGITAL THERMOMETER	1 NO
46	RELAY TESTING KIT/OMICRON RELAY TEST KIT	1 NO
47	TWO WAY INTERCOM SET WITH 50 to 100 MTRS CABLES FOR CHECKING THE CABLES CONTINUTITY	2 Sets
48	PROTECTIVE EARTH ROD SUITABLE FOR 220 / 400 KV SYSTEM HAVING LEAKAGE CURRENT METER, 70 SQMM CABLE & CLAMPS ANY REPUTED MAKE	2 Nos.
49	PHANTOM LOAD TEST KIT	1 No
50	DEW POINT METER	1 No.
51	OTHER PROTECTIVE DEVICES	AS REQUIRED

B. T&P FOR MECHANICAL WORK

SN	DESCRIPTION	MINIMUM QUANTITY
	HANDLING EQUIPMENTS	
1	TURN BUCKLES	AS PER REQMT
2	'D' SHACKLES	AS PER REQMT
3	STEEL WIRE ROPES	AS PER REQMT
4	MANILA ROPES	AS PER REQMT
5	CHAIN PULLEY BLOCK/TIRFUR	AS PER REQMT
	MAJOR T&P	
1	PIPE BENDING MACHINE – 2" SIZE	2 NOS
2	GRINDING MACHINE	2 NOS
3	DRILLING MACHINES 1/4", 1/2", 3/4" & 1"	1 NO. EACH
5	DYE SETS FOR THREADING UPTO 2" PIPE.	2 NOS
6	SPIRIT LEVEL	2 NOS.
7	TAP SETS FOR BOTH BSP AND MPT THREADS UPTO 1" EACH	1 SET EACH
9	WELDING GENERATORS	1 NO.
10	WELDING TRANSFORMER	1 NO.
12	MECHANICAL TOOL KIT FOR FITTERS	4 NOS.

SN	DESCRIPTION	MINIMUM QUANTITY
	HANDLING EQUIPMENTS	
13	ELECTRICIAN TOOL KIT	4 NOS.
14	CRIMPING TOOL UPTO ALL SIZE OF CABLES UNDER SCOPE OF WORK	4 NOS.
15	FLOOD LIGHT FITTINGS	2 NOS.
16	FIRE EXTINGUISHERS	3 NOS.
17	DISTRIBUTION BOARDS WITH POWER CABLE COMPLETE AS REQUIRED	1 SET
18	PAINTING BRUSH	AS PER REQMT.
19	FIRE PROOF TARPAULIN	AS PER REQMT.
20	SAFETY BELTS AND SAFETY HELMETS	AS PER REQMT
21	24V A/C TRANSFORMER & HAND LAMPS	4 NOS.
22	MIG WELDING MACHINE WITH ACCESSORIES AIR COOL TYPE	2 NOS.
23	CRIMPING TOOL HYDRAULIC UPTO 600 SQ.MM	1 NO.
24	TORQUE WRENCH SET	1 SET
25	HYDRAULIC JACKS 50T CAPACITY/100T	4 NOS.EACH
26	TUFFER CAPACITY 15T	2 NOS.
27	CHAIN PULLEY BLOCKS 5/10T	1 NO.EACH

Other than the aforesaid, one computer, printer and other necessary peripherals will have to be maintained by the contractor in his site office.

NOTE:

1. The list of instruments / equipments to be brought by the contractor as shown above sections-a and b are only indicative. any other instruments / equipments required for the execution of the work is to be necessarily arranged by the contractor within the quoted rates.

2. The testing/calibration instruments which are used to be duly calibrated in the interval prescribed by BHEL engineers from the reputed agencies decided by BHEL and test certificate to be furnished.

3. This above list is only indicative and neither exhaustive nor limiting. Quantities indicated above are only the minimum required. Contractor shall deploy all necessary t&p to meet the schedules & as prescribed by BHEL engineer and required for completion of work.

SN	DESCRIPTION & CAPACITY OF T&P	QUANTITY	PURPOSE
01	EOT CRANE IN TG HALL		FOR HANDLING AND ERECTION WITHIN TG HALL ON SHARING BASIS AS AVAILABLE AND SUBJECT TO THEIR ACCESSIBILITY AND APPROACHABILITY.

