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

No. BHE/PW/PUR/NST-CLE U#4/1581

FOR

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, COMMISSIONING AND HANDING OVER OF CONTROL & INSTRUMENTATION & ELECTRICAL WORKS FOR BOILER AND ITS AUXILIARIES, TURBOGENERATOR AND ITS AUXILIARIES, STATION C&I FOR UNIT #4 OF 5x270 MW RATTANINDIA NASIK POWER LTD., NASHIK.

AT

SPECIAL ECONOMIC ZONE

RATTANINDIA NASIK POWER LTD

(Formerly known as Indiabulls RealTech Ltd)

SINNAR

DISTRICT- NASHIK,

MAHARASHTRA.

VOLUME – I

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 Govt. of India Undertaking)
POWER SECTOR - WESTERN REGION
345, KINGS WAY - NAGPUR 440 001

Registered Office : BHEL House, Siri Fort, New Delhi – 110 049, India
Website : www.bhel.com

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BHARAT HEAVY ELECTRICALS LIMITED

(A GOVERNMENT OF INDIA UNDERTAKING)
POWER SECTOR - WESTERN REGION
SHREEMOHINI COMPLEX
345, KINGS WAY - NAGPUR 440 001

FOR

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, COMMISSIONING AND HANDING OVER OF CONTROL & INSTRUMENTATION & ELECTRICAL WORKS FOR BOILER AND ITS AUXILIARIES, TURBOGENERATOR AND ITS AUXILIARIES, STATION C&I FOR UNIT #4 OF 5x270 MW RATTANINDIA NASIK POWER LTD., NASHIK.

AT

SPECIAL ECONOMIC ZONE

RATTANINDIA NASIK POWER LTD

(Formerly known as Indiabulls RealTech Ltd)

SINNAR

DISTRICT- NASHIK,

MAHARASHTRA

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 :

1581

NOTICE INVITING TENDER

Bharat Heavy Electricals Limited

Ref: BHE/PW/PUR/NST-CLE U#4/1581 Date: 22/12/2015

NOTICE INVITING TENDER (NIT)

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

==========

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/NST-CLE U#4/1581	
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 & ELECTRICAL WORKS FOR BOILER AND ITS AUXILIARIES, TURBOGENERATOR AND ITS AUXILIARIES, STATION C&I FOR UNIT #4 OF 5x270 MW RATTANINDIA NASIK POWER LTD., NASHIK **AT SPECIAL ECONOMIC ZONE RATTANINDIA NASIK POWER LTD (Formerly known as Indiabulls RealTech Ltd) SINNAR DISTRICT- NASHIK, MAHARASHTRA.**	
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-IE	*Technical Specification Section-C, Section D and Plot Plan*	*Applicable*
f	Volume-II	*Price Schedule (Absolute value).*	*Applicable*
iv	**Issue of Tender Documents**	***1. Sale from BHEL PS Regional office at :*** ***Start : 23/12/2015 , Closes: 12/01/2016 , Time : 16.00 Hrs*** **2. From BHEL website (**www.bhel.com**)** Tender documents will be available for	*Applicable*

		downloading from website till due date of submission	
v	**DUE DATE & TIME OF OFFER SUBMISSION**	***Date : 13/01/2015, Time 15.00 Hrs*** ***Place : BHEL PS Regional office at :Nagpur*** Tenders being submitted through representative shall be submitted at dispatch section of PSWR HQ Office after making entry/registration at the reception. For any assistance on the matter kindly contact following officials: • Pratish Gee Varghese / Sr Engineer (Purchase) • Neeraj Tiwari / Sr Engineer (Purchase) • Shivkesh Meena / Engineer (Purchase)	*Applicable*
vi	**OPENING OF TENDER**	***1 hours after the latest due date and time of Offer submission*** *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 2,00,000/- (Rupees Two Lakhs Only)*	*Applicable*
viii	**COST OF TENDER**	*Rs 2000/-. (Rupees Two Thousand Only)*	*Applicable*
ix	**LAST DATE FOR SEEKING CLARIFICATION**	*Five 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)**		*Not Applicable.*
xi	**INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)**		*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	

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-IE: Technical Specification Section-C, Section D and Plot Plan*	
xiii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	

xiv.	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/ annexures 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
- 'P' is 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, excepting packages which are on HOLD due to reasons not attributable to Bidder..

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 for the 'Period of Assessment':

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)**:**

$$= \frac{\text{Aggregate of Performance scores for all similar packages in all the Regions}}{\text{Aggregate of months for each of the similar package for which performance should have been evaluated in all the Regions}}$$

$$= \frac{S_T}{T_T}$$

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 → (under execution/ executed during period of assessment)	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) <u>Calculation of Overall 'Performance Rating' (**R_{BHEL}**) in case 'similar Package/Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment'</u>:

This shall be obtained by summing up the 'Monthly Performance Evaluation' scores obtained by the bidder in all Regions for ALL the packages, divided by the total number of Package months for which evaluation should have been done. 'R_{BHEL} ' shall be calculated subject to availability of 'performance scores' for at least.6 'package months' in the order of precedence below:

a) 'Period of Assessment.
b) 12 months preceding the cut-off month
c) 24 months preceding the cut-off month
d) 36 months preceding the cut-off month

In case, R_{BHEL} cannot be calculated as above, then Bidder shall be treated as 'NEW VENDOR'. Further eligibility and qualification of this bidder shall be as per definition of 'NEW VENDOR' described in 'Explanatory Notes'

iii) <u>Factor "L" assigned based on Overall Performance Rating (R_{BHEL}) at Power Sector Regions,:</u>

Sl no	Overall Performance	Corresponding

	Rating (R_{BHEL})	value of 'L'
1	=60	NA
2	> 60 and ≤ 65	0.4
3	> 65 and ≤ 70	0.35
4	> 70 and ≤ 75	0.25
5	> 75 and < 80	0.2
6	≥ 80	NA

III. 'Assessment of Capacity of Bidder':

'Assessment of Capacity of Bidder' is based on the Maximum number of packages for which a vendor is eligible, considering the performance scores of similar packages, as below:

Max number of packages P_{Max}= (R_{BHEL}- 60) divided by corresponding value of 'L' i.e. (R_{BHEL}- 60)/L

Note:

i. In case the value of P_{Max} results in a fraction, the value of P_{Max} is to be rounded off to next whole number
ii. For R_{BHEL} = 60 , P_{Max} = '1'
iii. For R_{BHEL} ≥ 80, there will be no upper limit on P_{Max}

The Bidder shall be considered 'Qualified' as per 'Assessment of Capacity of Bidder' for the subject Tender if P ≤ P_{Max}
(where P is calculated as per clause 9.I)

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 TabIe-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 ii). Civil Works including foundations	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

	v). Structural Steel Fabrication & Erection v). Chimney vi). Cooling Tower ii). Others (Civil)		iv). ESP v). Steam Turbine Generator set & Aux vi). Gas Turbine Generator set & Aux vii). Hydro Turbine Generator set & Aux iii). Turbo Blower (including Steam Turbine) ix). Material Handling x). Material Management xi). Material Handling & Material Management xii). Others (Mechanical)

c) Bidders who have not been evaluated for at least six package months in the last 36 months in the online BHEL system for contractor performance evaluation in BHEL PS Regions, wef July'2010 shall be considered "NEW VENDOR".

A 'NEW VENDOR' shall be considered qualified subject to satisfying all other tender conditions

A 'NEW VENDOR' if awarded a job (of package/packages identified under this clause) shall be tagged as "FIRST TIMER" on the date of first LOI from BHEL.

The "FIRST TIMER" tag shall remain till execution of work for a period of not less than 09 months, from the commencement of work of first package

A Bidder shall not be eligible for the next job as long as the Bidder is tagged as "FIRST TIMER" excepting for the Tenders which have been opened on or before the date of the bidder being tagged as 'FIRST TIMER'.

After removal of 'FIRST TIMER' tag, the Bidder shall be considered 'QUALIFIED' for the future tenders subject to satisfying all other tender conditions including 'Capacity Evaluation of Bidders'.

d) 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' or due to non-approval by Customer, then BHEL at its discretion reserves the right to consider the further processing of the Tender based on the **Overall Performance Rating 'R_{BHEL}'** only, starting from the upper band.

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

i. up to Boiler Steam Blowing in case of Steam Generator and Auxiliaries

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

iii. Upto execution of at least 90% of anticipated contract value in case of Civil & Structures (unit wise), Enabling works and upto 90% of material unloading (in tonnage) as per the original contract in case of MM Package.

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.

f) 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

It may please be noted that guidelines/rules in respect of suspension of business dealings', 'Vendor evaluation format', 'Quality, Safety & HSE guidelines', etc may undergo change from time to time and the latest one shall be followed.

for BHARAT HEAVY ELECTRICALS LTD

AGM Pur

Enclosure

01. Annexure-1: Pre Qualifying criteria.
02. Annexure-2: Check List.
03. Annexure-3: Important Information.
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 & ELECTRICAL WORKS FOR BOILER AND ITS AUXILIARIES, TURBOGENERATOR AND ITS AUXILIARIES, STATION C&I FOR UNIT #4 OF 5x270 MW RATTANINDIA NASIK POWER LTD., NASHIK **AT SPECIAL ECONOMIC ZONE RATTANINDIA NASIK POWER LTD (Formerly known as Indiabulls RealTech Ltd) SINNAR DISTRICT-NASHIK, MAHARASHTRA.**
Tender Specification Number**: BHE/PW/PUR/NST-CLE U#4/1581**

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) (Note: To be submitted by Prime Bidder & Consortium/Technical Tie up partner jointly in case Consortium bidding is permitted, otherwise by the sole bidder)	**Not Applicable**	
B	**Technical** Bidder must have, executed following works in the last seven (7) years as on latest date of bid submission (i.e. Bidder must meet B.1 **And** B.2 **And** (B.3.1 or B.3.2 or B.3.3): **B.1)** B.1.1) Executed Erection, Testing and Commissioning of Control & Instrumentation works for **BTG/GT 'OR'** Control & Instrumentation works consisting of **DCS/ DDC/ Station C&I** in one unit of atleast **100 MW** rating. **OR** B.1.2) Executed atleast **one work of** Erection, Testing and Commissioning of **Control & Instrumentation** works consisting of **DCS/DDC/Station C&I** in any industry with its executed value of	**Applicable**	

	Rs 140 Lakhs or more. **AND** **B.2)** B.2.1) Executed Erection, Testing and Commissioning of Electrical works in a power Plant consisting of: a) HT Bus Ducts **AND** **B.3)** B.3.1) Executed **One job** of Erection, Testing and Commissioning of **Control & Instrumentation / Electrical** works of value not less than **Rs 182 Lakhs** against one work order ***OR*** B.3.2) Executed **Two jobs** of Erection, Testing and Commissioning of **Control & Instrumentation / Electrical** works each of value not less than **Rs 114 Lakhs** against maximum two work orders ***OR*** B.3.3) Executed **Three jobs** of Erection, Testing and Commissioning of **Control & Instrumentation / Electrical works each** of value not less than **Rs 91 Lakhs** against maximum three work orders.		
C-1	**Financial** **TURNOVER** Bidders must have achieved an average annual financial turnover (Audited) of **Rs 68 Lakhs** or more over last three Financial Years (FY) i.e. 2012-2013, 2013-2014, 2014-2015.	**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	**Applicable**	

	of the three Financial Years as applicable in the last three Financial Years defined in 'C-1 above based on latest Audited Accounts.		
D	Assessment of Capacity of Bidder to execute the work as per sl no 9 of NIT (if applicable)	**Applicable**	By BHEL
E	Approval of Customer Note: Names of bidders (including consortium/Technical Tie up partners in case consortium bidding is permitted) who stand qualified after compliance of criteria A to D shall be forwarded to customer for their approval.	**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		BY BHEL
F	Consortium criteria	**Not Applicable**	BY BHEL

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. If financial statements are not required to be audited statutorily, then instead of audited financial statements, financial statements are required to be certified by Chartered Accountant.
4. 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)
5. 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
6. ~~'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~~
7. 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
8. '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

9. 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~~
10. 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~~.~~
11. 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.
12. ~~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.~~
13. ~~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.~~
14. The value of work (Experience submitted against PQR B) shall be updated as per the PVC indices for "All India Avg. Consumer Price Index for Industrial Workers" with base month as date of execution (completion of contract/work) and indexed upto two months prior to bid opening month.

