TENDER SPECIFICATION

BHEL: PSSR: SCT: 1558

FOR

Handling at site stores / storage yard, transporting to site, erection, testing & commissioning including supply and application of final painting of **Control & Instrumentation** works for **Unit-3** of 1x700 MW

at

Bellary Thermal Power Station,

Kudatini, Bellay Dist, Karnataka

VOLUME –I BOOK – I

TECHNOCOMMERCIAL BID - Consists of Book-I & Book-II

Book- I Consists of

- **Notice Inviting Tender**
- **Volume-IA: Technical Conditions of Contract**

Book-II consists of

- **Volume-IB : Special conditions of Contract, Rev 01 dated 1st June 2012**
- **Volume-IC : General conditions of Contract Rev 01 dated 1st June 2012, Amendment 01 dated 15th April, 2013**
- **Volume-ID : Forms & Procedures Rev 01 dated 1st June 2012**

BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)

Power Sector – Southern Region

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

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

Tender Specification No. BHEL: PSSR: SCT: 1558

for

Handling at site, transportation to site of work, erection, testing & commissioning including supply and application of final painting of Control & Instrumentation works for Unit-3 of 1x700 MW at Bellary Thermal Power Station, Kudatini, Bellay Dist, Karnataka.

One set of Tender documents consisting of
1) TECHNOCOMMERCIAL BID - 2 copies
2) PRICE BID - 2 copies

Book Sl no …….

Issued to
M/s

Refer NIT for Last date of submission

Please note this tender document is not transferable

For and on behalf of
BHARAT HEAVY ELECTRICALS LIMITED

GENERAL MANAGER / HR & SCT

Place: Chennai -35
Date:

NOTICE INVITING TENDER

Bharat Heavy Electricals Limited

Ref: BHEL PSSR SCT 1558 **Date: Jun 06, 2014**

NOTICE INVITING TENDER (NIT)

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

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To

Dear Sir/Madam

Sub: NOTICE INVITING TENDER

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

1.0 **Salient Features of NIT**

Sl. No	ISSUE	DESCRIPTION	
i	**TENDER NUMBER**	**BHEL PSSR SCT 1558**	
ii	**Broad Scope of job**	Handling at site, transportation to site of work, erection, testing & commissioning including supply and application of final painting of Control & Instrumentation works for Unit-3 of 1x700 MW at Bellary Thermal Power Station, Kudatini, Bellay Dist, Karnataka.	
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) Rev. 01 Dt. 01 Jun 2012	Applicable
c	Volume-IC	General Conditions of Contract (GCC) Rev. 01 Dt. 01 Jun 2012; Amendment: 01 Dt. 15 April 2013	Applicable
d	Volume-ID	Forms and Procedures Rev. 01 Dt. 01 Jun 2012	Applicable

e	Volume-II	Price Schedule (Absolute value).	Applicable
iv	**Issue of Tender Documents**	**1. <u>Sale from BHEL PSSR Regional office at Chennai:</u>** **Start : Jun 06, 2014** **Closes: Jun 25, 2014, Time :15.00 Hrs** **2. From BHEL website (www.bhel.com)** Tender documents can however be downloaded from website till due date of submission	Applicable
v	**Due Date & Time of Offer Submission**	**Date : Jun 26, 2014, Time :15.00 Hrs** **Place : <u>BHEL PSSR : Chennai</u>** **Tenders can be submitted through post / representative / in person at Sub-contracts Dept., 7th floor, A-wing, BHEL, PSSR, EVR Periyar Building Chennai-35. Ph: 044 24330209,** **Fax: 044 24335920** (BHEL will not be responsible for any delay or loss of Tender document sent by post)	Applicable
vi	**Opening of Tender**	**Date : Jun 26, 2014, Time :15.30 Hrs** Notes: (1) In case the due date of opening of tender becomes a non-working day, tenders shall be opened on next working day at the same time. (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**	At least 7 days before the due date of offer submission or two days before the scheduled date of pre-bid meeting whichever is earlier Along with soft version also, addressing to undersigned & to others as per contact address given below	Applicable
x	**Schedule of Pre Bid Discussion (PBD)**	Date: **Jun 19, 2014,** Time **11.00AM** at BHEL:PSSR:Chennai-35	Applicable
xi	**Integrity**	Bidders shall enter into an **Integrity Pact (IP)**	***Not***

	Pact & Details of Independent External Monitor (IEM)	with BHEL as per format given at Volume 1D Formats of this tender. The bidders are required to return this Integrity Pact (IP) along with Techno Commercial Bid duly signed and stamped by the authorized signatory who signs the bid. It may be noted that only those bidders who have entered into such an IP with BHEL would be competent to participate against this tender .i.e. entering into this pact is a preliminary qualifications for the bidders. The Independent External Monitor against this NIT shall be **Shri ……**	***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 only (www.bhel.com → Tender Notifications →View Corrigendum) **and not in the newspapers**. Bidders to keep themselves updated with all such information. This also form part of tender hence the same shall be enclosed with their offer.	

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 Chennai 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 Chennai, 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 Chennai. 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 each document 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 phone 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 app licable
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification / NIT	
vii.	Notice inviting Tender (NIT)	
viii.	Volume – I A : Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	
ix.	Volume – I B : Special Conditions of Contract (SCC)	
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	
xiii.	Any other details preferred by bidder with proper indexing.	