While all efforts will be made for amicable sharing of the above, non-availability of the above due to any reason shall not absolve the contractor of performing his responsibilities in time. The contractor shall undertake sufficient pre-planning and arrange his own handling/transport equipment as deemed necessary.

NOTE :

Above T&P will be provided for specific erection/commissioning activities wherein these equipment will be required. While taking delivery, contractor shall check for proper working of the equipment and the same shall be returned after the work is completed to BHEL stores in good working condition subject to normal wear and tear.

6.1 TIME SCHEDULE & MOBILIZATION

6.1.1 INITIAL MOBILIZATION AND TENTATIVE SCHEDULE

CONTRACTOR SHALL REACH SITE, MAKE HIS SITE ESTABLISHMENT AND BE READY TO COMMENCE THE WORK **WITHIN TWO WEEKS** FROM THE DATE OF FAX LETTER OF INTENT (LOI) OR AS PER DIRECTIONS OF CONSTRUCTION MANAGER OF BHEL.

THE CONTRACTOR HAS TO SUBSEQUENTLY AUGMENT HIS RESOURCES IN SUCH A MANNER THAT THE ENTIRE WORK IS COMPLETED TO ACHIEVE THE FOLLOWING TENTATIVE SCHEDULE:

SN	Activity	Anticipated Dates		
		UNIT 1	UNIT 2	UNIT 3
01	Oil flushing start	Nov 2013	Dec 2013	Jan 2014
02	Oil flushing completion	Nov 2013	Dec 2013	Jan 2014
03	Running test ST & Blower	Dec 2013	Jan 2014	Feb 2014
04	Commissioning of unit	Jan 2013	Feb 2014	Mar 2014
05	Trial operation	Feb 2014	Mar 2014	Apr 2014
06	PG Test	Mar 2014	Apr 2014	May 2014

6.1.1 Contract Period

The Contract period shall be 7 monthsfrom the start of work. Erection, Testing, Calibration and Commissioning of permanent equipments required for completion of system shall be completed within the time schedule given above.

BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule by up to 15%. This will result in advancement of various milestones. Contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.

6.1.2 Void

6.2

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

6.3

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

6.4

Contractor shall draw the monthly erection program along with BHEL engineer indicating the work to be achieved and event to be completed. Once the program 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 program.

6.6 DEFINITION OF WORK COMPLETION

The contractor's scope of work under these specifications will be deemed to have been completed in all respect, only when all the activities are completed satisfactorily and so certified by BHEL site in charge. The decision of BHEL in this regard shall be final and binding on the contractor. The progressive payment for erection, testing and commissioning on accepted price of contract value for C&I Package rates will be released as per the break up given hereinafter.

	Total =	**85%**
7.0	**Panels/Cubicles/Desks/Racks/Enclosures/Monitors/Computers/Computer peripherals/PLCs/UPS/Batteries**	
7.1	Erection and alignment	50%
7.2	Fixing of loose items/instruments where ever applicable	5%
7.3	Pre commissioning checks, Charging of panel and Loop testing etc	15%
7.4	System commissioning	15%
		85%
8.0	**Instruments/Devices including Sensors/Cells/Probes etc**	
8.1	Calibration/Testing/Pre erection checks	30%
8.2	Erection/Placement and fixing of loose items/accessories	30%
8.3	Pre commissioning checks/loop testing/Simulation testing as required	10%
8.4	Remote/local commissioning as required	15%
	Total =	**85%**
9.0	**Commissioning and Testing activities for Equipments erected by other agencies, like control valves, on/off valves, electrical/pneumatic valves, actuators, solenoid valves, valves, limit switches, ERV controllers, power cylinders, Pressure & Temperature Gauges/Transmitters,etc**	
9.1	Removal & refixing/Fixing loose supplied components, including tubing/hose, regulators, etc	30%
9.2	Calibration/Local testing - commissioning readiness	30%
9.3	Local Commissioning & Loop Testing as required	10%
9.4	System Commissioning or Remote Commissioning as required	15%
	Total =	**85%**
10.0	**Power Cylinders**	
10.1	Erection and alignment of Power Cylinders	30%
10.2	Fixing of loose items and Commissioning readiness	30%
10.3	Loop Checking, Calibration and Local commissioning	20%
10.4	System/Remote commissioning as required	5%
	Total =	**85%**
11.0	**Miscellaneous items (items not covered under above heads)**	
11.1	Erection	50%
11.2	Alignment	10%
11.3	Testing	15%
11.4	Completion	10%
	Total =	**85%**