BIDDER SHALL SUBMIT ABOVE PRE-QUALIFICATION CRITERIA FORMAT, DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT INCLUSIVE OF WORK OREDER WITH BOQ AND WORK COMPLETION CERTIFICATE AND TDS CERTIFICATE ETC IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

Bidder's Response to BHEL TECHNICAL PQR (WHICHEVER IS APPLICABLE)				
PQR No	**Pre-Qualifying Requirement**	**Credentials based on which bidder is claiming PQR**	**Reference of the documents**	**Page No**
B	Bidder must have, executed following works in the last seven (7) years as on latest date of bid submission (i.e. Bidder must meet B.1 **And** B.2 **And** (B.3.1 or B.3.2 or B.3.3):			
B.1.1	Executed Erection, Testing and Commissioning of Control & Instrumentation works for **BTG/GT 'OR'** Control & Instrumentation works consisting of **DCS/ DDC/ Station C&I** in one unit of atleast **100 MW** rating.			
B.1.2	Executed atleast **one work of** Erection, Testing and Commissioning of **Control & Instrumentation** works consisting of **DCS/DDC/Station C&I** in any industry with its executed value of **Rs 140 Lakhs or more**.			
B.2.1	Executed Erection, Testing and Commissioning of Electrical works in a power Plant consisting of: a) HT Bus Ducts			
B.3.1	Executed **One job** of Erection, Testing and Commissioning of **Control & Instrumentation / Electrical** works of value not less			

Bidder's Response to BHEL TECHNICAL PQR (WHICHEVER IS APPLICABLE)				
PQR No	**Pre-Qualifying Requirement**	**Credentials based on which bidder is claiming PQR**	**Reference of the documents**	**Page No**
	than **Rs 182 Lakhs** against one work order.			
B.3.2	Executed **Two jobs** of Erection, Testing and Commissioning of **Control & Instrumentation / Electrical** works each of value not less than **Rs 114 Lakhs** against maximum two work orders.			
B.3.3	Executed **Three jobs** of Erection, Testing and Commissioning of **Control & Instrumentation / Electrical works each** of value not less than **Rs 91 Lakhs** against maximum three work orders.			

NOTE:

BIDDERS MUST CLEARLY INDICATE IN THE TABLE ABOVE, HOW THEY ARE SATISFYING TECHNICAL PQR ALONG WITH THE REFERENCE OF THE SUPPORTING DOCUMENTS AND THE PAGE NUMBER IN WHICH THE REFERRED DOCUMENTS ARE ANNEXED IN THE BID DOCUMENT. BHEL WILL NOT CONSIDER ANY OTHER DOCUMENT OTHER THAN THOSE SPECIFED BY THE BIDDERS IN THE TABLE ABOVE FOR EVALUATION OF TECHNICAL PQR. BIDDER MAY ATTACH SEPERATE SHEET IF NECESSARY

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.a	Details of Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:		
3.b	Details of alternate Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: 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(BY BHEL)	ENCLOSED BY BIDDER
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 . Also the Power of Attorney of the signatories executing the Consortium Agreement	Applicable/~~Not Applicable~~	YES/NO
20	Analysis of Unit rates	Applicable/~~Not Applicable~~	YES/NO

NOTE : STRIKE OFF 'YES' OR 'NO', AS APPLICABLE. TENDER NOT ACCOMPANIED BY THE PRESCRIBED **ABOVE APPLICABLE DOCUMENTS** ARE LIABLE TO BE SUMMARILY REJECTED.

DATE :

AUTHORIZED SIGNATORY
(With Name, Designation and Company seal)

Annexure-3

IMPORTANT INFORMATION

Sealed Tenders shall be submitted at following address to AGM /Purchase BHEL PSWR NAGPUR:
BHEL PSWR, SRIMOHINI COMPLEX , 345 KINGSWAY, NAGPUR 440001, INDIA

All correspondences regarding this tender shall be addressed to AGM / PURCHASE BHEL PSWR at above address. Bidders may also opt to correspond with following BHEL officials regarding this tender through email at following email ids. However please be informed that sealed tenders shall necessarily be submitted in original at above address:

AGM Purchase, Email id: rajeebc@bhelpswr.co.in. Ph: +91 – 712 – 3048633

Sr Engineer Purchase, Email: pgv@bhelpswr.co.in, Ph: +91 – 712 – 3048713

Sr Engineer Purchase, Email: nktiwari@bhelpswr.co.in Ph: +91-712-3048651

Engineer Purchase, Email id: svm@bhelpswr.co.in , Ph: +91 – 712 – 3048715

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)**

2. **Refer Chapter XII of Volume IB Special Conditions of Contract regarding Suspension of Business Dealings: The abridged version of extant 'Guidelines for suspension of business dealings with suppliers/ contractors' has now been uploaded on www.bhel.com on "supplier registration page" at the following link: http://www.bhel.com/vender_registration/pdf/Suspension-of-Business-Dealings-with-Supplier-issued-Sept13_abridged.pdf**

3. **All Statutory Requirements as applicable for this project shall be complied with.**

4. **BHEL Fraud Prevention Policy, "The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendors/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice."**

5. **Following clause shall form part of the HSE documents issued under Chapter IX of Volume IB 'Special Conditions of Contract'**

"In case of any financial deduction made by Customer for lapses of safety other than what is provided elsewhere in the contract , the same shall be charged on back-to-back basis on the defaulting contractor without prejudice to any other right spelt anywhere in the tender /contract"

6. Please take note of following Revised Tender Clauses:

i. Notice Inviting Tender: Sl No 9

ii. General conditions of Contract: Clause 2.12, 2.14, 2.17, Clause No 1.15.13 (New), Clause No 2.8.3, 2.8.4 and 2.8.5

iii. Special Conditions of Contract: Clause No 4.2.1.7

7. Following Notes are added to Form F- 15 of Volume I D 'Forms & procedures'

i. It is only indicative and shall be as per the online format issued by BHEL time to time.
ii. No request will be entertained after specified date of the current month w.r.t the changes requested in the scores of immediate previous month.

8. PRICE VARIATION CLAUSE

Revision in Price Variation Compensation Clause no. 2.17 of Vol I C GCC:

Clause No. 2.17.9 of Vol IC GCC is revised as below:-
PVC shall be applicable only during the extended period of contract (if any) after the schedule completion date for the portion of work delayed / backlog for the reasons not attributable to Contractor. However total quantum of Price Variation amount payable/recoverable shall be regulated as follows:

i. For the portion of backlog attributable to the contractor and for the portion of backlog due to force majeure condition during contract period, PVC shall not be paid.
ii. For the period of force Majeure during extended contract period, PVC will be as per the indices applicable at the beginning of the force majeure period.
iii. void
iv. The total amount of PVC shall not exceed 20% of the cumulatively executed contract value during the extended contract period. Executed contract value for this purpose is exclusive of PVC, ORC, Supplementary/Additional Items and Extra works.

Clause No. 2.17.5 of is modified as below:-

Base date shall be the calendar month of the (schedule completion date of the contract). Schedule Completion date shall be the actual start date plus contract period as defined in Chapter VI 'Vol IA TCC'

9. Acceptance of Bank Guarantee (BG)

Revision in Acceptance of Bank Guarantee (BG) Clause no. 1.10.3 (V) of Vol I C GCC:

Clause No. 1.10.3 (V) of Vol IC GCC is revised as below:-

"Bank Guarantee issued by:

a. Any of the BHEL consortium bank listed below :

State Bank of India
ABN Amro Bank N.V.
Bank of Baroda
Canara Bank
Citi Bank N.A.
Corporation Bank
Deutsche Bank
HDFC Bank Ltd.
The Hongkond and Shanghai Banking Corporation Ltd.
ICICI Bank Ltd.
IDBI Ltd.
Punjab National Bank
Standard Chartered Bank
State Bank of Travancore
State Bank of Hyderabad
Syndicate Bank

b. Any public sector Bank (other than consortium banks) with a clause in the text of Bank Guarantee that it is enforceable at Nagpur, Maharashtra

c. Any private sector banks, with a clause in the text of Bank Guarantee that it is enforceable by being presented at any branch of the bank

Note: "Bank Guarantees issued by Co-operative Banks are not acceptable".

10. Broad Terms & Conditions of Reverse Auction

In continuation to Clause 19.0 of NIT (Notice Inviting Tender) following are the broad terms and conditions of Reverse Auction is given in Annexure V of NIT:

10.1. Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

10.2. BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids. In case BHEL decides to go for Reverse Auction, only those bidders who have given

their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit „online sealed bid" in the Reverse Auction. Non-submission of „online sealed bid" by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.

10.3. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

10.4. Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder for any of the eligible items for which techno-commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.

10.5. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.

10.6. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.

10.7. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.

10.8. Bidders have to fax the Compliance form (annexure IV) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.

10.9. In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for noncompliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.

10.10. Reverse auction will be conducted on scheduled date & time.

10.11. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.

10.12. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure VII) as provided on case-to-case basis to Service provider within two working days of Auction without fail.

10.13. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL"s standard practice.

10.14. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the "Business Rules of Reverse Auction", which will be communicated before the Reverse Auction.

10.15. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action as per extant BHEL guidelines, shall be initiated by BHEL and the results of the RA scrapped/ aborted.

10.16. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.

10.17. In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process

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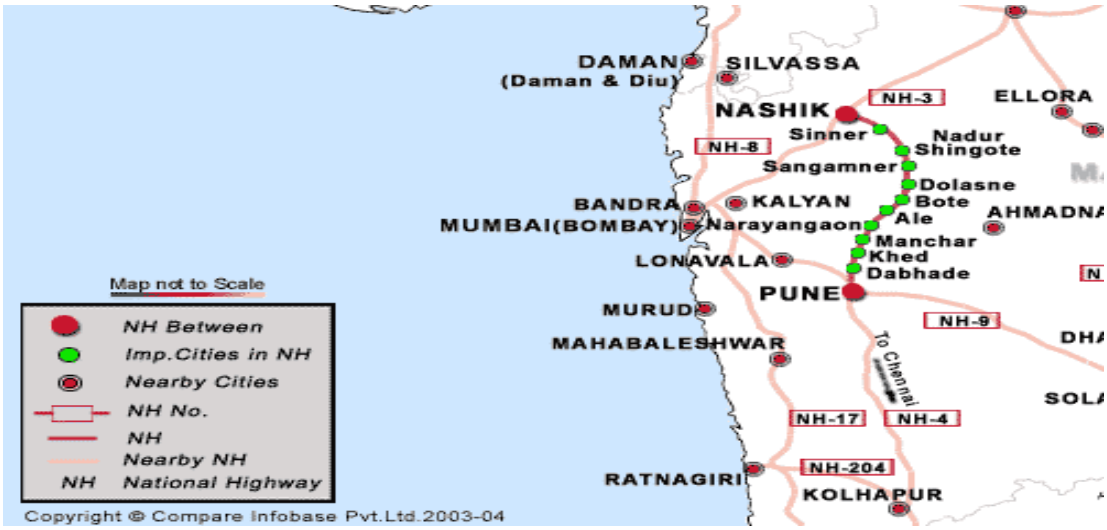
TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CONTENTS

1.0	**Project Information**
1.1	**INTRODUCTION** RattanIndia Nasik Power Ltd is setting up a coal based **Thermal Power Plant** at Sinnar-Special Economic Zone, Nashik district, Maharashtra. The project site is located on the State Highway 23, approximately 33 Km. from Nashik city. The nearest National Highway is NH 50. Nearest Railway Station : Nashik Road at 35 Kms from site on Mumbai Howrah rail section of Western - Central Railway passing through Dadar, Kalyan, Igatpuri. Nearest Highway : NH-50 (Nashik - Pune) Nearest Airport : Mumbai 230 KM **CLIMATE** Nashik District is located between 18.33 degree and 20.53 degree North latitude and between 73.16 degree and 75.16 degree East Longitude at Northwest part of the Maharashtra state, at 565 meters above mean sea level. Though average rainfall of the District is between 2600 and 3000 mm. Most of the rainfall is received from June to September. The maximum temperature in summer is 42.5 degree centigrade and minimum temperature in winter is less than 5.0 degree centigrade. Relative humidity ranges from 43% to 62%.
1.2	**OTHER INFORMATIONS:-** 1. **Owner : RattanIndia Nasik Power Ltd** 

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

CONTRACTOR SHALL ABIDE BY THE SAFETY / SECURITY RULES AND REGULATIONS AS PER THE REQUIREMENT OF RNPL / BHEL. CONTACTOR SHALL OBTAIN INFORMATION ABOUT ALL SAFETY / SECURITY NORMS OF RNPL WELL IN ADVANCE. BHEL WILL NOT ADMIT ANY CLAIMS WHATSOEVER ON ACCOUNT OF CONTRACTOR'S NON-FAMILIARIZATION OF SITE SAFETY / SECURITY REGULATIONS. CONSTRUCTION DESIGN AND MANAGEMENT HEALTH AND SAFETY PLAN OF CUSTOMER IS ATTACHED.

2.1 Control and Instrumentation

2.1.1 Brief Scope of work:

2.1.1.1

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/Metso DNA systems.

2.1.1.2

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.

2.1.1.3

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.*

2.1.1.4

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.

2.1.1.5

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.

2.1.1.6

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.

2.1.1.7

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

2.1.1.8

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

2.1.1.9

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 2.15 of GCC.

2.1.1.10

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

2.1.1.11

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.

2.1.1.12

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. Boiler Control & Instrumentation and its Auxiliaries

Digital Distributed microprocessor based max DNA system panels for FSSS, SADC, HP Bypass, auxiliary PRDS, soot blowers, coal milling system, gravimetric feeder remote /local control panels, Electronic water level indicator, air heaters, electrical panels for DC control supply, electrical heat tracing system, STLD, controlled circulation pumps, starter panel for mill lube oil /fans and field devices/ instrumentation work for above system, piping, cabling etc.