	PART-I B	
	ENVELOPE – II superscribed as: PART-I (EMD/COST of TENDER) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING**:-	
i.	1. Earnest Money Deposit (EMD) in the form as indicated in this Tender **OR** Documentary evidence for 'One Time EMD' with BHEL PSSR Chennai 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 *(Separate envelopes as IIIA,IIIB,……should be submitted in case the tender consists of more than one price bid)* 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: **Addressed to …….** **Sub Contracts Dept., 7th floor, A-wing, BHEL, PSSR, EVR Periyar Building, 690, Annasalai, Nandanam, Chennai-600035.** **CONTAINING THE FOLLOWING:**	
i	○ Envelopes I ○ Envelopes II ○ 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:**

Bidder's 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_{BHEL}' 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 = $\mathbf{P_T}$ 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) = $\mathbf{T_T}$
3	Monthly performance scores for the corresponding period (as in Row 2)	$S_{1\text{-}1}$, $S_{1\text{-}2}$, $S_{1\text{-}3}$, $S_{1\text{-}4}$, … $S_{1\text{-}T1}$	$S_{2\text{-}1}$, $S_{2\text{-}2}$, $S_{2\text{-}3}$, $S_{2\text{-}4}$, … $S_{2\text{-}T2}$	$S_{3\text{-}1}$, $S_{3\text{-}2}$, $S_{3\text{-}3}$, $S_{3\text{-}4}$, … $S_{3\text{-}T3}$	$S_{4\text{-}1}$, $S_{4\text{-}2}$, $S_{4\text{-}3}$, $S_{4\text{-}4}$, … $S_{4\text{-}T4}$	$S_{5\text{-}1}$, $S_{5\text{-}2}$, $S_{5\text{-}3}$, $S_{5\text{-}4}$, … $S_{5\text{-}T5}$	.. … … … …	$S_{N\text{-}1}$, $S_{N\text{-}2}$, $S_{N\text{-}3}$, $S_{N\text{-}4}$, … $S_{N\text{-}TN}$	---
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) = $\mathbf{S_T}$

ii). Calculation of Overall 'Performance Rating' (R_{BHEL}) in case 'similar Package / Packages' for the tendered scope ARE NOT AVAILABLE, during 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 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) Factor "L" assigned based on Overall Performance Rating (R_{BHEL}) at Power Sector Regions,:

Sl. No.	Overall Performance Rating (R_{BHEL})	Corresponding 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 $P \leq P_{Max}$
(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 Table-1 below), the 'PERFORMANCE' part against sl no II above, needs to be evaluated considering all the identified packages (ie., Boiler, ESP and Power Cycle Piping) and finally the Bidder's capacity to execute the tendered scope is assessed in line with III above.

b) Identified Packages (Unit wise)

Table-1

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

c) 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 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--1(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 Void

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 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".

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

28.0 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
Rev. 01 Dt. 01 Jun 2012

f. General Conditions of Contract (GCC) —Volume-1C
Rev. 01 Dt. 01 Jun 2012; Amendment: 01 Dt. 15 April 2013

g. Forms and Procedures —Volume-1D
Rev. 01 Dt. 01 Jun 2012

For BHARAT HEAVY ELECTRICALS LTD

General Manager / HR and SCT

Enclosure

1. Annexure-1: Pre Qualifying criteria.
2. Annexure-2: Check List.
3. Annexure-3: Pre Qualifying criteria detail
4. Annexure-4 Format
5. Annexure-5 performance

6. Annexure- 6 Tender Schedule.
7. Annexure-7 Declaration for Reverse auction
8. Other documents as per this NIT.

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	Handling at site, transportation to site of work, erection, testing & commissioning including supply and application of final painting of Control & Instrumentation works for Unit-3 of 1x700 MW at Bellary Thermal Power Station, Kudatini, Bellay Dist, Karnataka.
TENDER NO	**BHEL PSSR SCT 1558**

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** Refer Annexure-3	Applicable	To be filled in Annexure-4
C: C-1	**FINANCIAL** **Turnover** Bidders must have achieved an average annual financial turnover (Audited) of **Rs.105 Lakhs** or more over last three Financial Years (FY) i.e 2010-11, 2011-12, 2012-13	Applicable	To be filled in Annexure-4
C-2	**Net worth** (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		To be filled in Annexure-4
C-3	**Profit** Bidder must have earned cash profit in any one of the three Financial Years as		To be filled in Annexure-4

	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 (if applicable) **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	Applicable	BY BHEL
G	Consortium criteria (if applicable)	Not applicable	
	Explanatory Notes for the PQR (unless otherwise specified in the PQR): 1. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated against C-1 above along with all annexures. 2. In case audited financial statements have not been submitted for all the three years as indicated against C-1 above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e. total divided by three. 3. C-2:-NETWORTH: Shall be calculated based on the latest Audited Accounts as furnished for C-1 above. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated in case of companies) 4. C-3:- PROFIT : shall be NET profit (PAT + Non cash expenditure viz depreciation) earned during any one of the three financial years as in C-1 above 5. Void 6. Time period for achievement of the 'Technical' criteria of PQR (as in 'B' above) will be the last 7 years ending on the 'latest date' of Bid submission 7. 'EXECUTED' means the Vendor should have achieved the criteria		

	specified in the Technical criteria of PQR (as in 'B' above) even if the Contract has not been completed or closed. 8. Void. 9. Void 10. Void 11. Void 12. In case the experience / PO / WO certificate enclosed by bidders do not have separate break up prices for the E&C portion of Electrical and CI Works, (i.e. the certificates enclosed are for composite order for supply and erection of Electrical & CI and other works if any), then value of Erection and Commissioning for the Electrical & CI portion shall be considered as 15% of the supply & erection of Electrical & CI, unless otherwise specifically indicated in the PQR. 13. Void 14. In case the tendered scope is not a Pulverised Fuel Boiler, experience of Oil/Gas Fired Boilers also can be considered unless otherwise specifically indicated in the PQR.