II	**STAGE/MILESTONE PAYMENTS (15%)**	**% of unit rate**

1	Boiler Light Up	1%
2	ABO	1%
3	Steam Blowing	0%
4	Safety Valve Floating (Electromatic Relief valves)	1%
5	Oil Flushing (TG)	0%
6	Barring Gear (TG)	0%
7	Rolling and Synchronization	2%
8	Coal Firing	0%
9	Full Load	2%
10	Trial Operation of Unit	3%
11	Painting	0%
12	Area cleaning, temporary structures cutting/removal and return of scrap	1%
13	Punch List points/pending points liquidation	1%
14	Submission of 'As Built Drawings'	1%
15	Material Reconciliation	1%
16	Completion of Contractual Obligation	1%
	Total for Milestone/Stage payments (15%)	**15%**
	Total	

B	**OTHERS**	
1	Laboratory Instruments installation and demonstration where ever applicable	100%
2	PG Test Instruments installation (50%) and removal (50%)	100%

Electrical:

Sl. No.	Activity/Work Description	% of unit rate
I	**PRO RATA PAYMENTS (85%)**	
1.0	**Cable tray and accessories**	
1.1	Fabrication and fixing/welding/bolting in position	60%
1.2	Earthing of cable trays	10%
1.3	Tagging of cable trays (including touch up painting & cable tray numbering on sides)	8%

1.4	Covering of trays where ever envisaged	7%
	Total =	**85%**
2.0	**Cable laying including earthing wires**	
2.1	Laying of cables/Wires	45%
2.2	Glanding and termination (except HT terminations)	15%
2.3	Testing and charging	10%
2.5	Dressing and clamping	15%
	Total =	**85%**
3.0	**Junction box/Push button station (local)**	
3.1	Erection including fixing of terminal blocks where ever applicable	75%
3.2	Name plate fixing where ever applicable and labeling (inside and outside)	10%
	Total =	**85%**
4.0	**Misc. Structural steel including cable tray supports, Canopies etc, Conduits, pipes etc**	
4.1	Fabrication/Pre assembly	45%
4.2	Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	40%
	Total =	**85%**
5.0	**DG sets/Switch Gears/MCC/PCC/Distribution Boards/Marshalling Box/Starter Units/ Dry Transformers / Electrical Hoists/ Panels/Cubicles/Desks/UPS/ Batteries/ Chargers/VFD/ LA assy/ NGT/ NGR/ SP/Miscellaneous Equipments/ etc**	
5.1	Placement, Alignment and coupling/interconnection where ever applicable, erection of associated accessories etc	50%
5.2	Precommissioning checks and tests	10%
5.3	Charging, Loop testing and commissioning	15%
5.4	System commissioning	10%
		85%
6.0	**Earthing/Lightning protection strips, Earthing pits**	
6.1	Fabrication, erection, alignment, welding/bolting of earthing/lightning protection strips; earth pits completion	60%
6.2	Testing/commissioning	25%
		85%
7.0	**LT /HT Bus Ducts**	