B. Turbo generator Control & Instrumentation and its auxiliaries

Digital distributed microprocessor based maxDNA system panels consist of TSC, EHTC, LPBP, TSI, ATT, LSR/AS, ATRS, turbine protection and monitoring,

Gamp and field instrumentation work / cabling, boiler feed pumps /condensate extraction pump, and misc. System like lube oil, seal oil, hydrogen gas system, vacuum pumps etc.

C. Station C&I / Balance of Plant

Digital Distributed microprocessor based Metso DNA 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, Steam and water analyzers, instrumentations, cabling, etc..

2.1.1.13

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.

2.1.2 Collection of materials

2.1.2.1.1

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, 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., for transport of equipment.

Note: - Damaged cable drums or any damaged items also to be shifted within the quoted rates. No extra compensation for difficulty in shifting due to damaged drums shall be done in this regard.

2.1.2.1.2

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.

2.1.2.1.3

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.

2.1.2.2

Void

2.1.2.3

All works such as cleaning, leveling, 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.

2.1.2.4

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 BHEL free of cost. All equipments shall be preserved and protected before and after erection as per the advice of BHEL engineer.

2.1.2.5

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 of contractor to arrange for adequate security round the clock for protection from such damages / pilferages / theft / losses.

2.1.2.6

All equipments shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc. shall be used for unloading and/or handling of the equipments without the specific written permission of the engineer. The 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.

2.1.2.7

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.

2.1.2.8

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.

2.1.2.9

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.

2.1.2.10

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.

2.1.2.11

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.

2.1.2.12

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 the preassembly and boiler area is the responsibility of the contractor. Contractor should visit the site and acquaint himself with all restrictions and difficulties that he may encounter during erection/commissioning stages.

2.1.2.13

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.

2.1.2.14 <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.

2.1.2.15.0 Pre-commissioning / commissioning and post commissioning activities

2.1.2.15.1

The work is also inclusive of various commissioning activities of turbine package along with its auxiliaries and station C&I 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.

2.1.2.15.2

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.

2.1.2.15.3

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 Section-2.15 of the GCC. The parts to be replaced shall however be provided by BHEL free of cost.

2.1.2.15.4

The pre-commissioning activities will start prior to steam blowing activity 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 specialized gangs including electricians/instrument mechanics in each area.

Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted.

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

2.1.2.15.5

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.

2.1.2.15.6

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 is involved, the same shall be carried out by the contractor promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by section-2.15 of GCC.

2.1.2.15.7

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.

2.1.2.15.8

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.

2.1.2.15.9 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 upto 12 to 15 areas. Contractor has to augment the manpower as and when required as per work demand and necessity at site. The quoted rates shall include this.

2.1.2.15.10

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.

2.1.2.15.11

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

2.1.2.15.12

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.

2.1.2.15.13 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 and testing, commissioning.) The classification of activity is only a guideline for understanding the total volume of work in each activity. The contractor shall have no claim for performing or providing manpower for such overlapping work, which is also within the scope of the work.

A **<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 computerized calibration certificates in the formats specified by BHEL Engineers and getting those signed by the customer is in the scope of the contractor.

B **<u>Erection</u>**

- Drawal 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 upto 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.
- Motor IR value measurement, bearing/winding RTD checking, drying out of motor, providing assistance for trial run of motor which includes monitoring temperature rise winding/bearing during trial run.
- Contractor shall prepare calibration/testing report/protocols.
- During trial run of various systems, if the performance of any instrument is found erratic, un-satisfactory and requires re-adjustment, re-calibration etc., the defect shall be attended by contractor.
- Observing and checking the performance of the various devices on load/process variation. Any deficiencies/defect noticed during the variable load conditions, the same should be attended properly.
- Observe the proper functioning of sub-group/sub-loop control.
- Check the operation of various controls in manual/auto mode for smooth functioning.
- Clearing of all bad / invalid signals noticed during commissioning.
- Providing necessary assistance for **Trial Operation** of the unit is in scope of this specification. Smooth operation and availability of all instrument/controls of the systems installed under the scope herein, shall be ensured by the contractor. Contractor shall provide adequate number of skilled manpower 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.

2.1.3 Brief description of work

2.1.3.1 Installation of Cable trays/cable ducts

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

2.1.3.1.2

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 galvanizing paint (refer clause no. 2.1.14 for details) on weld joints. *Installation of tray/duct covers, wherever provided, will be done as a part of tray erection and no extra rates will be payable.*

2.1.3.1.3

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.

2.1.3.1.4

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.

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

2.1.4.1

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 fiber cables on cable trays /cable trench shall necessarily be done using flexible conduit.

Note: -Damaged cable drums also to be used within the quoted rates. No extra compensation for difficulty in cable laying due to damaged drums shall be done.

2.1.4.2

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. Spare Holes of JB/Panels are to be sealed as per the requirement.

2.1.4.3

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.

2.1.4.4

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

2.1.4.5

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

2.1.4.6

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.

2.1.4.7

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.

2.1.4.8

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.

2.1.4.9

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.

2.1.4.10

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

2.1.4.10.1

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.

2.1.4.11 Terminal Connections:

The types of cable terminations are generally as detailed below:

TG package, Station C&I and Auxiliaries

1) All field cables in TG 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.

2.1.5 Junction Boxes:

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

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

2.1.6.1

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.

2.1.6.2

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, conducting RT/UT, painting (refer clause no. 2.1.14 for details) and erection and commissioning of other standard accessories as per instrument hook-up diagram.

Piping works shall involve either arc or TIG welding. Contractor to follow the BHEL supplied welding schedule and welding procedures. The decision of BHEL engineer will be final in this regard.

2.1.6.3

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.

2.1.6.4

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.

2.1.6.5

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.

2.1.6.6

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.

2.1.6.7

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

2.1.6.8

Impulse pipes shall be painted. Refer clause no. 2.1.14 for details.

2.1.6.9

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.

2.1.7 Structural steel fabrication and installation

2.1.7.1

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.

2.1.7.2

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, leveling, alignment, providing bracings, painting etc. No gas cut holes will be permitted. Contractor to follow the BHEL supplied welding schedule and welding procedures.

2.1.7.3

All the fabricated supports/frames shall be painted. Refer clause no. 2.1.14 for details.

2.1.7.4

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***.**

2.1.7.5

In certain packages, galvanized 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.

2.1.7.6

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.

2.1.8 Panels

2.1.8.1 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.

2.1.8.2

Installation of panel shall include fixing of base frame, fabrication of base frame if required, leveling, 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.

2.1.8.3

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 elevations in, TG hall, LT & HT switchgear room, unit control room, etc.

2.1.8.4

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.

2.1.8.5

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.

2.1.8.6

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.

2.1.8.7

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.

2.1.8.8

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.

2.1.8.9

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.

2.1.8.10

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.

2.1.9 Control panels

TG, Station C&I system panels are based on maxDNA/Metso DNA distributed digital control philosophy. MaxDNA/Metso 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 fiber 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.

2.1.10 Battery/battery charger/UPS

2.1.10.1

HDP Tubular 550/600AH or NiCd (or similar type) or Lead acid Batteries will be supplied loose along with battery interconnection in the series/parallel

links/bus bar, lugs, steel/wooden battery stand either assembled or knocked down condition, cables and associated charger and UPS system.

2.1.10.2

In case of Lead acid battery, the electrolyte shall be supplied in plastic cans. After installation, the electrolyte has to be filled in batteries and charging/discharging shall be carried out to achieve specific gravity of electrolyte and stability of battery/battery bank. If required, discharging of the charging cycle shall be repeated to achieve the desired results. However, BHEL engineer's decision shall be final. Any preparatory arrangement required to be done for charging and discharging of battery, the contractor shall arrange consumables, safety equipments etc., at his own cost.

2.1.10.3

In case of NiCd (or similar type) batteries are normally supplied in charged condition, due care shall be exercised while handling/installation of the same. If the battery charge is found to be less than the required level, the charging/discharging cycle shall be carried out as per instruction of BHEL engineer.

2.1.10.4

Battery charging/discharging is a continuous process and skilled manpower shall be deployed by the contractor round-the-clock.

2.1.10.5

Contractor shall arrange suitable load, cables, safety equipments and consumables for discharging the battery during charging and discharging cycle at his cost.

2.1.10.6

Contractor shall provide skilled manpower for periodic maintenance after the battery are fully charged for the activities such as checking of electrolyte level, specific gravity, topping up with distilled water and cleaning till the set is handed over to customer and record of the same shall be maintained and submitted before handing over of the system.

2.1.11 Vibration monitoring system & Flue gas analyser for Boiler

2.1.11.1 Vibration monitoring system for boiler auxiliaries

System comprises of transducers with integral cables, weldable pads, wall mounted cabinet including monitors. The pads required to be welded on SS block on HT motors end shield and fan bearing housing. In case of pad sizes more than the SS block provided on motor, contractor shall get the pads machined as per the required size and blue matching to be carried out before welding on bearing housing. No extra charges will be applicable.

2.1.11.2 Flue gas analysers

2.1.11.2.1 Oxygen Analysers

The system consists of Zirconia probes, electronic units Panel for mounting electronic unit, purging and calibration gas arrangements, etc. The probes are meant for direct mounting on duct / chimney, etc., at suitable elevation.

Commissioning support will be provided by vendor.

2.1.11.2.2 NOX, SOX, CO analysers

NOX, SOX, CO analysers system consists of extraction type sampling probes and shall be mounted on the chimney at a considerable height. This will also consist of other accessories like gas extraction sampling pumps, sampling tubing, electrical heat tracer, insulation, test gas cylinders, purge air compressors, etc, etc.

Commissioning support will be provided by vendor.

2.1.11.2.3 Opacity Monitor

This consists of transmitters, receivers, Local electronic units and housing, air blower and associated hoses / pipes, JBs and cables.

Commissioning support will be provided by vendor.

2.1.12 Field instrumentation

2.1.12.1

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.

2.1.12.2

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 upto 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.

2.1.12.3

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.

2.1.12.4

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.

2.1.12.5

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.

2.1.12.6

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.

2.1.12.7

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, trip valves, dampers, motorized 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, 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.

2.1.12.7.1

Transmitter enclosure / open racks for various packages which are to be erected and commissioned at various locations of the 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.

2.1.12.8

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

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 lumpsum 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.

2.1.12.9

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.

2.1.12.10

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.

2.1.13 Unit control desk and components

2.1.13.1 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.

2.1.13.2

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.

2.1.13.3

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.

2.1.13.4

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 upto the plug end of the tiles.

2.1.14 Final painting

2.1.14.1

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

2.1.14.2

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.

2.1.14.3

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. Paint, primer, brush, etc. supply is in the scope of the contractor. Colour codes for impulse piping, etc. will be as per standard codes.

2.1.14.4

All the weld joints of GI cable trays and GI structural members shall be applied with a coat of cold galvanizing zinc paint. Paint, etc shall be arranged by contractor at his cost.

2.1.14.5

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

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

2.1.15.1

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.

2.1.15.2 Void

2.1.15.3 Void

2.1.15.4

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.

2.1.15.5 Void

2.1.15.6

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.

2.1.15.7

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.

2.1.15.8 VOID

2.1.15.9

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.

2.1.15.10

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

2.1.16 Guidelines for erection

2.1.16.1 Impulse Pipelines

2.1.16.1.1

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.

2.1.16.1.2

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

2.1.16.1.3

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

2.1.16.1.4

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

2.1.16.1.5

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.

OR as below:-

Tube OD (mm)	Tube Material	Wall Thickness (mm)	Max. Unsupported span (mm)
6	SS	1.65	900
10	SS	1.65	1200
12	SS	1.65	1500
20	SS	1.65	1800

2.1.16.1.6

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

2.1.16.1.7

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

2.1.16.1.8

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.

2.1.16.1.9 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.

2.1.16.1.10

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.

2.1.16.1.11 Air Piping

All instrument air pipelines shall be isolated from the instruments and pressurized 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.

2.1.16.1.12 Pneumatic Signal Lines

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

2.1.17 Electrical cabling & Earthing

2.1.17.1 Electrical cabling /wiring

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

2.1.17.1.1

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

2.1.17.1.2

Insulation test of the various circuits shall be done.

2.1.17.1.3

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

2.1.17.1.4

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

2.1.17.1.5

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

2.1.17.1.6

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

2.1.17.1.7

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.

2.1.17.1.8

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.

2.1.17.1.9

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

2.1.17.1.10

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

2.1.17.1.11

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

2.1.17.1.12

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.

2.1.17.1.13

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.

2.1.17.1.14

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

2.1.17.1.15

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

2.1.17.1.16

The layout of all cables shall be arranged to give adequate clearance from other services and cables shall be routed to avoid hot zones. No extra cost shall be consider for rework.

2.1.17.1.17

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.

2.1.17.1.18

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

2.1.17.2 Earthing installations

2.1.17.2.1

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

2.1.17.2.2

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. Suitable 'CU" Lugs are to be supplied for earthing with GI wire by the agency where ever is required.

2.1.17.2.3

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

2.1.17.2.4

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

2.1.17.2.5

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

2.1.17.2.6

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

2.1.17.2.7

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

2.1.17.2.8

Welded joints on GI earthing conductors shall be painted. Refer clause no. 2.1.14 for details.