BIDDER SHALL SUBMIT PRE-QUALIFICATION CRITERIA FORMAT (Refer Annexure-4), DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT INCLUSIVE OF WORK ORDER AND WORK COMPLETION CERTIFICATE ETC. IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

ANNEXURE - 2

CHECK LIST

NOTE :- Tenderers are required to either fill in or submit separately the following details. No column should be left blank

1	Name and Address of the Tenderer			
2	Details about type of the Firm / Company			
3a	Details of Contact person for this Tender: Name : Mr. / Ms. Designation: Telephone No: Mobile No: Fax No: E-mail ID:			
3b	Details of alternate Contact person for this Tender: Name : Mr. / Ms. Designation: Telephone No: Mobile No: Fax No: E-mail ID:			
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)	**Bidder Reply**
6	Whether the format for compliance with **PRE QUALIFICATION CRITERIA** (ANNEXURE-I & **ANNEXURE-III**) is understood and filled with proper supporting documents referenced in the specified format		Applicable	YES / NO
7	Submission of Copy Audited profit and Loss Account for the last three years		Applicable	YES / NO
8	Submission of Copy of PAN Card		Applicable	YES / NO

9	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable	YES / NO
10	Submission of Integrity Pact	Not Applicable	YES / NO
11	Submission of Declaration by Authorised Signatory	Applicable	YES / NO
12	Submission of No Deviation Certificate	Applicable	YES / NO
13	Submission of Declaration confirming knowledge about Site Conditions	Applicable	YES / NO
14	Submission of Declaration for relation in BHEL	Applicable	YES / NO
15	Submission of Non-Disclosure Certificate	Applicable	YES / NO
16	Submission of Copy Bank Account Details for E-Payment	Applicable	YES / NO
17	Submission of Capacity Evaluation of Bidder for current Tender	Applicable	YES / NO
18	Submission of Tie Ups/Consortium Agreement are submitted as per format	Not Applicable	YES / NO
19	Submission of Power of Attorney for Submission of Tender / Signing Contract Agreement	Applicable	YES / NO
20	Submission of Analysis of Unit rates	Applicable	YES / NO
21	Unquoted price bid submitted or not	Applicable	YES / NO
22	Tabular column showing Category- wise, month wise, man power deployment sub package wise planned for the execution of the scope of works. Data on categories of labour like mill wright fitters, fitters, gas-cutters, welders, electricians, riggers, khalasis, grinder-men, crane operators and helpers shall be shown in detail. Data shall be split up under the work areas like cooling water lines, buried piping, wrapping and coating, GI pipe lines, tanks and vessels, pumps etc.	Applicable	YES / NO
23	Submission of "Declaration by bidder for price opening through Reverse Auction" (Annexure-7)	Applicable	YES / NO

NOTE:

1. STRIKE OFF 'YES' OR 'NO', AS APPLICABLE.
2. TENDER NOT ACCOMPANIED BY THE PRESCRIBED **ABOVE APPLICABLE DOCUMENTS** ARE LIABLE TO BE SUMMARILY REJECTED.
3. For Sl. No. 10 to 20 above, the formats are available in "Volume ID of Volume I Book-II – Forms and Procedures" of this tender specification.

DATE:

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

Annexure-3

B.1.1 Technical PQR

1.1.1 Bidder should have executed* One (1) C&I or C&I and Electrical work of value not less than **Rs 290 Lakhs** in a Power / Industrial projects in the last seven years reckoned from the date of bid submission

(OR)

Bidder should have executed* Two (2) C&I or C&I and Electrical works each of value not less than **Rs 180 Lakhs** in a Power / Industrial projects in the last seven years reckoned from the date of bid submission

(OR)

Bidder should have executed* Three (3) C&I or C&I and Electrical works each of value not less than **Rs 145 Lakhs** in a Power / Industrial projects in the last seven years reckoned from the date of bid submission

AND

1.1.2 Bidder should have executed** Erection, testing and commissioning of Control Instrumentation works for BTG (Boiler, Turbo Generator) / GT (Gas Turbine) of minimum one unit rating of 400 MW in a Thermal/Gas Power Plant in the last seven years reckoned from the latest date of bid submission

OR

The bidder should have executed** Erection, testing and commissioning of Control Instrumentation works consisting of DCS/DDC/station C&I in minimum one unit rating of 400 MW in a Thermal/Gas Power Plant in the last seven years reckoned from the latest date of bid submission.

OR

The bidder should have executed** atleast one contract of C&I works consisting of DCS/DDC/station C&I in any industry with its completed value of **280Lakhs** or more in the last seven years reckoned from the latest date of bid submission

Note:

1. Executed** means “Synchronization of the unit”

2. The value of work executed* will be updated as per PVC formula of GCC with indices for All India average consumer price index for Industrial workers with base month as the date of completion of execution and indexed upto two months prior to the bid opening month. **Calculation for value updation** is enclosed as Annexure**.**

3. EXECUTED* means the Vendor should have achieved the criteria specified in the PQR even if the Contract has not been completed or closed.

Example Calculation for value updation:

Value of work with completion month mentioned as June 2011is say Rs.75,00,000.00

Tender opening date is say Feb 01, 2014

Consumer Price Index for labour as published in www.labourbureau.nic.in is as follows:

Nc = For the month of June 2011(work completed month) is 189.

Nt = For the month of Dec 2013 (two months prior to tender opening month) is 239.

Updated value= Executed value (Ev) + (Ev X 0.40 $\frac{(Nt - Nc))}{Nc}$

$$=7500000 + (7500000 \times 0.40 \frac{(239 - 189))}{189}$$

$$=7500000+ (7500000x.4x50/189)$$

=**Rs. 8293650.00**

ANNEXURE – 4

Name of the Bidder: M/s . . . . . .

Additional Format to be submitted by Bidders in an additional separate cover superscribed as "Annexure to Pre-Qualifying Criteria"							
Sl. No.	PQR Ref	PQR	Qualifying Experience	Work order Ref with page no in Offer for supporting documents	Completion certificate ref for the referred Work with page no in Offer for supporting documents	Details of work with Project, Unit , Qty & Period	Remarks
1	B: Technical	Bidder should have executed One (1) C&I or C&I and Electrical work of value not less than **Rs 290 Lakhs** in a Power / Industrial projects in the last seven years reckoned from the date of bid submission (OR) Bidder should have executed Two (2) C&I or C&I and Electrical works each of value not less than **Rs 180 Lakhs** in a Power / Industrial projects in the last seven years reckoned from the date of bid submission (OR) Bidder should have executed Three (3) C&I or C&I and Electrical works each of value not less than **Rs 145 Lakhs** in a Power / Industrial projects in the last seven years reckoned from the date of bid submission					