7.1	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc complete with supporting structure	50%
7.2	Pre commissioning checks	20%
7.3	Testing, Charging and Painting (as applicable)	15%
		85%
8.0	**Oil Filled Transformers (Generator, Station, UAT, Station Service etc)**	
8.1	Placement on foundation and alignment	25%
8.2	Erection of associated auxilliaries/assemblies, oil filling, etc	25%
8.3	Dry out including oil filtration	15%
8.4	Precommissioning checks	10%
8.5	Testing, Charging and Painting (as applicable)	10%
		85%
9.0	**Testing/Commissioning of Equipment (like motors, actuators, ESP trfr, miscequipments, etc) erected by other agencies**	
9.1	Local testing	40%
9.2	Remote testing, Loop testing, and commissioning	40%
9.3	System commissioning	5%
		85%
10.0	**Other items**	
10.1	Rubber mats/ Display Boards/Miscellaneous items/etc : on installation	85%
10.2	Specialized Commissioning Services - on pro rata basis.	85%
10.3	Civil Works - Prorata on completion of actual work.	85%
10.4	Termination, HT Termination, Straight through jointing etc : on pro rata basis	85%
II	**STAGE/MILESTONE PAYMENTS (15%)**	
1	Boiler Light Up	1%
2	ABO	1%
3	Steam Blowing	0%
4	Safety Valve Floating	1%
5	Oil Flushing (TG)	0%
6	Barring Gear (TG)	0%
7	Rolling and Synchronisation	2%
8	Coal Firing	0%
9	Full Load	2%
10	Trial Operation of Unit	3%
11	Painting	0%

12	Area cleaning, temporary structures cutting/removal and return of scrap	1%
13	Punch List points/pending points liquidation	1%
14	Submission of 'As Built Drawings'	1%
15	Material Reconciliation	1%
16	Completion of Contractual Obligation	1%
	Total for Stage/Milestone Payments (15%)	**15%**

8.0 TAXES, DUTIES, LEVIES (Consolidated Rev 02 dated 20/09/2012)

8.1. For All types of works excepting works covered under sl no 8.2

8.1.1

The contractor shall pay all (save the specific exclusions as enumerated in this contract) taxes, fees, license charges, deposits, duties, tools, royalty, commissions or other charges which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

However, provisions regarding Service Tax and Value Added Tax (VAT) on output services and goods shall be as per following clauses.

8.1.2 Service Tax & Cess on Service Tax

Contractor's price/rates shall be exclusive of Service Tax and Cess on Services. In case, it becomes mandatory for the contractor under provisions of relevant act/law to collect the Service Tax & Cess from BHEL and pay the same to the concerned tax authorities, such applicable amount will be paid by BHEL at the prevailing Service Tax Rate (presently 12.36 %) on the admitted bill value.

Contractor shall submit to BHEL documentary evidence of Service Tax registration certificate specifying name of services covered under this contract. Contractor shall submit serially numbered Service Tax and Cess Invoice, signed by him or a person authorized by him in respect of taxable service provided, and shall contain the following, namely,

1. **The name, address and the registration number of the contractor,**
2. **The name and address of the party receiving taxable service,**
3. **Description, classification and value of taxable service provided and,**
4. **The service tax payable thereon.**

All the Four conditions shall be fulfilled in the invoice before release of service tax payment.

Wherever, more than one route/option are available for discharge of service tax liability under a particular service, (e.g. "works contract Service"), contractor shall obtain prior written consent from BHEL site before billing the amount towards Service Tax.

8.1.3 VAT (Sales Tax /WCT)

As regards Value Added Tax (VAT)/CST on transfer of property in goods involved in Works Contract (previously known as Works Contract Tax) applicable as per local laws, the price quoted by the contractor shall be inclusive of the same and in no case input or output VAT/CST will be reimbursed extra.

In any case the Contractor shall register himself with the respective Sales Tax authorities of the state and submit proof of such registration to BHEL along with the first RA bill. Contractor will submit all the details of VAT/CST paid for the contract in the prescribed format of the respective state VAT laws. Also, the

contractor will issue the tax Invoices to BHEL as per the Tax laws of respective state on monthly basis. Contractor shall also be required to furnish to BHEL necessary proof of VAT remittance on monthly basis.

Deduction of tax at source shall be made as per the provisions of law and is to be construed as an advance tax paid by the contractor and no reimbursement thereof will be made.

Further, if BHEL, at the instance of customer or otherwise adopts the specific route for discharging output VAT liability itself, benefit of the reduction in liability of the contractor will be passed on to BHEL.