2.1.18 Instruments and Equipments

2.1.18.1

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.

2.1.18.2

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

2.1.18.3 Void

2.1.18.4

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

2.1.18.5

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.

2.1.18.6

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. Refer clause no. 2.1.14 for details.

2.1.18.7

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

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

2.1.19.1

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

2.1.19.2

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

2.1.19.3

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.

2.1.19.4

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

2.1.19.5

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

2.1.20 Storage

2.1.20.1

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

2.1.20.2

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

2.1.20.3

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

2.1.20.4

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.

2.1.20.5

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.

2.1.20.6

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.

2.1.20.7

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

2.1.21 Sub-assemblies

2.1.21.1

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

2.1.21.2

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.

2.1.21.3

Subassemblies should not be stacked one above the other.

2.1.22 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 categorized and stored separately.

2.1.23 Guidelines for handling of electronic modules

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

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

2.1.23.3

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.

2.1.23.4

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

2.1.23.5

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

2.1.23.6

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

2.1.23.7

Soldering irons and any other tools used must be grounded.

2.1.23.8

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.

2.2 ELECTRICAL

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 Electrical **Main Plant Electrical System** & Associated items .

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.

Contractor may tie up with separate suitable agency/agencies for carrying out Bus Duct, Relay Testing and Integrated Testing of Generator System work. However before deploying such agencies on job, the Contractor shall obtain approval of BHEL Construction Manager in writing.

HT/LT power Transformers, Variable Frequency Drive for ID, Fans, Soot Blower System, LIGHTING package and associated equipments & Associated Auxiliaries for the following: -

1. CABLE TRAY.CABLE TRAY SUPPORTS AND ACCESSORIES
2. LT POWER CABLES (Generally Armoured/Unarmoured), HT POWER CABLES(Generally Armoured/Unarmoured/unearthed grade),LT CONTROL CABLES (Generally Armoured/Unarmoured, Screened or Unscreened).
3. JUNCTION BOXES AND PUSH BUTTON.
4. STRUCTURAL STEEL.
5. STARTER PANEL/LOCAL STARTER BOXES/POWER DISTRIBUTION BOXES /MARSHALLING BOXES.
6. PANELS.
7. DIGITAL AUTOMATIC VOLTAGE REGULATOR.
8. MISCELLANCEOUS EQUIPMENTS.
9. EQUIPMENT EARTHING MATERIALS .
10. HT BUS DUCT (IPBD)
11. ONLY TESTING & COMMISSIONING.
12. SOOT BLOWER SYSTEM.
13. ELECTROSTATIC PRECIPITATOR (ESP).
14. OTHER EQUIPMENTS

2.2.1 GENERAL REQUIREMENTS

2.2.1.1

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.

2.2.1.2

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

2.2.1.3

The contractor will have following valid certificates.

A) Contractor Electrical License for Extra High Voltage System installation work.

B) Supervisory Competency Certificate to deal with Electrical High Voltage equipments for their erection, testing & commissioning. During the execution of work, minimum two persons should be posted at site that has valid Supervisory Competency Certificate.

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

2.2.1.4

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.

2.2.1.5

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.

2.2.1.6

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.

2.2.1.7

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.

2.2.1.8

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.

2.2.1.9

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.

2.2.1.10

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.

2.2.1.11

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.

2.2.1.12

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.

2.2.1.13

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.

2.2.1.14

All works such as cleaning, leveling, 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.

2.2.1.15

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.

2.2.1.16

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.

2.2.1.17

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.

2.2.1.18

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.

2.2.1.19

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

2.2.1.20

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.

2.2.1.21

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.

2.2.1.22

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.

2.2.1.23

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.

2.2.1.24

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.

2.2.1.25

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.

2.2.1.26

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.**

2.2.1.27

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

2.2.1.28

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.

2.2.1.29

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.

2.2.1.30

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.

2.2.1.31

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.

2.2.1.32

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.

2.2.1.33

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.

2.2.1.34

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.

2.2.1.35

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.

2.2.1.36

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.

2.2.1.37
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.

2.2.2 TESTING, PRE-COMMISSIONING AND POST COMMISSIONING:

2.2.2.1
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 arranged 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.

2.2.2.2
The contractor shall simultaneously start testing & commissioning activities for equipments to match the mile stone activities of the project.

2.2.2.3
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.

2.2.2.4
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.

2.2.2.5
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.

2.2.2.6
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.

2.2.2.7
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.

2.2.2.8
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.

2.2.2.9
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.

2.2.2.10
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.

2.2.3 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.

2.2.4 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

2.2.4.1
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.

2.2.4.2
The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc., shall be made on the basis of length actually laid.

2.2.4.3
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.

2.2.4.4
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.

2.2.4.5

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.

2.2.4.6
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.

2.2.4.7
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.

2.2.4.8
The erection contractor shall make every effort to minimize wastage during erection work. Cutting and wastage allowance shall be computed on length, weight of material actually used, measured and accepted. In any case, the wastage shall not exceed the following limits;

Sl.No.	Item	% Wastage on issued Qty
01.	Each iron/steel section	2
02.	Each size of power cables	1
03.	Each size of control / shielded cable	2

2.2.4.9
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.

2.2.4.10
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.

2.2.4.11
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 contractor‘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.

2.2.5 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.
- Goodlass Nerolac 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.

2.2.6 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.

2.2.7

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.

2.2.8 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.

2.2.9 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.

2.2.10 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 (25 x 3 mm Aluminium Flat) etc with hardware, PVC sleeves etc. shall be supplied by contractor within the quoted rate for cable laying. Single core power cable shall be laid in trefoil formation and suitably clamped at every 3 Mtr of cable length with 25mm wide 8 SWG Aluminium Strip by contractor with in quoted rate for cable laying. 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 their own 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. Damaged cable drums also to be used within the quoted rates. No extra compensation for difficulty in cable laying due to damaged drums shall be done.
12. **Unit rate quoted for cable lying shall include the activities as defined above from Sl. No. 1 to 12.**

2.2.11 JUNCTION BOXES/PUSH BUTTONS

1. Checking of installation for correctness.
2. Functional checking/ adjustment of JB / PBfor their system.
3. Hardware for erection (Like Nuts ,Bolts and Washers etc.) where ever is required shall be in the scope of the contractor.

2.2.12 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 Local Instrument Racks, 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, levelling, 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.

8. Hardware for erection (Like Nuts, Bolts and Washers, etc.) where ever is required shall be in the scope of the contractor.

B. METAL CHANNEL FLEXIBLE BOLTABLE CABLE SUPPORT SYSTEM

Flexible GI cable support system, consisting of single/double channels, base plates, and cantilever arms are as per BOQ given in section 16. Wherever necessary, the base plate beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded to the racks or beams if necessary at 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 inclusive in quoted rates for erection of support channel and cantilever arm. Brief scope of work is further defined as below:

1. Metal channel boltable GI cable support shall be supplied. Each cable rack assembly comprises of sub components such as single or double channel, base plate for single/ double channel, angle fitting, clamps, cantilever arm, anchor fastener, associated hardware (spring loaded nuts, bolts and washers) etc.

2. Channel shall be supplied in standard length of six meter. Contractor shall cut the channel and assembly the rack as per site requirement. Cantilever arm is to be fixed on channel support with spring loaded nuts / bolts as per installation drawing.

3. Base plate / angle fitting shall be continuously welded all around to steel members /plate insert if provided. Brackets / clamps shall be welded to steel surface with channel as applicable in position to ensure alignment of clamps / channels. Weld thickness shall be 6 mm minimum. In case steel surface in not available for welding, anchor bolts is to be used for fixing the base / angle fitting.

4. Main support for longitudinal cable tray run in the cable vaults shall be fixed at both ends at top as well at bottom as out lined above.

5. Galvanisation damaged due to welding / cutting shall be re-painted with cold galvanising paint (supply of paints is in contractor's scope).

6. Unit rate for **"Single / Double Channel"** shall include cutting channel in required lengths, fixing of angle fittings/ base plate / clamps / brackets / fasteners/ cantilever arms /, welding etc as required as per type of installation.

2.2.13 Switchgear, MCC & PCC (Not applicable for this project)

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.

2.2.14 INSTALLATION OF PANELS (STARTER PANEL/LOCAL STARTER BOX/POWER DISTRIBUTION BOX / MARSHALLING BOX / CONTROL PANELS/GEN. METERING PANEL/GEN. RELAY PANEL)

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.**

2.2.15 Void
2.2.16 Void

2.2.17 SOOT BLOWER SYSTEM

Soot blower system comprises of motor control centre / Local Starter Boxes having various feeders of motor starters / Switch Fuse Units , micro-processor based PLC panel with mimic diagram and control station, push button boxes, junction boxes, wall blowers/LRSB with drive mechanism, integral control box with limit switch and internal wiring, inter connecting cables between field blowers and MCC, PLC panel etc. The scope of work for testing, commissioning covers the items/devices as per rate schedule and the testing, commissioning of blowers shall be carried out in close co-ordination with mechanical agencies who shall be erecting these blowers and contractor shall obtain clearance from BHEL engineer prior to start of work. The contractor shall carry out the following works under testing & commissioning:-

01 Pre-commissioning checks and tests on MCC's / Local Starter Boxes, soot blowers, PLC panels, energisation of MCC and its feeders, wiring checks, insulation resistance measurements, testing of thermal over load relays, etc.

02 Adjustment of limit switches, torque switches, internal wiring checks, minor wiring modification to suit to system requirements for wall/LRSB blowers.

03 Electric operation of each blower from local, MCC / Local Starter Box and PLC panels and from Unit control board.

04 Providing loop on terminal block of MCC individual feeders & blowers.

05 During pre-commissioning / post-commissioning of soot blower system, the component like TB's, limit switch, torque switch, over load relay, contactors, etc. if found defective, contractor shall replace such components without any extra payment.

2.2.18 ELECTROSTATIC PRECIPITATOR

1. ESP shall have four flue gas passes and each pass comprises of HT rectifier transformer (silicon oil filled), Auxiliary Control Panels, electronic controller, LT

Main switch board and its bus duct, Drives for Rapping / Collecting / Gas damper screen, heating element for hoppers / shaft and supporting insulator housing, ash level indicator and EP management (IOS) system (software based) including computer interface and associated interlock and protection.

2. HT rectifier transformer shall be erected by mechanical agencies. Scope of work covered under this contract is oil filtration of transformers (If BDV Value is less than prescribed in O&M Manual / FQP / Commissioning check list / applicable standard) and erection and testing of various devices as listed in rate schedule. Contractor shall provide silicon oil filter machine as a part of scope. Contractor has also to provide operator round-the-clock for oil filtration and other necessary testing equipments. Contractor shall utilize power supply for filter machine from the source, which is given for the construction purpose, and shall arrange required cables.
3. **Panel type heaters are supplied along with power supply cable (3 to 5 meters approximately) as an integral part of heater. Termination of cable at JB end, after laying it through flexible GI conduit is part of job. No separate rate shall be applicable**.
4. **Heaters are to be tested, for its Resistance, IR value and current drawn measurement before mounting as a part of job and inclusive in the rate quoted**.
5. **Looping at JB, ferruling, lugs etc. is part of job and inclusive of rate quoted**

2.2.19 BRUSHLESS EXCITATION SYSTEM:

System comprises of DAVR Panel which is connected by Input cable from DAVR to PMG, DAVR to Main Exciter, DAVR to axis coil , Mounting of Local Instrument in Exciter Enclosure, Winding resistance & IR value of PMG, Main Exciter, Q axis coil, Diode wheel, Checking healthiness of diodes / Fuses, Commissioning of stroboscope, Exciter Heater / Blower, Rotor earth fault brush checking / setting, Lighting inside exciter enclosure, Flap actuator commissioning (If provided). Any other work inside exciter enclosure, Mounting of loose components supplied for Brushless exciter system, Dummy load test of DAVR, Checking from Control desk & Field related inputs/ outputs to commission the excitation system fully operational,

No separate item rate is applicable. Rate quoted by contractor shall be inclusive of all above related to Excitation system.

2.2.20 SCOPE OF ABOVE GROUND EARTHING

2.2.20.1

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.

2.2.20.2

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

2.2.20.3
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.

2.2.20.4
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.

2.2.20.5
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.

2.2.20.6
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.

2.2.20.7
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.

2.2.20.8
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.

2.2.20.9
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 shall be provided by the contractor irrespective of whether equipment of the area is in their scope or not.

2.2.20.10

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.

2.2.20.11

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

2.2.20.12

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.

2.2.20.13

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.

2.2.20.14

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.

2.2.21 VOID

2.2.22 ISOLATED PHASE BUS DUCT 16.5 KV, 20KA CONTINUOUS AIR-COOLED

1. GENERAL DESCRIPTION

Generator isolated bus duct is connected to low voltage side of Three phase power transformers 320MVA and main bus duct shall have tee off connection for unit transformer, LAVT cubicles, excitation transformer and air pressurisation equipment. Bus duct consist of round / octagonal/ box hollow aluminium alloy conductor and supported inside aluminium enclosure with post insulator. Flexible connections and expansion joints are provided at terminals and intermediate point to alleviate stresses. Ring type protection current transformer will be mounted inside the bus duct.