		AND 1.1.3 Bidder should have executed** Erection, testing and commissioning of Control Instrumentation works for BTG (Boiler, Turbo Generator) / GT (Gas Turbine) of minimum one unit rating of 400 MW in a Thermal/Gas Power Plant in the last seven years reckoned from the latest date of bid submission OR The bidder should have executed** Erection, testing and commissioning of Control Instrumentation works consisting of DCS/DDC/station C&I in minimum one unit rating of 400 MW in a Thermal/Gas Power Plant in the last seven years reckoned from the latest date of bid submission. OR The bidder should have executed** atleast one contract of C&I works consisting of DCS/DDC/station C&I in any industry with its completed value of **280Lakhs** or more in the last seven years reckoned from the latest date of bid submission					

2	**C:Financial Criteria**						
	C1	**<u>Financial Turnover</u>** Bidders must have achieved an average annual financial turnover (Audited) of **Rs.105 Lakhs** or more over last three Financial Years (FY) i.e 2010-11, 2011-12, 2012-13					
	C2	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					
	C3	PROFIT Bidder must have earned cash profit in any one of the three Financial Years as applicable in the last three Financial Years defined in 'C-1 above based on latest Audited Accounts.					
Non submission of this additional format will make the bid liable for rejection.							

ANNEXURE-5

PERFORMANCE CERTIFICATE

Performance certificate to be submitted by bidders who have not been working with any of the four BHEL Regions in the last 12 months prior to the latest date of bid submission.

Performance of the Agency _____in Project _____

Name of the Agency :
Address of the agency :
Work Order issued :

Erection and Commissioning works in Project _____ under work order dated _____ under reference number / LoI number _____ for the scope of_____ (Copy of work order issued enclosed)

Duration of work as per contract without extended periods : __ months

Time taken for actual completion of works : __ months
(Actual completion of works will mean the completion of contracted works enabling the intended purpose of contract, and not necessarily the closure of contract)

Delays in execution of works attributable to contractor : __ months

Performance of the Contractor in the referred works :

Sl. No	Description of Parameter	Max. Marks	Please enter your score here	Remarks, if any
01	Performance – Technical performance with respect to plan, progress achieved and organization of works at site and HQ	45		
02	Resources – Capacity to plan, organize and utilize the resources like skilled manpower, Tools & Plants(T & P), Consumables	20		
03	Management of Finance for the project	7		
04	Compliance with Safety requirements	10		
05	Compliance with Quality requirements	10		
06	Site infrastructure and services	8		
	Total	100	"X"	

Total score of the Agency _____ in work above is (in words) _____
_____

Signature

Name and Seal of the issuing Authority

Note:

The average marks scored by the bidder in the qualifying work should be above 60% for qualifying the bidder against tendered work.

Further to this BHEL reserves the right to obtain feedback from customer directly and any adverse report from respective customers on the performance of the bidder will render the bidder liable for rejection.

New vendors (Ref: NIT 9.0 Clause) should enclose the duly filled in certificates for performance as per this format.

ANNEXURE-6

Tender Schedule

Description	Schedule	Remarks
Technical Bid Opening	As mentioned in Notice Inviting Tender.	
Communication from BHEL for Clarifications, if any, required by BHEL	On or before fifth day of tender opening	
Last date for Bidders to submit the clarifications / documents required	On or before tenth day of tender opening	Bidders to note that their competent representative to be readily available in this week for offering clarifications / submitting the further documents, if any, required.
If Reverse Auction is applicable, then the tentative date for conducting Reverse Auction	Twenty first day of tender opening	Exact date of reverse auction shall be informed to the bidders through BHEL's reverse auction agency. Bidders to note that their competent representative to be readily available at one day notice for Reverse Auction.

Note:

1. Bidders to note that the above schedule should be adhered to and no further extension will be given. To adhere to the schedule indicated below, Bidders should ensure the adequacy of the documents submitted in their offer, with proper validation.

Annexure 7

DECLARATION BY BIDDER FOR PRICE OPENING THROUGH REVERSE AUCTION

(To be typed and submitted in the Letter Head of the Company / Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : Declaration by Bidder for Price opening through Reverse Auction

Ref : 1) NIT / Tender Specification No: ……,
2) Participation in the Reverse Auction

We have studied and understood the clauses of Reverse auction published in the tender specification.

Strike out either (1) or (2) of the following whichever is not applicable.

1. I / We, hereby declare that I / we **shall be** participating in the Reverse Auction in case BHEL opts for opening the price bid through Reverse auction.
2. I / We, hereby declare that I / we **shall not be** participating in the Reverse Auction in case BHEL opts for opening the price bid through Reverse auction.

Yours faithfully,

Date: (Signature, Date & Seal of Authorized Signatory of the Bidder)

VOLUME – IA
Part I & II
TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

VOLUME-IA PART – I CHAPTER – I
PROJECT INFORMATION

BELLARY UNIT-3, 1 X 700 MW TPS

BELLARY THERMAL POWER PROJECT –1 x 700 MW – UNIT - 3

1.0	Project Title	:	1x 700 MW Bellary TPS Stage–III, Unit-3
2.0	Details of site location	:	Kudathini Village Bellary Dist Karnataka State, India.
3.0	Site postal address	:	BHEL site office Bellary TPS Stage –III 700 MW Unit -3 Kudathini P.O Bellary District – 583 115 Karnataka
4.0	Owner	:	Karnataka Power Corporation Ltd., Shakthi Bhavan No.82, Race Course Road Bangalore – 560 001 Karnataka, India
5.0	Latitude and Longitude	:	15^0 11’ 58” N Latitude 76^0 43’ 23” E Longitude
6.0	Elevation above mean sea level	:	478 meters

7.0 Climatic Conditions

(a) Temperature

i) Monthly basis

Mean of daily Maximum Temperature	:42.5^0 C (in the month of April)
Mean of daily Minimum temperature	:19.5^0 C (in the month of Dec)

ii) Monthly basis
Mean of daily Maximum : 37.5^0C
Mean of daily Minimum : 19.5^0C

iii) Highest temperature recorded :42.5^0C

iv) Lowest temperature recorded :14.6^0C

(b) Relative Humidity : Varies between 11% to 70%

(c) Rainfall : 492 to 846 mm most of which
Annual average rain Occurs during August to October

(d) Wind Speed

i) Annual mean wind speed : 8.4 km / hr

ii) Maximum mean wind speed : 19 km / hr in the month of July.