In case, BHEL is forced to pay any VAT liability on behalf of contractor, the same will be recovered from contractor's bill or otherwise as deemed fit

~~**8.2 'Enabling Works'**~~

~~The contractor shall pay all (save the specific exclusions as enumerated in this contract) taxes, fees, license charges, deposits, duties, tools, royalty, commissions or other charges which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.~~ ~~**(i.e. rates quoted by bidder shall be inclusive of Service Tax, VAT/WCT and all other taxes and duties)**~~

~~However, Since the proposed work is in the nature of 'Works Contract service' as per Service tax law, Hence, For non-corporate contractors being Individual, HUF, Proprietary Firm, Partnership Firm or Association of Persons (AOP), BHEL shall recover the applicable Service Tax under reverse charge mechanism from the contractor and remit the same with the Government as per the provisions of Law. Necessary advice/confirmation of remittance shall be issued to the contractor. The contractor shall not be eligible for any refund/reimbursement of such service tax from BHEL. It shall be the responsibility of the contractor to submit proper invoice giving all the requisite details as per Service Tax Law for the determination of the service tax liability of BHEL under reverse charge mechanism. BHEL reserves the right to determine such liability based on the invoice submitted by the contractor or otherwise independently and remittance of the same with the Government.~~

8.3 New Taxes/Levies

In case the Government imposes any new levy/tax on the output service/ goods/work after award of the contract, the same shall be reimbursed by BHEL at actual.

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

No reimbursement/recovery on account of increase/reduction in the rate of taxes, levies, duties etc. on input goods/services/work shall be made. Such impact shall be taken care of by the Price Variation/Adjustment Clause (PVC) if any. In case PVC is not applicable for the contract, Bidder has to

make his own assessment of the impact of future variation if any, in rates of taxes/duties/ levies etc. in his price bid.

8.4 BUILDING & OTHER CONSTRUCTION WORKERS (REGULATION OF EMPLOYMENT AND CONDITIONS OF SERVICE) ACT, 1996 (BOCW Act) AND RULES OF 1998 READ WITH BUILDING & OTHER CONSTRUCTION WORKERS CESS Act, 1996 & CESS RULES, 1998.

In case any portion of work involves execution through building or construction workers, then compliance to the above titled Acts shall be ensured by the contractor and contractor shall obtain license and deposit the cess under the Act. In the circumstances it may be ensured as under:-

i. It shall be the sole responsibility of the contractor in the capacity of employer to forthwith (within a period of 15 days from the award of work) apply for a licence to the Competent Authority under the BOCW Act and obtain proper certificate thereof by specifying the scope of its work. It shall also be responsibility of the contractor to furnish a copy of such certificate of licence / permission to BHEL within a period of one month from the date of award of contract.

ii. It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under these act and rules including that of payment / deposit of 1% cess on the extant of work involving building or construction workers engaged by the contractor within a period of one month from the receipt of payment.

iii. It shall be the responsibility of the sub-contractor to furnish the receipts / challans towards deposit of the cess together with the number, name and other details of beneficiaries (building workers) engaged by the sub-contractor during the preceding month.

It shall be the absolute responsibility of the sub-contractor to make payment of all statutory payments & compensations to its workers including that is provided under the Workmen's Compensation Act, 1923

9.0 SPECIAL INCLUSIONS:

Consumables/items to be provided by BHEL free of charge

01 Metallic Cable glands

02 Steel for fabrication

03 Lugs beyond 4 mm^2 size

10.0 Exclusions

The following are specific exclusions from this work.

2. Erection of flow nozzles.

3. Erection of valves, actuators along with valves, damper actuators along with dampers, burner tilt power cylinder, seal air dampers and scanner air emergency dampers and control valves. (However, SADC power cylinder installation will be in the scope of the contractor)

Note:

The aforesaid exclusions should not be construed as exhaustive. They are meant for general guideline. 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.