Isolated phase bus duct shall have tap connection for potential transformer, surge protector, etc. housed in a metal clad cubicle, UAT and NG cubicle/resistor cubicle. Various electrical tests have to be performed before and after erection.

Bus duct enclosure /conductor is a continuous welded type. Conductor, enclosure, makeup pieces, shunts pieces etc have to be welded at site.

1.The scope for Isolated Phase Bus Duct shall include Transportation of material from stores/ storage yard, preparatory work such as erection of supporting structure, placement of sub assemblies / equipments, alignment, edge preparation of conductor / enclosure, welding of conductor / enclosure, welding of shunt pieces & make up pieces, installation of seal of bushing & wall frame assemblies, shorting links, earthing, LAVT cubicle, copper flexibles, copper rubber bellows, weldable/ bolted flexibles, installation of air pressurising unit and its associated piping work and cable etc, testing and commissioning.

1.Pre-fabricated G.I. supporting members shall be supplied in loose condition and are to be erected as per lay out drawing. Foundation pockets and embedded plate inserts shall be provided as per lay out drawing (on floor for bottom support and on bottom of concrete slabs). Contractor shall weld the supports on insert plate and shall carry out grouting including supply of grout materials after complete alignment/bolting of structural members. If any modification required in supporting structure due to site conditions, the same shall be carried out without any extra cost. All welded joints shall be applied cold galvanizing zinc paint. Supply of Paints, primers etc are in the scope of the supplier, within the quoted rates.

1. Required aluminium welding of conductor, enclosures, shunt, make up pieces, aluminium flexible, etc. as detailed in drgs. has to be carried out by contactor. MIG/ TIG welding shall be applicable. Contactor shall arrange necessary welding equipment/ accessory in sufficient number, filler wire, argon gas and other required consumables at his cost.
2. During erection of bus duct/enclosure, makeup pieces and shunts, if any modifications needed to match the alignment shall be part of work and no extra payment shall be made.
3. All bolted joints and flanges shall be tightened with torque wrench to the approved torque. Wherever there are bolted joints, the same shall be cleaned and a layer of anti-oxidation paints shall be applied. Necessary paints, etc. to be arranged by contractor within the quoted rates.
4. Top chamber/adapter box for line and neutral side, hood assembly at UT hood assembly at excitation transformer and at LAVT cubicle end shall have drilled hole in flange. If there is any mismatch of the hole in above with respect to the counter flange/welded studs provided on UAT, LAVT and excitation cubicle, the contractor shall drill new holes if required.
5. Proper sequence shall be followed during erection to avoid any mismatch and alignment problem.
6. Prior to installation of bus duct assemblies in position, various components like conductor, insulator shall be inspected and cleaned and insulation resistance to be measured and recorded. If any insulator is found damaged, the same shall be replaced.
7. Electrical test on current transformers and potential transformers shall have to be carried out prior to installation & during pre-commissioning. The tests are insulation resistance measurement, winding resistance, magnetisation characteristic, ratio test, water ingress and air leak test on assembled bus ducts.
8. Minor civil work such as chipping, levelling of foundation, providing pockets, drilling/enlargement of holes in structure, bus bar etc. Which are incidental to the erection of bus duct shall not be treated as extra.
9. All miscellaneous items such as disconnecting links, flexibles, shorting bars, hardwares, conduit for wiring, marshalling box, CTs and PTs wiring through conduit, earthing materials, bus bar fish plates etc. are part of bus duct installation. Hence separate breakup quantity is not given in BOQ.
10. Round makeup pieces for main and tee off duct shall be supplied in two halves and it involves but circumferential and horizontal welding at parting plain.
11. Air tightness and water tightness test have to be carried out on completion of bus duct installation. In case of any leakages, contractor has to rectify and bring to the required level of air tightness/water tightness without any extra cost.

12. High voltage test of bus duct is to be carried out as per the instruction of BHEL engineer. Contractor shall arrange necessary test equipment / instrument for conducting various electrical tests at his own cost.
13. Contractor has to carry out final painting as per standard colour code recommended by BHEL. Paints and consumables shall be in contractor's scope.
14. Shunt pieces shall be supplied in two halves and to be welded between two-phase bus ducts at transformer end. The shunt pieces to be welded on both the side on matching plain and bus duct circumference and horizontal plain
15. Contractor shall conduct 20% radiography and 100% NDT test on welded joints.
16. **Enclosed / attached drawings are for estimation and tendering purpose only. Contractor has to ascertain quantum of work involved. The BOQ as furnished in this tender specification for Isolated Phase Bus Duct & Segregated Phase Bus Duct is tentative / approximate. The enclosed drawings are for tender purpose only. Contractor has to ascertain the quantum of work involved and quote the lump sum value, as called in the rate schedule, without any additional compensation for any variation in length or numbers of joints.**
17. One end of the enclosure to be earthed to the station earth at shunt location where all three-phase enclosures are shorted. Wherever shunts are not provided, each phase should be earthed separately.
18. In case of bolted bus ducts, phase split covers, rubber bellows, a clamping earth straps to be connected to maintain the electrical continuity and in turn enclosure gets earthed at one point.

All other equipment such as LAVT, NG transformer/ resistor cubicle, air pressurisation, CT chambers, junction boxes, etc to be earthed at two points to the earth grid.

2.2.23 VOID

2.2.24 INTEGRATED ELECTRICAL TESTING/COMMISSIONING

The brief scope of work under is defined as below, but not limited to the following. Contractor shall discuss & finalize testing procedure with BHEL Engineer In-Charge for the test to be conducted on Generator system. Drawing & documents shall be provided by BHEL at the time of testing. BHEL decision in this regard shall be final and binding on the contractor.

The contractor shall prepare all erection / commissioning log sheets and protocols / test certificates as per field quality plan/ Commissioning check list, get it signed by the concerned BHEL/customer engineer and submit the same to BHEL engineer as per his instruction.

Contractor shall maintain the charged and commissioned equipment till the same is taken over by customer.

Contractor's quoted rates for all concerned items shall include Integrated Testing as defined hereinafter.

2.2.24.1 GENERATOR CONTROLS AND PROTECTIONS RELAY PANELS & ASSOCIATED EQUIPMENTS SUCH AS BUS DUCTS, GT, UNIT & STATION TRANFORMER, GENERATOR BREAKER etc.

1. Integrated Electrical testing/commissioning of Generator Control and Protection Relay Panels & associated equipment, etc. shall involve various activities like relay testing/setting, simulation checks, testing of energy meters, on/off line functional checks on integrated system.
2. Relay Testing in static condition for Generator, Transformers, and associated system by secondary current injection at different current and recording the time duration.
3. Testing and checking of control and protection interlock scheme in static condition and simulation of protection device contact from internal and external devices of all electrical panels.
4. Measurement of Insulations, Winding Resistance, Polarization Index of winding of Generator & associated equipment/ system, DC resistance test & Impedance test on rotor, Brushless excitation system at the time of rotor insertion as well as during pre-commissioning stage / commissioning stage/ post commissioning stage.
5. Relay setting and checking the stability of protection relays in static and dynamic condition during the OCC (Open Circuit Characteristic) & SCC (Short Circuit Characteristic).
6. Functional checks / testing of synchronizing schemes, other electrical panels during the static and dynamic by simulation / back charging of generator transformer conditions.
7. Monitoring & recording the various parameters during open circuit and short circuit conditions test on generator & associated field equipment like generator transformer, unit auxiliary transformer. Recording and monitoring measurement.
8. Testing of protection current transformer for ratio test by primary injection, magnetization characteristic, polarity test, and IR measurement. Functional checks of relays of protection system by primary injection.
9. Testing of potential transformer for ratio test by voltage ratio, polarity test, insulation resistance measurement etc, testing of surge capacitors, PT isolator in PTPS cubicle etc.
10. Measurement of Insulation resistance of individual equipment and connected together.
11. Calibration of energy meters, tri-vector meters, voltmeters, ammeters, current & power transducers etc.
12. Providing temporary shorting link on bus duct or any other location while testing & normalisation after the test

2.2.24.2 GENERATOR SYSTEM TESTING

The following major works also shall be in the scope of the Contractor

1. Generator stator winding resistance and PI value measurement / check
2. Generator rotor winding resistance, impedance, IR value measurement before and after rotor insertion.
3. Generator Bushing HV test
4. Main exciter winding resistance, IR value measurement / check
5. PMG winding resistance, IR value measurement / check
6. Testing and commissioning of generator and exciter accessories viz., heaters, blowers, stroboscope, diodes, enclosure lighting, potential measurement of bearings (TE &EE) etc
7. Meggering during drying out of generator.
8. Meggeriing of generator bushing and its accessories. This test has to be conducted many times during erection and commissioning stages

2.2.24.3 6.6 KV HT SWITCHGEAR, 415 VOLT LT SWITCHGEAR / MCC, 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, magnetisation characteristic, winding resistance on CT and PT.
6. Checking of electrical control & protection interlock of individual breaker and integration with other system.
7. Calibration of energy meters, tri-vector meters, voltmeters, ammeters, power current & voltage transducers, etc.
8. Provide assistance for checking the electrical operation of individual breakers from remote panels / MMI package (maxDNA 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.*

2.2.24.4

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.

2.2.24.5

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.

2.2.24.6

Contractor has to repeat any test free of cost, even if already conducted, whenever required to prove and check the healthiness of system before power flow, such test

could be primary injection and primary injection in CTs. CVT, Insulation resistance of system / individual equipment, functional tests or any other tests as required by BHEL/ BHEL's client.

2.2.25 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.

2.2.26

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.

S. 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 approx. 500 M from site (Distance is only estimated, it may vary up to 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**			FREE

a	Single point source	Yes		At a distance of approx. 500 M from site (Distance is only estimated, it may vary up to 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	
3.2.3	**Electricity for living accommodation of the bidder's staff, engineers, supervisors etc**		Yes	
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		
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**			FREE
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	
3.3.3	**Water supply for Living Purpose**		**Yes**	
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	
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	Téléphone, fax, internet, intranet, e-mail etc.		Yes	
3.6.0	**COMPRESSED AIR wherever required for the work**		Yes	
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**	**Scope / to be taken care by**		*Remarks*
		BHEL	**Bidder**	
3.9.0	**ERECTION FACILITIES**			
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		
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**	In consultation with BHEL
d	Shipping lists etc for reference and planning the activities	Yes		In consultation with BHEL
e	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
f	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
g	Weekly erection schedules based on S. No. e. Hard copy to Construction manager, by email to HO.		Yes	In consultation with BHEL

h	Daily erection / work plan based on S. No. g. Hard copy to Construction manager, by email to HO.		Yes	In consultation with BHEL
i	Periodic visit of 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	
m	Coordination for inspection (IMIR etc) and getting clearance from Client / PMC		Yes	
n	Preparation of formats for completion of activities		Yes	

4.1 TOOL & PLANTS FOR C&I WORK

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

S/N	Description	Quantity
I. Instruments		
1	Dead weight tester rated 400 Kg/cm2 and with weights and test gauge facility. Make 'Budenberg or 'Ravika'	2 no.
2	Oil temperature bath suitable to calibrate the instruments range 0 – 200 deg. C with standard temperature gauges and thermostatic control	4 nos.
3	Muffle furnace – 800 deg. C with standard temperature gauges	2 no.
4	Standard gauges 12" dial size make "Budenberg" or "H Guru" or "Odin"	
	A) – 1-0 kg/cm2 pressure gauge(vacuum gauge)	2 no.
	B) 0 – 5 or 6 kg/cm2 pressure gauge	2 no.
	C) 0 – 10 kg/cm2 – do –	2 no.
	D) 0 – 25 kg/cm2 – do –	2 no.
	E) 0 – 60 kg/cm2 – do –	2 no.
	F) 0 – 100 kg/cm2 –do –	2 no.
	G) 0 – 250 kg/cm2 – do –	2 no.
	H) 0 – 600 kg/cm2 – do –	2 no.
	I) 0.2 to 1 kg -- do --	2 no.
5	Manometers (+/-) 1000 mm water column With hand bulb for lab and small manometers for field purpose.	4 no.
6	Manometer (+/-) 500mm mercury column with hand bulb for lab and small manometer for field purpose.	2 no.
7	Inclined manometer (+/-) 300 mm water column	2 no.
8	Portable air compressor with drier and regulator make "Toshniwal" / "Khosla" rated for 7 to 10 kg/cm2	5 nos.
9	Soldering iron "Soldron" make 25 watt	5 nos.
10	Vacuum pump	2 no.
11	Multimeters	
A)	Digital, 3 1/2 digit Motwane/HIL/Fluke	12 nos
B)	Analog: Motwane make	6 nos.
C)	Digital, 4 1/2 digit Motwane/HIL/Fluke	8 nos.
12	Standard milliamps / millivolts source of reputed make. Range 0 to 50 ma and 0 to 100 mv	4 nos.
13	Insulation tester hand operated 250V / 500V / 1000V rated mains/battery operated	2 no. Each
14	DC power supply 0-50 VDC, 5 A make "Aplab" or equivalent (variable source)	4 nos

15	Single phase variac 250 V, 8 amp	2 no
16	3 phase variac rating 5 amps	2 no.
17	Glass thermometer 0-120 deg. C, 0-200 deg.c and 0-600 deg.c	2 no. Each
18	Tong tester AC 5/10 and 25/60/300 amp of reputed make	2 no. Each
19	Tong tester DC 30/60/300 amp	2 no.
20	Secondary current injection kit upto 300 amp	1 no.
21	Tarpaulin fire proof	20 nos.
22	DC shunt 400 amp 75 mv	2 no.
23	Tachometer non-contact type 0 to 4000 rpm	2 no.
24	Industrial type vacuum cleaner	2 no.
25	RTD/Pt 100 source	4 nos.
26	Decade resistance box	4 sets.
27	Teletalk 2 wire system	12 sets
28	Equipment and consumables for LPI/MPI test on impulse pipes	2 set
29	Function generator	2 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 to submit calibration report from recognised agency prior to deployment of same at site and periodical calibration of the same to be arranged by contractor as per procedure of BHEL.