8.0 Wind Load

Calculations for wind effect shall be in accordance with IS:875-1987 (Part-3) taking into account the following:

(a) Basic wind speed of 39 m/sec as given in fig.1 of the code.

(b) Factor K1 shall be taken as 1.06

(c) Terrain category shall be 2 and corresponding values shall be taken for K2

(d) Factor K3 shall be taken as 1.0

9.0 Wind Loading for Stack

(a) For wind pressure as per clause 8.0 above
(b) For RC stacks as per IS: 4998

10.0 Seismic data (as per IS: 1893 latest issue)

(a)Zone : Zone III
(b)Importance factor (I) : 2.5 for electrical equipment
1.5 for others.

11.0 Auxiliary power supply : Auxiliary electrical equipment to be supplied against this specification

shall be suitable for operation on the following supply system.

(a) For motors rated above 175 kW	:	11000V, 3 phase, 3 wire, 50Hz medium earthed AC 3300V, 3 phase, 3 wire, 50Hz medium earthed AC
(b) For motor control center	:	415V, 3 phase, 3 wire solidly earthed AC
(c) For motor rated 175 kW and below	:	415, 3 phase, 3 wire solidly earthed AC
(d) DC motor starters, DC solenoids, DC alarm, control and protections	:	220 V DC, 2 wire, unearthed DC
(e) AC control & protective devices	:	110 V 1 phase, 50Hz, 2 wire AC supply. The single-phase 110V AC supply shall be derived by CONTRACTOR BY PROVIDING 415V/110V control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
(f) Uninterrupted power Supply	:	230 V, 1 phase, 50Hz, 2 wire AC supply from UPS system for I & C (including indicator recorders) and UCMS only.
(g) AC solenoids, Indicators/recorders, space Heaters (for motors rated 30 KW and above)	:	240V 1 phase, 2 wire, 50Hz AC system with effectively earthed neutral. The power supply shall be derived by CONTRACTOR by providing 415V / 240V transformer of adequate rating with MCCB/MCB on primary / secondary sides.
(h) Winding heating of motors below 30kW	:	24 V 1 phase, 50Hz, AC with one point earthed. This shall be derived by CONTRACTOR by providing 415 V 3 phase, 3 wire, AC supply through an adequately rated step down transformer of adequate rating with

			MCCB / MCB on primary / secondary sides.
(i)	Solid state controls (including solenoid valves)	:	24 V DC, 2 wire, supply from UPS for instrumentation system only.
(j)	Lighting fixtures	:	24 V, 1 phase, 2 wire, 50Hz system.
(k)	Lighting fixtures and space heater in panels	:	240 V, 1 Phase, 2 wire, 50Hz system.

(i) The above voltages may vary as follows:

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

i. AC supply	:	Voltage variation $\pm$ 10% Frequency variation $\pm$ 5% Combined voltage & frequency variation $\pm$ 10%
ii.DC supply	:	Voltage variation + 10% , -20%

VOLUME-IA PART – I CHAPTER – II
SCOPE OF WORKS

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

1.2.0 SCOPE OF WORK IN GENERAL:

It is not the intent to specify herein all details of material. Any item related to this work, not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

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

1.2.1.1 Preassembly, Erection, Testing, Commissioning, Trial operation and reliability operation of equipment.

1.2.1.2 Erection and commissioning of All Types of Field Instruments like Temperature, Pressure and Flow instruments (local & remote) and special instruments like, Sonic Tube Leak Detection system, Vibration Monitoring System, SWAS, Gas analyser, Master clock system, Coal Bunker level monitor, LVS System, Hart Management System, Furnace Flame Viewing system etc.

1.2.1.3 Erection and commissioning of all types of Control room mounted instruments like Recorders, Indicators, Microprocessor based panels, DCS system and its accessories like system panels, PC, printers, furniture etc.

1.2.1.4 Calibration of instruments at site with the contractor's own calibration and testing equipments under the supervision of BHEL / Customer Engineers.

1.2.1.5 Erection and commissioning of all Types of Pneumatic Power Cylinders, Controllers etc.

1.2.1.6 Commissioning of all Types of Pneumatic operated Valves / Actuators / Power Cylinders / Controllers and Relief Valves.

1.2.1.7 Erection of all types of Hardware like impulse pipes, trays & tray supports, instrument airline, etc.

1.2.1.8 Erection & Testing of all types of power / control / instrumentation cables etc.

1.2.1.9 Erection and commissioning of UPS, ACDB, Battery, Battery Charger, DCDB etc.

1.2.1.10 Erection and commissioning of control panels.

1.2.1.11 Fabrication and installation of steel supports wherever required.

1.2.1.12 Supply of all consumables required for installation as detailed elsewhere in the contract.

1.2.1.13 Supply of paints and application of final painting.

1.2.1.14 Installation of any other items that have not been specifically indicated, but required for completing installation.

Note: BHEL will provide vendor's technical support for commissioning of various proprietary type special instruments / systems like Analysers, Vibration Monitoring System, Battery / Battery Charger, Master clock system, Sonic Tube Detection System, Hart Management System etc. The contractor shall carry out the works as per instructions of BHEL / Vendor Engineer.