Void

Annexure- I

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

Please Note:

1. All the items in general are to be erected and commissioned by the contractor, unless specifically mentioned otherwise.
2. In such cases where systems are described with component quantities (viz., Vibration monitoring systems, Lube Oil skids, etc., etc.) lump sum rates are to be quoted. No separate payment will be made for the component items of those systems, although these systems may have certain items for which separate unit rates are also available elsewhere.
3. The dimensions and weights mentioned are only approximate. No extra claims will be entertained due to change in dimensions/weight.

- **Sl No I1.0.1 to I1.0.4: Cable trays and accessories**

  Flexible GI cable support system, consisting of single/double channels, base plates, cantilever arms as per BOQ given. Wherever necessary, the base plate and beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded to the racks or beams. Necessary 90 deg. angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc. will be supplied for fixing trays and cantilever arms and for this no separate erection charges will be paid. Rates shall be accommodated in support channel and cantilever arm erection. Support channels will be supplied in standard running lengths, and shall be cut at site depending on requirement, and exposed metal portion shall be painted as per specification given in the relevant sections. Payment for erection will be made on per meter basis. No separate rate will be paid for cutting & painting.

  Cantilever Arm for 150 mm tray, complete with 4 Nos. spring nuts, 2 Nos. bolts & washers for fixing to main channel support and for fixing cable tray.

  Cantilever Arm for 100 mm tray, complete with 4 Nos. spring nuts, 2 Nos. bolts & washers for fixing to main channel support and for fixing cable tray.

  Base Plate (For Single Channel) complete with 2 Nos. spring washers, bolts and nuts for fixing main support channel

- **Sl No I7.0.3 to I7.0.5: Control panels**

These are microprocessor based sophisticated electronic control panels in majority. Weights range from 400 to 1600 Kg from I6.0.2 to I6.0.5 respectively.

- **Sl No I7.0.6: Network panels.**

  These panels are used basically for housing Ethernet switches which are to be wired up with various other max stations. System interface network panels also house computer CPUs, monitors, etc.(Approx. Dimension 750x800x2415 mm,Wt-400kgs per panel),power distribution panel cum links.

- **Sl No I7.0.15: Vibration Monitoring system for Turbo Blower**

  1 set of Vibration monitoring system for turbo blower consists of the following (approximate quantities):

  Workstation for TSI: 1no
  Vibration Axial displacement monitoring system: 1No
  Proxymeters: 10 no.
  Proxymeter housing : 7 nos.
  Vibration probes: 6 nos.
  Axial Displacement Probe: 2 No
  LVDT Casing expansion probe: 1 No
  Differential Expansion probe: 2 no
  Solenoid Valves: 6 No.
  Velocity probes: 4 No.

  Work station for TSI: 1No (common for all three units)

- **Sl No I7.0.18:WOODWARD GOVERNOR**

  Woodward Governor module having Approx Dimension: 356x280x97mm (W x H x D) Approx weight: 15 kg. Total 3 sets are used for all 3 units

- **Sl No I7.0.19:TURBO LOG ANTISURGE CONTROL & SURGE PROTECTION SYSTEM**

  These are mounted on EDN panels. Total 6 sets are used for all 3 units. Approx Dimension: 484x195x410mm (W x H x D) Approx weight: 15 kg

- **Sl No I7.0.20:TURBO LOG MASTER CONTROLLER**

  Turbo log master controller is mounted on EDN panel total 1 set is for all 3 units. Approx Dimension: 484x460x410mm (W x H x D) .

- **Sl No I7.0.14: Vibration monitoring system for CEP**

Vibration monitoring system for CEP consists of the following (approximate quantities):

12 inches rack(7 modules Slots)-panel mounts option mini rack.

Approx. Dimension:266 x305x349 mm.

Power supply (175-264 VAC)-1 no

TDI RIM standard - 1 no

Relay modules 16 channel

Prox-seismic monitor Prox /velomint term -1 no

Communication gateway data base Modbus RS 485-1 no

Key phaser module 2 channel- 1nos

Cable for connecting 3500/92 to 3500/92 –length 10 ft-2 no

HC to 3500 rack cable -1 no

Rack configuration software.

Portable configuration station (3500) -1 no.