Sl. No.	Description	Quantity
II. Handling equipment		
1	Turn buckles	As required
2	D-shackles	
3	Steel wire ropes	
4	Manila ropes	
5	Chain pulley block/turfer	
III. Major T&P		
1	Pipe bending machine – 2” size	6 nos
2	Grinding machine	12 nos
3	Drilling machines 1/4”, 1/2”, 3/4” & 1”	2 no. Each
4	Copper tube bender and cutter sizes 6mm, 8mm, 1/2”, 1/4”	2 no. Each
5	Die sets for threading upto 2” pipe.	4 nos
6	Spirit level	4 nos.
7	Tap sets for both BSP and NPT threads upto 1” each	2 set each

8	Measuring instruments like micrometers and callipers	2 set each
9	Welding generators	8 nos.
10	Welding transformer	8 nos.
11	TIG welding set	4 no.
12	Mechanical tool kit for fitters	12 sets.
13	Electrician tool kit	16 sets.
14	Crimping tool	8 nos.
15	Flood light fittings	16 nos.
16	Fire extinguishers as required	2 set.
17	Distribution boards with power cable complete as required	2 set
18	Painting brush	As required
19	Fire proof tarpaulin	As required
20	Safety belts and safety helmets	As required
21	24V AC transformer & hand lamps	16 nos.
22	Ferrule printing machine	4 nos
23	Electrode drying ovens	As required
24	Personal computer and accessories, Printer	1 set
25	Cranes, trucks etc for transportation and erection of equipment	As required

Note:
The list of instruments / equipments to be brought by the contractor as shown above is only indicative. Any other instruments / equipments required for the execution of the work is to be necessarily arranged by the contractor. The testing/calibration instruments which are used to be duly calibrated in the interval prescribed by BHEL engineer from the BHEL approved agencies. And test certificate to be furnished.

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

S/N	Description
1	Welding electrodes for welding AS/CS/SS pipe and other welding from BHEL approved vendors only
2	Filler wire for argon welding
3	Argon, oxygen and acetylene gas
4	Provision for temporary scaffoldings.
5	GI “U” clamps with nuts and washers for impulse and GI pipe clamping.
6	Round aluminium tags (30mm dia x 3mm thick)
7	Teflon tape and insulation tape.
8	Hold tight / bitumen tape for GI pipe coupling.
9	Required paints and primer from BHEL approved vendors only.
10	Solder wire (60/40)
11	Protocol/calibration report sheets as per BHEL format.

12	Panel/JB sealing compound material (for cable entry from bottom/top of panel).
13	PVC cable tie, aluminium strip and hardware for clamping of cables, copper tube, temperature gauge capillary.
14	Copper lugs upto 4 sqmm, PVC sleeve of different size, PVC button & tape
15	Ferrules (PVC) and suitable for ferrule printimg

Pl note: The above list is only indicative. The contractor to arrange consumables as required as per scope of contract.

4.2 T&P FOR ELECTRICAL WORKS

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

SN	DESCRIPTION	MINIMUM QUANTITY
1	HV TEST KIT AC, 0 –50 KV &DC, 0- 100 KV PREFERSBLY WITH DRY TYPE TRANSFORMER	1 NO. EACH
2	SOLDERING IRON “SOLDRON” MAKE 25 WATT	2 NOS.
3	MULTIMETRES	4 NOS.
4	A) DIGITAL 3 1/2 DIGIT OF REPUTED MAKE	3 NOS.
	B) ANALOG MOTWANE MAKE	1NO.
5	INSULATION TESTER HAND OPERATED 25OV/500V/1000 V RATED MAINS/BATTERY OPERATED	1 NO. EACH
6	INSULATION TESTER MAINS OPERATED 2500/5000V	1 NO.
7	PHASE SEQUENCE INDICATOR	1 NO.
8	TONG TESTER AC 5/10, 25/60/300 AMP RANGE REPUTED MAKE	1 NO. EACH
9	TONG TESTER DC 30/60/300 AMP	1 NO.
10	DC RESISTANCE METER	1 NO.
11	STOP WATCH	1 NO.
12	TARPOLIN FIRE PROOF	As required
13	TELETALK 2 WIRE SYSTEM	6 SETS
14	TORQUE WRENCH (12-60Nm, 50-225 Nm)	1 NO EACH
15	FERRULE PRINTING MACHINE	1 NO
16	SILICON OIL FILTER MACHINE	1 NO.

4.2.2 T&P FOR MECHANICAL WORK

SN	DESCRIPTION	MINIMUM QUANTITY
	HANDLING EQUIPMENTS	
1	TURN BUCKLES	As required
2	'D' SHACKLES	As required
3	STEEL WIRE ROPES	As required
4	MANILA ROPES	As required
5	CHAIN PULLEY BLOCK/TIRFUR	As required
	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.
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 required
19	FIRE PROOF TARPAULIN	As required
20	SAFETY BELTS AND SAFETY HELMETS	As required
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	3 NOS.EACH (Not applicable for this project)
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 for electrical, C&I and mechanical works 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.

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

01	EOT crane in TG hall shall be made available on sharing basis for handling panels	1 no

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.

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6.0 TIME SCHEDULE AND MOBILIZATION:

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 or as per directions of Construction Manager/ Project Manager of BHEL.

The contractor has to subsequently augment his resources in such a manner that the entire related works are completed to achieve the following **tentative** schedule:

SN	Activity	Anticipated Dates
		U#4
1	Start of work	0 months
2	Boiler light up	4 months
3	Steam Blowing completion	7 months
4	TG on Barring gear	7 months
5	Synchronisation and coal firing	9 months
6	Full load	9 months
7	Trial Operation	11 months
8	PG test	13 months

6.1.2 Contract Period

The Contract period shall be 13 months from 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 upto 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.

6.2

The contract shall commence from the date of deployment of contractor's T&P, proper site setup and erection of first equipment. All

the above three conditions are to be fulfilled (certified by BHEL engineer) for deciding the date of commencement of the contract.

The contractor shall complete all the work in the scope of this contract within the contract period

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 programme along with BHEL engineer indicating the work to be achieved and event to be completed. Once the programme is drawn, he shall adhere to the same. Contractor shall plan and erect the materials as it is received at site. The monthly 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 programs.

6.5

Contractor shall specifically note that there is likely to be some delay in supplies of materials / release of work fronts / other reasons. Contractor shall have to work round the clock on such critical activities as a part of catch up programme to meet the project requirement to the extent possible and shall also provide required resources as part of scope of work.

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.

6.7 Material Re-conciliation

The BOQ is for one unit. The contractor shall do material re-conciliation periodically.

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

TERMS OF PAYMENT FOR C&I

Sl. No.	Activity/Work Description		% of unit rate
A	**Main E&C Equipments/Items**		
I	**PRO RATA PAYMENTS (85%)**		
2.0	**Cable laying (Power Cables)**		
2.1	Laying of cables		45%
2.2	Glanding, Termination and tagging of cables		15%
2.3	Dressing and clamping of cables		10%
2.4	Testing and charging of cables		15%
		Total =	**85%**
3.0	**Cable laying (Control and Signal Cables)**		
3.1	Laying of cables		45%
3.2	Glanding, Termination and tagging of cables		15%
3.3	Dressing and clamping of cables		10%
3.4	Shielding of cables		5%
3.5	Testing and charging of cables		10%
		Total =	**85%**
4.0	**Junction box/Push button station (local)**		
4.1	Erection including fixing of terminal blocks where ever applicable		75%
4.2	Name plate fixing where ever applicable, Labelling (both inside and outside) and Commissioning of connected equipment		10%
		Total =	**85%**
5.0	**Conduits/impulse pipe/tubes**		
5.1	Fabrication, Laying and Erection		50%
5.2	Leak Test/Hydraulic Test (where ever applicable, other wise clubbed with next activity)		20%
5.3	Dressing, clamping, tagging and painting where ever applicable		8%
5.4	Testing & commissioning of associated equipment/system		7%
		Total =	**85%**
6.0	**Miscellaneous Structural steel including frames for Panels/Racks/Instruments, supports for cable tray/pipes/tubes, Canopies etc**		
6.1	Fabrication, Erection, Alignment, Welding/bolting and where ever applicable chipping/grouting/painting		65%
6.2	Erection of associated Items/Equipments/Systems as applicable		20%
		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 Guages/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%**
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%)**	
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%**

TERMS OF PAYMENT FOR ELECTRICAL WORKS

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, misc equipments, 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 05 dated 13/08/2015)

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 14 %) 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 including new levies/taxes/duty if any)~~**

~~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 - For All types of works excepting works covered under sl no 8.2

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 BOCW Cess - For All types of works excepting works covered under sl no 8.2

The quoted rates shall be exclusive of the BOCW Cess which, if applicable, shall be paid extra by BHEL against Documentary evidence. However, the applicability of the BOCW Cess shall be got confirmed from BHEL in writing, before remitting such Cess/tax.

8.5 GST: For All types of works excepting works covered under sl no 8.2

As and when GST becomes applicable to this contract, the net differential (negative or positive) financial liability of the bidder to the Authorities (as compared to such liability prior to applicability of GST), if any, shall be to the account of BHEL. For this purpose, all available options under the GST shall be explored, and the decision of BHEL in this regard shall be final and binding on the bidder.

9.0 SPECIFIC INCLUSIONS

9.0.1 SPECIFIC INCLUSIONS C&I

Consumables/items to be provided by BHEL free of charge

01 Metallic Cable glands

02 Steel for fabrication

03 Lugs beyond 4 sq.mm size

Consumables/items to be arranged by Bidder

01 Cable ferruling numbers and characters

02 Name plates/Tag plates with tying/fixing material for cable's at both end & field instruments

03 Cable Markers

9.0.2 SPECIFIC INCLUSIONS ELECTRICAL

Sl.No	Description	Scope / to be taken care by		*Remarks*
		BHEL	Bidder	
1	*Lugs up to 4 sq mm size*	-	Yes	
2	*Lugs beyond 4 Sq. mm size*	Yes	Yes	For GI wire earthing
3	*Paint, primer and consumables*		Yes	
4	*LT cable straight through jointing Kits*		Yes	
5	*HT Termination Kits*	-	-	**Not applicable for this project.**
6	*Trefoil Clamps with hardware*	Yes	-	For single core HT cable
7	*Identification tags PVC /Metals, sleeve and clamps with hardware. PVC ties, Ferrule, Buttons and tap*		Yes	
8	*Dry Nitrogen Cylinder for Transformer*		Yes	

10.0 Exclusions:

10.0.1 Exclusions C&I:

The following are specific exclusions from this work.

1. Attachment welding of thermocouple pads for tube metal temperature measurement and fixing of thermowells in the pipelines.

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)*.

4. Erection of electro hydraulic actuators.

10.0.2 EXCLUSIONS ELECTRICAL

The following are specific exclusions from this work.

1. Erection of dampers, valves, electrical actuators, pneumatic actuators.
2. Erection of ESP rectifier transformer, electrical heaters, rapping motors, mechanical interlock.
3. Erection of HT/LT motors (except those specified herein)
4. Erection, testing and commissioning of elevators and DG sets.
5. Generator Erection.
6. Supply of cable trays

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.

TECHNICAL DETAILS

C&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.), lumpsum 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.
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 I1.0.10: 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 (refer clause no. 2.14). Payment for erection will be made on per metre 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 I6.0.3 to I6.0.7: Assembly of JB mounting frames:**

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

- **Sl No I7.0.2 to I7.0.6: Control panels**

  These are microprocessor based sophisticated electronic control panels in majority. Weights range from 400 to 2000 Kg from I7.0.2 to I7.0.6 respectively.

  Lump sum price is to be quoted.

- **Sl No I7.0.11: Unit Control panel**

  Approx. Dimension 824(W) x 2355(H) x 1000(D) mm. Shipped in one or two sections. Pushbuttons, LEDs, console inserts, vertical indicators, recorders, digital indicators, analog indicators (about 100 nos), LED/PB stations (about 200 nos), etc, are located in these panels in suitable tiles. Alarm annunciation facia are also mounted. The individual items may come mounted or loose. Other than what is envisaged for certain items (viz., console inserts, vertical indicators, digital/bargraph indicators, recorders-3CH/24CH) in the rate schedule, no separate charges will be entertained. Erection, calibration (as the case may be) testing and commissioning of analog indicators and LED Pushbutton Stations located in these panels will be considered as a part of Unit control panel Erection and commissioning and no separate payment will be done for the same.