1.2.2 EXCLUSIONS

The following are specific exclusions from this work

a. Erection of dampers, valves, electrical actuators, HT / LT drives

b. Attachment welding of thermocouple pads, flow nozzle, orifice plates and control valves

c. Root valves on the instruments tapping points

Note to Exclusions (Clause 1.2.2)

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

NOTE TO CHAPTER II:

FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT CHAPTERS IN THIS BOOK

VOLUME-IA PART – I CHAPTER – III

FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope to be taken care by		Remarks
	PART I	**BHEL**	**Bidder**	
1.3.1.1.0	**ESTABLISHMENT**			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
A	Open space for office	Yes		
B	Open space for storage	Yes		
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	Firefighting equipments like buckets, extinguishers etc		Yes	
G	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.3.1.1.2	FOR LIVING PURPOSES OF THE BIDDER			
A	Open space		Yes	
B	Living accommodation		Yes	
1.3.1.2.0	**ELECTRICITY**			
1.3.1.2.1	Electricity For construction purposes (to be specified whether chargeable or free)	**yes**		
1.3.1.2.1.1	Single point source	Yes		Free of charges
1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and execution		Yes	
1.3.1.2.2	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	

Sl.No	Description PART I	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.2.4	Living facilities for office use including charges		Yes	
1.3.1.2.2.5	Demobilization of the facilities after completion of works		Yes	
1.3.1.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc on the above lines.(in case BHEL provides this facility, the scope should be given without ambiguity)		Yes	
1.3.1.3.0	**WATER SUPPLY**			
1.3.1.3.1	For construction purposes:	**yes**		**Free of charges**
1.3.1.3.1.1	Making the water available at single point	Yes		
1.3.1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc			
1.3.1.3.2.1	Making the water available at single point		Yes	
1.3.1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4.0	**LIGHTING**			

Sl.No	Description PART I	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site / area		Yes	
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.5.0	**COMMUNICATION FACILITIES for site operations of the bidder**	**-**		
1.3.1.5.1	Telephone, Fax, internet, intranet, email etc		Yes	
1.3.1.6.0	**COMPRESSED AIR SUPPLY**			
1.3.1.6.1	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc	**-**	YES	
1.3.1.6.2	Installation of above system and operation & maintenance of the same	**-**	YES	
1.3.1.6.3	Supply of the all the consumables for the above system during the contract period		YES	

Sl.No	Description PART II	Scope to be taken care by		Remarks
		BHEL	Bidder	
	ERECTION FACILITIES			
1.3.2.1.0	**Engineering works for construction**			
1.3.2.1.1	Providing the erection drawings for all the equipments covered under this scope	Yes		
1.3.2.1.2	Drawings for construction methods		Yes	In consultati

Sl.No	Description PART II	Scope to be taken care by		Remarks
		BHEL	Bidder	
				on with BHEL
1.3.2.1.3	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes	Yes	Yes	”
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes	Yes	”
1.3.2.1.5	Preparation of site erection schedules and other input requirements		Yes	”
1.3.2.1.6	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	
1.3.2.1.7	Weekly erection schedules based on Sl No 1.3.2.1.5		Yes	
1.3.2.1.8	Daily erection / work plan based on Sl No 1.3. 2.1.7		Yes	For daily monitoring meeting at site
1.3.2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
1.3.2.1.10	Preparation of preassembly bay		Yes	
1.3.2.1.11	Laying of racks for gantry crane if provided by BHEL or brought by the contractor / bidder himself			**Not applicable**

1.3.3 **OPEN SPACE:**

1.3.3.1 Open space for building of temporary office shed and contractor's stores shed(s) will be provided free of charges. Contractor has to make his own arrangements for labour colony.

1.3.3.2 BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements.

1.3.3.3 Contractor has to furnish along with their offer, the details of requirements of area of space for his temporary site office, stores / storage shed.

1.3.3.4 Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed to.

1.3.4 **ELECTRICITY:**

1.3.4.1 Construction power will be provided to the contractor on free of charges from the nearest substation at one single point by BHEL. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc.

1.3.4.2 Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.8 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.

1.3.4.3 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards contractor's office shed also all such expenditure shall be borne by the contractor.

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

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

1.3.4.6 As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, contractor shall make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown / failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.

1.3.5 **WATER:**

Water (Raw water) required for construction purposes including testing of Equipments will be provided at one single point in the nearest storage tank located inside the plant area. The required pumps & accessories, pipes for drawing water from the storage tank and further distribution will be arranged by the contractor at their cost.

Incase non-availability of water, the contractor shall make his own arrangements for uninterrupted work. No separate payment shall be made for any contingency

arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

1.3.6 **MATERIALS / CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR FOR ERECTION AND COMMISSIONING AS PART OF THE SCOPE WITHIN THE QUOTED RATE / PRICE**

i) All types of welding electrodes, filler wires, Gases and other consumables
ii) Provision for Temporary Scaffoldings.
iii) Insulation tape.
iv) Paints required for primer & final coating and for protective coating.
v) Solder wire (Lead) - (60/40)
vi) Protocol / Calibration report sheets as per BHEL Format.
vii) Panel / JB sealing compound material (for cable entry from bottom / top of Panel).
viii) Materials required for cable dressing (GI / aluminum flats, PVC cable ties etc).
ix) PVC wire marker sleeves and Tag plates
x) Lugs of size 2.5 Sq.mm and below.
xi) Anchor fasteners for fixing panels, wall mounted cable trays, JBs.
xii) Ferrules,
xiii) "U" Clamps with nuts and washers for impulse pipes and GI pipe clamping.
xiv) Tag Plates- Al / Fiberglass / Stainless Steel
xv) Insulation tape.
xvi) Teflon tape for GI pipe coupling.
xvii) Protocol / Calibration report sheets as per BHEL Format.
xviii) Fastener for mounting JB, local PB Boxes and earthing flats.
xix) Panel / JB Sealing compound material (for cable entry from bottom / Top of Panel).
xx) PVC cable tie, Aluminium or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing, grommet
xxi) sleeves for cables

1.3.7 **TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS**

1.3.7.1 CABLE LUGS:

a)	Type:	Solderless crimping type
b)	Material	Copper / Aluminium

c)	Whether tinning required (For copper cable lugs)	Yes.
d)	Thickness of tinning:	10 microns
e)	Applicable Standard for LT Cables	IS:8309

1.3.7.2 FERRULES:

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

1.3.7.3 TAGS:

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

1.3.8 **LIGHTING FACILITY :**

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

1.3.9 **POWER REQUIREMENT:**

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

1.3.10 **CONTRACTOR'S OBLIGATION ON COMPLETION:**

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

VOLUME-IA PART – I CHAPTER – IV

T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR

The following minimum major Tools & Plants and MMEs shall be deployed by the contractor for execution of this contract with in the quoted rate:

1.4.0 For loading and transportation, all necessary T&P such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor. All the tools & plants required for this scope of work, except the tools & plants provided by BHEL are to be arranged by the contractor within the quoted rates.