Commissioning supervision in the scope of the supplier. Contractor to provide erection and commissioning support only.

- **Sl No I7.0.16: LVS**

LVS consists of 2 LVS Screens (Screen size: 67”or70” diagonal, DLP based rear projection, 1400 x 1050 pixels resolution) with projector and stand. Accessories like video switches associated cabling (prefab and otherwise) etc are also included.

LVSerection and commissioning supervision in scope of other agency (supplier).

Lump sumrate is to be quoted.

- **Sl No I7.0.10: Computer furniture:**

Local operator station desk-3 no
Approx. Dimension: 1200(W) x1100(D) x740(H) mm
Computer tables- 19 no
Dimension:1500(W) x750(D)x735(H) mm
Printer Tables- 16 no:
Approx. Dimension: 900(W) x650(D) x740(H) mm.

Computer chairs-28 no. the furniture will be delivered in knocked down condition and will have to be assembled at site by contractor.
Lump sum rate is to be quoted.

❖ **Sl No I7.0.11: Plant Control Desk**

To be erected in the PCR (Plant Control Room). It consists of 1 desk with 6 sections.

This consists of modular operator desks, integrated into a single curved Operator control desk (approx. Dimension 5370 (W) x 750(D) x 1100(H) mm). Relevant CPUs will be housed inside.

Lump sum rate is to be quoted.

❖ **Sl No I7.0.12: Laboratory Setup for Customer**

Package consists of various standard laboratory instruments, which are to be installed in Customer's lab. Tentative list is as follows:

SN	Description	Qty.	UOM
1	Digital Multimeter (Portable) 4 ½	10	No
2	Vacuum cleaner	2	No
3	Soldering/desoldering station	2	No
4	Dual beam 2 channel CRO 100 MHZ	2	No
5	mV and mA feeder	10	No
6	Insulation Tester	2	No
7	Portable Temperature Calibrator	3	No
8	Portable pressure calibrator	2	No
9	Universal calibrator	5	No
10	EPROM PROGRAMMER(MODEL No-ANDO-AF 9706)	10	No

Lump sum rate is to be quoted.

❖ **Sl No I7.0.17: 230/240 V UPS System with batteries and ACDB**

- 80 KVA UPS comprising of the following :

- 1 no UPS Panel consists of 3 no of battery chargers,3 no of inverter banks & one no of static voltage stabilizer. (Approx. Dim.7670 (W) x 1050(W)x2110(H)mm, Weight-2000 Kg)

UPS BATTERY:

- Rating-2V-750 AH, consist of 110 cells,

- 2 set of UPS battery panels with Approx. Dimension: 3200(L) x 1200(W) x 1600(H) mm Approx. Weight -2000 kg.

Lump sum rate per set is to be quoted.

❖ **Sl No I7.0.13: SWAS system for CEP**

Steam & Water Analysis System consists of:

- Conductivity Analyzer: 1 No.
- pH Analyzer: 1 No.

Sample handling system consists of:

- Sample handling system - Wet & Dry Panels

Tentative sizes are:

Dry &Wet Panel: 600 mm (W) x 800 mm (D) x 2100 mm (H)

Lump sum rate is to be quoted.

❖ **Sl No I11.0.1: Master and Slave clock system**

This equipment consists of Master Clock System Panel (Approx. Dim. 900 x 600 x 2415 mm; 300 kg approx.), housing power supplies, clock modules etc. GPS antenna is also to be suitably located and cabled up under this scope. About 2 No. slave clocks (approx. dim. 800 x 120 x 120 mm) will have to be installed at various locations throughout the plant. Commissioning supervision will be provided by the supplier of Master clock system.

Lump sum rate is to be quoted.

❖ **Sl No I11.0.2: HART Management system**

Consists of panel Approx. Dimension is 1200(W) x 800(D) x 2415(H) approx weight 400 Kg. Also consists of PC, printer, Hart communicators for field use, etc. Erection supervision and commissioning is in the scope of the supplier. The Contractor is to provide erection and commissioning support only.

Lump sum rate is to be quoted.