  Lump sum price is to be quoted.

- **Sl No I7.0.12: Generator/Electrical Control Panel**

  Dimension approx. 3080(W) x 2355(H) x 1000(D) mm.

  This panel houses the electrical mimic diagram of the plant and consists of various switches, indicators, semaphore indicators, digital indicators etc., in suitable tiles.

Alarm annunciation facia are also mounted. The individual items may come mounted or loose. Other than what are envisaged in the rate schedule, no separate charges will be entertained. Erection, calibration (as the case may be) testing and commissioning of analog indicators and LED Pushbutton Stations located in these panels will be considered as a part of Electrical control panel Erection and commissioning and no separate payment will be done for the same.

Lump sum price is to be quoted.

- **Sl No I7.0.13: 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.

- **Sl No I7.0.14: Vibration monitoring system for Fans and Pulverisers:**

The scope covers installation of Vibration monitoring system, integration of system, commissioning etc. including drilling and tapping, welding of vibration probe mounting pads, etc. Vibration Monitoring System (VMS) for Fans (6 nos.) and Mills (6 nos.) consists of the following (approximate quantities):

3 Nos. of VMS Local Cabinets, each of size 400 x 300 x 300 mm, along with monitor/ VDU.

Piezoelectric Transducer -24 Nos., Extension cable -24 nos., Phase sensors -12 nos., 8 mm extension cable -8 nos., Junction Boxes-12 nos.

Lump sum rate is to be quoted.

- **Sl No I7.0.15: Vibration Monitoring system for Main turbine/ Generator**

Vibration Monitoring system for Main turbine: 1 no. panel (2415x800x800 mm, approx. wt. 1000kg), 1 PC, 14 nos. Piezo Velocity Sensors, Extension Cables for sensor 10 meters-14 nos., Displacement sensors- 14 nos., Extension cable for VL sensor – 14 nos., Driver (for relative shaft vibration)-14 nos., Displacement sensor with 1 meter cable-6 nos., Extension cable-6 nos., Drivers-6 nos., Complementary differential expansion monitors -2 nos., 19” Instrument Rack-2 nos., Mounting Pads-10 nos., Junction boxes-9 nos., Cable seals-9 nos., Cable conduit for sensor-200 mtrs., Ethernet switch-1 nos.,

Lump sum rate per set is to be quoted.

- **Sl No I7.0.16: Vibration monitoring system for pumps:**

  The scope covers installation of Vibration Monitoring System, integration of system, commissioning etc. including drilling and tapping, welding of vibration probe mounting pads, etc. Vibration Monitoring System (VMS) for pumps consists of the following (approximate quantities):

  1 Nos. of VMS Cabinet, each of size 2415x800x800 1000kg, along with monitor/ VDU.

  Piezoelectric Transducer -24 Nos., Extension cable -24 nos., Phase sensors -6 nos., 6 mm extension cable -8 nos., Junction Boxes-12 nos.

  Lump sum rate is to be quoted.

- **Sl No I7.0.17 : DC motor starter box for scanner fan**

  Installation & commissioning of DC starter box (dimension approx 900 x 1120 x 375 weight approx 100 KG.) along with its resistance box for scanner air fan

- **Sl No I7.0.18: Burner tilt Shear pin failure indication box**

  One set consist of 4 Nos. shear pin alarm boxes with 4 Nos. Shear pin failure contact switches. These are to be erected and commissioned.

- **Sl No I7.0.19: Air Heater Rotor stoppage box**

  Rotor Stoppage Alarm Box- including sensors (magnetic switch), timer relays, interconnecting cables etc. Lump sum rate per set is to be quoted.

- **Sl. No. I7.0.20: Steam Leak Detection system:**

  Qty given is for 1 set (approximate):

  Consist of 36 nos. of acoustic sensors mounted in sonic tube which are mounted on stubs provided in the boiler, 36 nos. of field amplifier units, decibel scanner, 1 no. of panel (800x2315x800 mm, approx wt. 600kg) with electronic modules like power supply, electronic module rack etc., 1 no. PC, 10 nos. of field JBs. Scope includes calibration of sensors using calibrator and erection and commissioning of the

system components including providing purging air to the sensors. However, cabling and termination will be paid as per rates for cables. The quantities mentioned are approximate.

Lump sum rate per set is to be quoted.

❖ **Sl No I7.0.21: Electronic water level indicator (EWLI)**

4 nos. Electronic Water Level Indicator EWLI comprises of the following: Details are per unit:

- 2 Nos. 16 Port pressure vessel & 2 No. 8 port pressure vessel with loose supplied electrodes (48 nos)
- 4 Nos. of Ascertor Units (Local) with Display, each of dimension: 600 x 350 x 600 mm; Weight: 25 kg each
- 2 Nos. of Remote Display Unit (99 x 194 x 81 mm)
- Interconnecting cables between local panel and 48 electrodes (included in cabling BOM)
- Display units (2 nos.) to be mounted in backup desk

Lump sum rate per set is to be quoted.

❖ **Sl. No. I7.0.22 ; LP dosing system**

LP dosing system consist of 2 nos. of control panels for Ammonia and Hydrazine dosing (Approx. dim.1000 x 800 x 300, 3.0 MT) with local/remote starter box, alarm facia, auto stroke controller etc., 4 nos. dosing pumps with actuator for auto stroke controller, 4 nos. of pressure gauges, 6 nos. level switches, 4 nos. level gauges. 4 nos. of agitator pumps.

Lump sum rate per set is to be quoted.

❖ **Sl No I7.0.23: Condenser Vacuum Pump (CVP) system**

Removal, calibration and commissioning of CVP skid mounted instruments including CVP PLC and motor mounted on the skid. The approximate quantity of skid mounted instruments shall be

- Pressure Indicators – 2

- Flow Switches – 2
- Level Switches – 2
- Pressure/DP – 3
- Temp. Indicators – 2
- Flow Indicators – 1
- Solenoid valves – 4 nos.

Lump sum rate per set is to be quoted.

❖ **Sl No I7.0.26 and I7.0.27: LIRs and LIEs**

Local instrument racks are open type housing for field instruments. These have to be located in suitable places, impulse piping and cabling to be done. Number of instruments in each LIR will vary.

Local instrument enclosures are closed type housing for field instruments. These have to be located in suitable places, impulse piping and cabling to be done. Number of instruments in each LIE will vary.

❖ **Sl No I7.0.30: Computer furniture**

Computer table 9 nos., printer tables 4 nos., chairs 14 nos. approx.

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 I7.0.31: LVS**

Other than the LVS (67" diagonal), rear Projection, Resolution 1400 x 1050 pixels mentioned in the rate schedule, accessories like video switches, associated cabling (prefab and otherwise) etc are also included.

LVS erection and commissioning supervision is in scope of other agency (supplier).

Lump sum rate is to be quoted.

❖ **Sl No I7.0.32: 220/240VAC UPS System and ACDB**

Parallel Redundant UPS Power supply system with isolation transformer, inverter and SCVS, 2X120 KVA rating consisting of UPS panels 5 nos. UPS Panels (App dim 1200 x 1000 x 2215 mm), Oil cooled variac (app. 250 Kg without oil), AC distribution boards 2 nos (dim. 1600 x 1000 x 2110 mm), Battery of 258 Nos. HDP tubular, KBH 670 AH cells and charger. Scope includes laying and termination of approx 120 sqmm 3C copper / aluminium cable (about 200 meters) between the panels, battery banks, ACDBs, Cable connectors (120 sq.mm Copper, L=3200, Qty.:5 nos.; L=1300, Qty. 10 nos.; L=1200 Qty: 50; L=800 Qty.:20; L=400, Qty. 80 nos.) etc, connectors : 258 nos.

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

Lump sum rate per set is to be quoted.

- **Sl No I8.0.02: Furnace temperature probes**

Consist of Type K thermocouple, advance/retract/park mechanism with limit switch tripping, pressure switch, solenoid valve, local pushbutton cum control box, remote control station at control room, etc. The temperature probes will be erected by mechanical agency. The local control box (800 x 800 x 400 mm, 75 Kgs) shall be erected by the contractor.

Lump sum rate per set is to be quoted.

- **Sl No I8.0.27: Direct water level gauge**

Commissioning of Direct Water Level Gauge consisting of illuminator assembly, fibre port system illuminator, transformer, lights, etc.

Lump sum rate per set is to be quoted.

- **Sl No I8.0.34: HEA Exciter System**

H.E.A. exciter box along with retractor assembly, flexible spark rod, spark tip, flexible HT cable assembly, S.S. Hose (1 Mtr long, 6.35 mm ID), Air Filter Regulator, HEA Exciter transformer, solenoid valve, limit switches, etc.

Lump sum rate per set is to be quoted.

❖ **Sl No I8.0.35: Flame Scanner head assembly**

It includes erection of fibre optic cable of length 120", Lens Barrel Assembly, Miniature 6 way Junction Box etc.

Lump sum rate per set is to be quoted.

❖ **Sl No I8.0.41 and I8.0.42: SWAS system**

SWAS sample handling system consists of primary rack, wet rack {4500(W) X 900(D) X 2300(H)} - 1 no., dry panel {4000(W) X 900(D) X 2300(H)} - 1 no., chiller {3100(W) X 1900(D) X 2300(H)} - 1 no. etc. and various analysers including Conductivity Analyser (11 nos.), Dissolved Oxygen Analyser (3 nos.), pH Analyser (6 nos.), Silica Analyser (1 no.), Phosphate Analyser (1 nos.), Sodium Analyser (1 no.) and Hydrazine Analyser (1 no.) per set.

Lump sum rate is to be quoted.

❖ **Sl No I9.0.01: Rack mounted Instruments commissioning**

Involves removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc.

- LP Bypass rack –1 set consisting of
  - Pressure Gauges: 11 Nos., Pressure Switches: 1 Nos.
- EHG Rack –1 set consisting of
  - Pressure Gauges: 10 Nos., Pressure Switches: 4 Nos.
- Supply Unit Racks for HPV-1, HPV-2, IPV-1&2 - 1 set consisting of
  - Pressure Gauges: 17 Nos., Pressure/DP Switches: 15 Nos.

Lump sum rate per set is to be quoted.

❖ **Sl No I9.0.2: Coal Feeder local instruments**

Involves only cabling and commissioning of local cabinet and peripherals like load cells, coal motion monitor, several switches, etc.

Lump sum rate per set is to be quoted.

- **Sl No I9.0.8: ERV Controller**

The controller box (Dimension: 400 x 350 x 270 mm; weight: 5 kg each) to be erected near the Electromatic Relief Valve and impulse piping to be done. It has 220V DC rated pressure switches inside which are to be calibrated. Remote console is to be mounted in UCP/backup desk located in control room.

Lump sum rate per set is to be quoted.

- **Sl No I9.0.11: Fan Lube oil skid**

The scope of work includes removal of instruments, calibration, refixing, checking cable connection from JB to instruments, motor connection, meggering and improving IR value of motor etc. and commissioning the skid.

The approximate total quantity of instruments for all the 6 Nos. skids put together is given below:

Pressure/DP Gauges - 44 Nos.

Temperature Gauges – 18 Nos.

DP Switches – 6 Nos.

Pressure Switches - 28 Nos.

Level Switches - 6 Nos.

Lump sum rate per set is to be quoted.

- **Sl No I9.0.12: Pulveriser Lube oil skid**

The scope of work includes removal of instruments, calibration, refixing, checking cable connection from JB to instruments, motor connection, meggering and improving IR value of motor etc. and commissioning the skid.

Equipment per set:

DP/ Pressure Switch - 5 Nos.
Temperature Switch - 2 Nos.
RTD – 10 Nos.
Pressure/DP Gauge- 3 Nos.
Level Switches – 3 nos.
Level gauge- 1 no.
Temperature Indicators- 3 Nos.

Flow Indicators cum switches- 3 Nos.

Lump sum rate per set is to be quoted.

- **Sl No I11.0.1: Master and slave clock system**

This equipment consists of one control panel (1200 x 900 x 2415 mm) housing power supplies, clock modules etc. GPS antenna is also to be suitably located and cabled up under this scope. About 6 nos. slave clocks will have to be installed at various locations throughout the plant. Commissioning supervision will be provided by the supplier of Master clock system.

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

Consists of panel (2400 x 800 x 2415 mm) approx. weight 500 Kgs. Also consists of PC, printer, Hart communicators for field use, etc. Erection supervision and commissioning is in the scope of the supplier. Contractor to provide erection and commissioning support only.

TECHNICAL DETAILS, BILL OF QUANTITIES & DRAWINGS
ELECTRICAL

❖ Sl No E1: 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.