1.4.1 The following minimum Instruments / T&P shall be arranged by contractor in sufficient number to carry out the job simultaneously in more than one area.

1.4.2 **LIST OF RECOMMENDED INSTRUMENTS FOR Erection, Testing & Commissioning:**

Sl. No	DESCRIPTION	QUANTITY
01	Dead Weight tester rated 600 kg/sq.cm with weights & test gauges facility.	02 No.
02	Oil temperature bath suitable to calibrate upto 400˚C	02 No.
03	Furnace range 600 Deg C	01 No.
04	Standard Pressure Gauges as below :	
	0 to 1 kg/Sq.cm	01 No.
	0 to 5/6 kg/Sq.cm	01 No.
	0 to 10 kg/Sq.cm	01 No.
	0 to 16 kg/Sq.cm	01 No.
	0 to 25 kg/Sq.cm	01 No.
	0 to 60 kg/Sq.cm	01 No.
	0 to 100 kg/Sq.cm	01 No.
	0 to 250 kg/Sq.cm	01 No.
05	Standard Temperature Gauges as below :	
	0 to 100 Deg C	02 No.
	0 to 200 Deg C	02 No.
	0 to 600 Deg C	02 No.
06	Standard compound pressure gauge -1 to +3 kg/Sq.cm	02 No.
07	Standard Vacuum Gauge -760 mm Hg to 0 kg/Sq.cm	01 No.
08	Portable air compressor with drier and regulator rated for 10 kg/Sq.cm	01 No.

Sl. No	DESCRIPTION	QUANTITY
09	Manometer 0 to 1000 mm WC with hand bulb	03 Nos.
10	Vacuum pump with standard vacuum gauge	01 No.
11	Standard Milliamps Source (Digital)	03 Nos.
12	Standard Millivolts Source (Digital)	03 Nos.
13	Mercury Manometer different range	04 Nos.
14	DC Power Supply , 24 V ; 5A	03 Nos.
15	Single Phase Variac 250V; 10A	01 Nos.
16	Glass Thermometers of ranges in Deg C as below : 0-120 ; 0-200; 0-600	02 Nos. (Each)
17	Tong tester AC 5/10/25 ; KEW Snap Make	01 No.(Each)
18	Function Generator	01 No.
19	Hand Operated Megger 500V ; 2.5 kV / 100 M Ohms	Each type As required
20	Torque wrench	As required
21	AC Voltmeter 0-125 ; 250 ; 625V	01 No. (Each)
22	AC Ammeter 0-2A ; 10A	01 No. (Each)
23	Analog Multimeter Motwane Make	03 Nos.
24	Digital Multimeter 3 1/2 Digit	08 Nos.
25	Digital Multimeter 4 1/2 Digit	03 Nos.
26	Wire wrapping tool	As required
27	Oscilloscope	01 Nos.
28	Soldering irons, soldering pump, Vacuum cleaner, Air blower etc.	As required

1.4.3 RECOMMENDED LIST OF TOOLS & PLANTS TO BE ARRANGED BY CONTRACTOR

S.No.	DESCRIPTION	QUANTITY
01	Steel wire ropes	As required
02	Chain pulley block / turfer	As required
03	2 " size pipe bending machine	As required
04	Grinding machine	As required
05	Drilling machines : 1/4" , ½" , 3/4" , 1 "	As required
06	Ttube bender and cutter sizes 6 mm ;8 mm ;1/2",1/4"	As required
07	Dye sets for threading upto 2 " pipe	As required
08	Set of spanners	As required

09	Allenkey sets	As required
10	Bench vice	1 No.
11.	Spirit level	As required
12	Tap sets for both BSP & NPT threads upto 1 "	1 Set each
13	Measuring instruments like micrometers, calipers etc.	1 each
14	Welding generator	1 No.
15	Welding transformer	As required
16	TIG Welding set	1 No.
17	Mechanical tool kit for fitters	As required
18	Electrician tool kit	As required
19	Crimping tool	As required
20	Flood light fittings	As required
21	Fire extinguishers	As required
22	Distribution boards with power cable complete as required with energy meter	As required
23	Hydraulic test pump rating 750 kg/sq.cm	As required
24	Painting brush	As required
25	Fire proof tarpaulin	As required
26	Safety belts & safety helmets	As required
27	Telephone sets	As required

1.4.4 ACCURACY REQUIREMENT OF CALIBRATION / TESTING INSTRUMENTS

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
01	Digital Multimeter	Voltage 200 mV to 1000 V DC	± 1% + 1 digit	
		Philips Voltage 200mV to 1000 V AC	± 1% + 1 digit	
		Philips Current 20 mA to 20 A AC	± 0.8% + 1 digit	
		Resistance (Hcl) 2120 200* to 20M*	± 0.5% + 1 digit	
		Resistance (Hcl) 2105 200* to 200M*	± 0.25% + 3 digits	
		Hcl Voltage 200 mV to 750 V	± 0.8% + 1 digit	

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
		Philips Current 20 mA to 20 A DC	± 0.5% + digit	
		Hcl Current 200 mA to 010 A AC	± 1% + digit	
02	Analog Multimeter	Voltage 2.5 to 2500V AC	± 1.0%	
		Current 100 mA to 10A AC	± 2.0%	
		Current 250 micro A to 1A DC	± 1.5%	
		Resistance upto 100 ohms	± 3.0%	
		Voltage 2.5V to 2500V DC	± 1%	
03	MV/mV Source	0 to 200 mA / 200mV	0.2%	
		0 to 700	± 1% Lc – 10 kg/cm^2	10”
		0 to 700	± 1% Lc – 5 kg/cm^2	10”
		0 to 100	± 1% Lc – 0.2 kg/cm^2	10”
		0 to 70 kg	± 1% Lc – 1 kg/cm^2	10”
		0 to 60 kg	± 1% Lc – 11 kg/cm^2	10”
		0 to 60 kg	± 1% Lc – 0.5 kg/cm^2	10”
		0 to 10.5 kg/cm^2	± 1% Lc – 0.25 kg/cm^2	10”
		0 to 420	± 1% Lc – 2.5 kg/cm^2	10”
		0 to 280	± 1% Lc – 2.5 kg/cm^2	10”
		0 to 40	± 1% Lc – 1 kg/cm^2	10”
		0 to 106	± 1% Lc – 2.5 kg/cm^2	10”
		0 to 28	± 1% Lc – 0.5	10”