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

❖ Sl No E5C: GENERATOR, GT & UT PROTECTION AND METERING PANEL

SN	DESCRIPTION	Qty/Unit
	Generator, Generator Transformer, Station & Unit Transformers, **"Control / Protection & Metering Panels",**. Protection relay shall be numerical of Alstom / ABB / Siemens / or equivalent. 1.Generator, Generator Transformer & Unit Auxiliary Transformer Control, Protection & Metering Panel (size 2230(H) x 1000(W) x 1000(D) mm) – 4 Nos. 2. Station Transformer Control & Protection Panel (size 2230(H) x 1000(W) x 1000(D)) – 1 Nos.(**Not applicable for this project**) Following items along with each unit panels shall be supplied loose for mounting in the panels / Unit Control Board 1. PC -2 Nos. 2. Replay S/W on CD –1 NO. 3. Colored Inkjet printer – 2 Nos. 4. Antenna with 6 mtr cable 5. Cables for antenna- 60 m 6. UPS for PC – 2 Nos. 7. Hub between PCs & DR – 1 No. 8. Cable DR to Hub – 2 Nos 9. Cable from Hub to PC – 2 Nos. 10. Disturbance Recorder (DR) – 2 Nos. 11. Energy Meter along with power pack unit & chargers – 1 Nos.	4 Nos.

❖ Sl No E5D: DIGITAL AUTOMATIC VOLTAGE REGULATOR PANELS

S.No.	DESCRIPTION	Qty per unit
1	Digital Voltage Regulator panels consist of Regulation Cubicle, Thyristor Cubicle and Field suppression cubicle , Overall dimension 3050 x 800 x 2230 mm, Total weight - 1.5 MT. DVR console assembled or loose components are to be mounted on Unit Control Desk.	1 Nos

❖ Sl No E7: ISOLATED PHASE BUS DUCT (IPBD)

BUS DUCT SET PER UNIT
EACH SET COMPRISES OF THE FOLLOWINGS: -

Description	Main Run		Tap-Off Run
Weight per meter	800 Kg		250 Kg
Conductor Material	GR 19501		GR 63401
Enclosure Material	GR 19501		GR 31000/63401
Conductor Shape	ROUND		BOX formation (2 Channels)
Conductor size	37800 Sqmm		7455 Sqmm
Phase Spacing	1300		1000
Outside Diameter	1070		780
Thickness	8		4.78
Phase to earth Clearance	220MM		220MM
Bus insulator (no per sup)	3		3
Grounding Material	10x60 GI		10x60 GI

SN	DESCRIPTION	Qty (approx.)	APPROX. WEIGHT
A	**Main Bus Duct**		
	1070 OD/ 8th Encl. with 530 OD/ 16 th conductor size	50 nos.	60 MT
B	**Delta Bus Duct**		
C	**Tap off Bus Duct**		
	780 OD/ 4.78 th Encl. with 203 sq channel conductor	64 nos.	16 MT
D	**Line/ Neutral terminal adapter chamber**		
	Single phase main IP busduct assembly	4 nos.	4.8 MT
E	**Star Duct**		
	Three phase main IP busduct assembly (E shape)	2 nos.	5 MT
F	SP and VT Cubicle consist of epoxy cast dry type VT –9 Nos., Lighting arrestor –03 Nos, Surge Capacitor –03 Ns, etc Weight of Cubicle approx. 3.5 MT, Dimension 2000 x 1800 x 3500 mm	1 Set	11 MT

G	**Neutral Grounding Cubicle consist of :-**		
	a) Dry type epoxy cast NG transformer	1 Set	1.5 MT
	b) NG Resistor		
	c) Dimensions 2500x 2500 x2000 mm		
H	**Supporting Structural steel**	1 Lot	80 MT
I	Air pressuring system comprising of compressor, panel, and piping: Approximate wt	2 No.	1 MT
J	Misc Items such as weldable flexibles, bolted flexibles, shorting links, weldable shunt pieces, Earthing Material GI flats 50 x 6 mm etc.	One Lot	20 MT
K	Rubber bellow and seal off bushing	50 nos.	5 MT

4 . <u>GENERAL INFORMATION</u>

1. CONTACT PRESSURE

FOLLOWING TORQUE ARE NORMALLY RECCOMMENDED EOR VARIOUS BOLTS.

BOLT SIZE	RECOMMENDED TORQUE	TORQUE SPANNER CAPTY.
M10	0.85 TO 1.3 NM (20-30 Ft- lb)	0.85 TO 1.3 NM
M12	1.3 TO 1.7 NM (30-40 FT-lb)	0.85 TO 4.3NM
M16	1.7 TO 2.1NM (40 –50 FT-lb)	0.85 TO 4.3NM
M20	2.1 TO 2.5 NM (50 –60 FT-lb)	0.85 TO 4.3NM

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

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

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

2.Recommendation For Welded Joints (For Enclosure, Box Conductor, Make Up Pieces, Shunt And Flexible Joint, Etc.)

TYPE OF WELDING	MIG / TIG WELDING
FILLER WIRE	1.6 mm DIA. (NG 21 WITH 5% SILICON)
ANGLE	10 TO 15 DEG. FOREHEADS
CLEANING	DEGREASE AND SCRATCH BRUSH
CURRENT SETTING	DEPENDED ON THICKNESS
GAS SUPPLY/ PURITY	50 Cu. FT/ HRS ARGON /99.98% WELDING QUALITY

Following Drawings are attached for general guideline only. Actual Drawings may differ slightly.

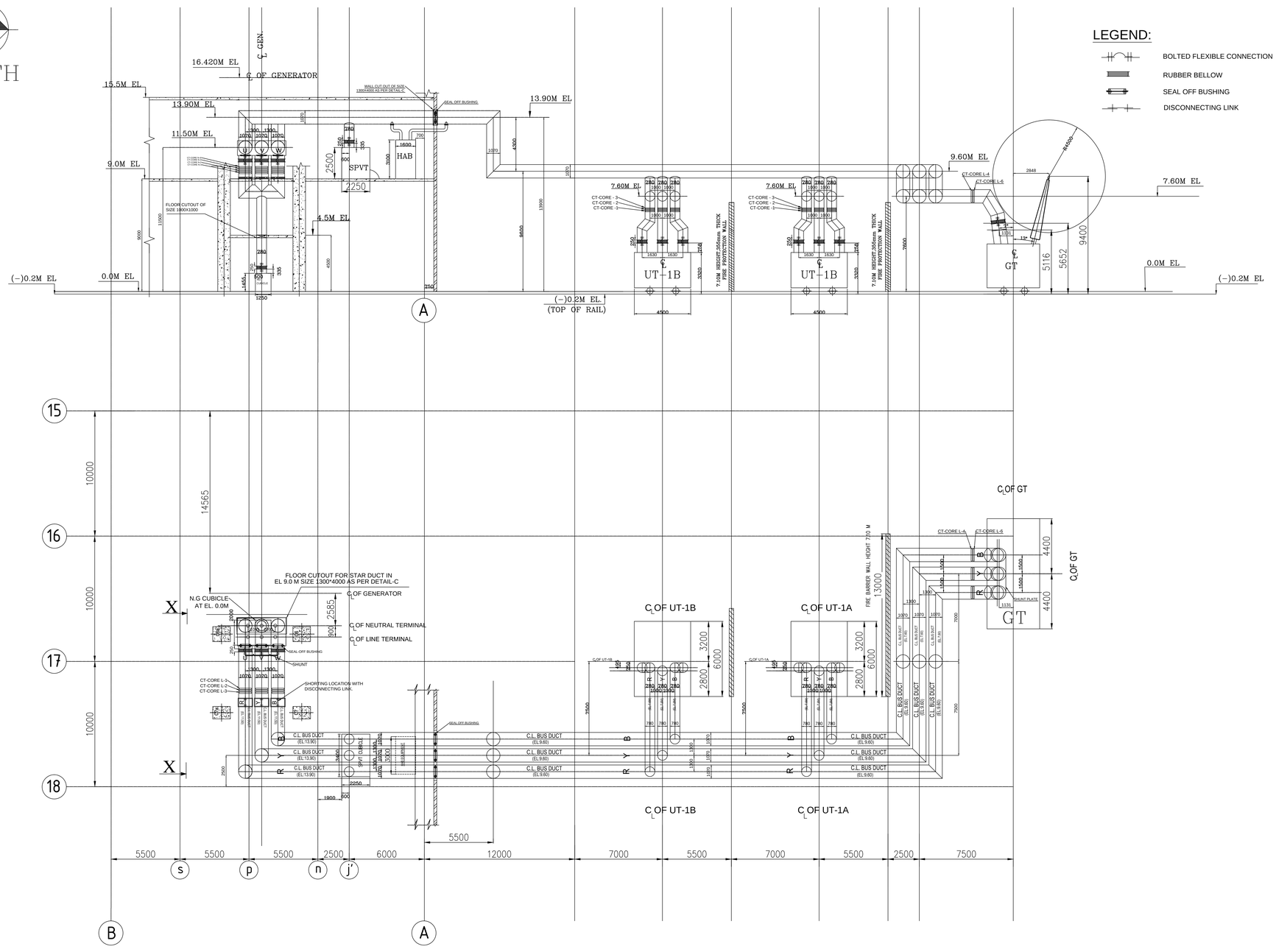
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRAWING NO. 01391110001

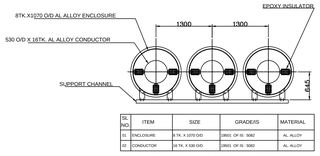
INVENTORY NO. | SIGN & DATE | REF. DRG. NO.

NORTH



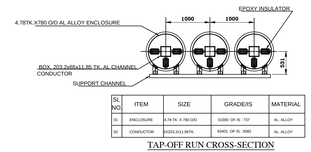
LEGEND:

- BOLTED FLEXIBLE CONNECTION
- RUBBER BELLOW
- SEAL OFF BUSHING
- DISCONNECTING LINK



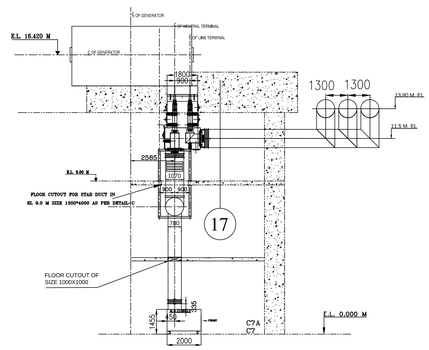
SL NO.	ITEM	SIZE	GRADE/IS	MATERIAL
01	ENCLOSURE	8 TK. X 1070 O/D	18501 OF IS : 5082	AL. ALLOY
02	CONDUCTOR	16 TK. X 530 O/D	18501 OF IS : 5082	AL. ALLOY

MAIN RUN CROSS-SECTION



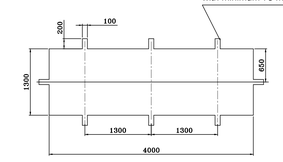
SL NO.	ITEM	SIZE	GRADE/IS	MATERIAL
01	ENCLOSURE	4.78 TK. X 780 O/D	31000 OF IS : 737	AL. ALLOY
02	CONDUCTOR	303.2x11.BTK.	63401 OF IS : 5082	AL. ALLOY

TAP-OFF RUN CROSS-SECTION



SECTION X-X

8-POCKETS 100x200 DEEP
(Pockets shall be within the concrete with minimum 75 mm edge cover.)



DETAIL–C

REFERENCE DRAWINGS.-

1. TRANSFORMER YARD LAY OUT DRG.NO.–010213–E–TP–13–EL–0001
2. GENERAL ARRANGEMENT OF GT DRG. NO. –L01–0006
3. GENERAL ARRANGEMENT OF UT DRG. NO. –A1–21881
4. T.G HALL EQUIPMENT LAYOUT PLAN DRG. NO.–PE–DG–352–100–M003
5. MAIN LINE DIAGRAM DRG. NO. –TCE58920A–733–AU–3002

FOR APPROVAL ONLY

CUSTOMER:–INDIABULLS INFRASTRUCTURE COMPANY LTD.

CONSULTANT :– TATA CONSULTING ENGINEERS LTD.

TYPE OF PRODUCT: 5 X 270 AMRAVATHI TPP

NAME OF CUSTOMER/PROJECT: (UNITS 1 TO 5)

BHARAT HEAVY ELECTRICAL LTD.
RUDRAPUR

	NAME	SIGN	DATE
DRN.	ANUJ SAIN	-sd-	16/3/2011
CHD.	S. MINJ	-sd-	16/3/2011
APPD.	S. MINJ	-sd-	16/3/2011

REV.	DATE	ALTERED	
01	21/4/2011	ANUJ SAIN	
		CHECKED	S. MINJ

THE DRAWING IS REVISED AS PER THE CUSTOMER'S COMMENTS MAIL DATED-15/4/2011

DEPT. BDE | CODE | GRADE TOL. DIM. CMR | SCALE 1:1 | WEIGHT(KG) | ITEM NO. | NO. OF ITEM

TITLE: LAY OUT OF I.P. BUSDUCT (FOR UNIT-1 TO UNIT-5)

DRAWING NO. 01391110001 | REV. 01

SHEET NO.- 01 | NO. OF SHEET- 01

SIZE-A0

This Chapter consists of Part-B: *Schedule of items & Quantities and Factor for deriving Item Rate from the accepted Lumpsum Price.*

Note: This Chapter-XI is uploaded as file titled 'Chapter XI BOQ and *Factor*'-1581

Calculation Excel Sheet for arriving at item rates is uploaded as file titled 'Excel-Sheet-1581'. This document is only for the purpose of calculation/information and same does not form part of Contract