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
			kg/cm^2	
		0 to 25 kg/cm^2	± 1% Lc – 0.5 kg/cm^2	10”
		0 to 250 kg/cm^2	± 1% Lc – 0.25 kg/cm^2	10”
		0 to 16 kg/cm^2	± 1% Lc – 0.25 kg/cm^2	10”
04	Hand operated Megger 500V / 1000V	Upto 200 m Ohms	± 5% at Centre scale	
05	Standard Pressure Gauges	0 to 1 kg/cm^2	±0.25% LC–0.02 kg/cm^2	10”
		0 to 6 kg/cm^2	±0.25% LC–0.1 kg/cm^2	10”
		0 to 10 kg/m^2	±0.25% LC– 0.02kg/cm^2	10”
		0 to 25 kg/cm^2	±0.25% LC– 0.25kg/cm^2	10”
		0 to 60 kg/cm^2	±0.25% LC– 0.1kg/cm^2	10”
		0 to 250 kg/cm^2	±0.25% LC– 2.5kg/cm^2	10”
		0 to 400 kg/cm^2	±0.25% Lc–2.5 kg/cm^2	10”
		0 to 600 kg/cm^2	±0.25% Lc–2.5 kg/cm^2	10”
		0 to 6 kg/cm^2	±0.25% Lc–0.1 kg/cm^2	10”
		0 to 1000 kg/cm^2	±0.25% Lc–1.0 kg/cm^2	10”
06	Dead Weight Tester	0 to 400	LC – 5 kg/cm^2	
		0 to 600	Lc – 5 kg/cm^2	
07	Standard Hg in glass Thermometer	0 to 100^{0}C	LC - 1^{0}C	
		0 to 110^{0}C	LC - 1^{0}C	
		0 to 250^{0}C	LC - 1^{0}C	

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
		0 to 150^{0}C	LC - 1^{0}C	
		0 to 360^{0}C	LC - 1^{0}C	
		0 to 420^{0}C	LC - 1^{0}C	
08	Single Phase Variac	15A Capacity	N/A	
09	Power Pack	0 to 50V DC, 3A	± 2%	
10	Vibration Measuring Equipments	Velocity upto 50 mm/sec.	± 0.5% mm/sec	
		Displacement upto 300 microns	± 2 microns	
11	Tongue tester Tongue tester	0 / 300 / 600 A AC 0 to 300A DC	± 5% ± 5%	
12	Tacho Meter (Hand held)	0 to 4000 rpm	± 5%	
13	Phase Sequence Meter		N/A	
14	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	± 5% at Centre Scale range	
15	DC Ammeter	0 to 300 A	± 10%	
16	DC Voltmeter	0 to 500 V	± 10%	

1.4.5 The contractor shall arrange all the above T&P, equipment and instruments as indicated except those testing instruments, which are proprietary in nature.

1.4.6 Any other tools and plants, instruments and equipment required in addition to the above for the successful completion of this job shall have to be arranged by the contractor at his cost except proprietary type equipment.

1.4.7 Necessary accessories for the above shall also be provided by the contractor.

1.4.8 The above testing instruments / equipment shall be sent for testing and calibration wherever from time to time and maintained by contractor as required by BHEL. All testing instruments shall have calibration certificate issued by recognized / accredited agencies. List of such agencies and periodicity of calibration required for different instruments shall be furnished by BHEL at site.

1.4.9 Contractors shall arrange experienced / qualified persons for using these calibration instruments at laboratory and also at work spot.

1.4.10 Wherever frequent calibration is required, contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments.

1.4.11 Contractor shall maintain calibration records as per the following format and produce them whenever called for by BHEL Engineers.

BHEL PS:SR

Format No. CP: PEX:FOX

CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS

Name of Site :

Name of Sub-contractor:

Sl. No.	NAME OF INSTRUMENT	INSTRUMENT REGN. NO.	DATE OF ENTRY EXIT	PERIODICITY OF CALIBRATION	CALIBRATION DETAILS
					DATE OF CAL.
					CAL. AGENCY
					NEXT DUE DATE
					DATE OF CAL.
					CAL. AGENCY
					NEXT DUE DATE
					DATE OF CAL.
					CAL. AGENCY
					NEXT DUE DATE

1.4.12 PROTECTION / HANDLING OF TOOLS AND PLANTS ARRANGED BY THE CONTRACTOR

1.4.12.1 Equipment, vehicles, tools and plants and materials brought to site by the contractor from his resources shall have distinctive identification marks and the contractor shall intimate the description and quantity to BHEL in writing.

1.4.12.2 All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without extra cost necessary enclosures containers and protective materials for proper storage of materials inside, whenever so instructed by the purchaser without any extra cost.

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

VOLUME-IA PART – I CHAPTER - V

T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis.

Sl. No	Description	Qty
1	EOT Crane at TG Hall	01 No

1.5.1 EOT crane without operating personnel shall be made available in the T.G. Hall free of charge. The contractor has to arrange operator for EOT Crane. As the above crane is deployed for the purpose of **shifting the panels within PH building** on sharing basis at free of hire charges and also for various contractors the decision of BHEL engineers will be final with regard to allotment of crane.

1.5.2 Experienced Crane operator for EOT crane to be arranged by the bidder at their cost.

1.5.3 Providing manpower assistance required for free movement of Trailing cable of EOT Crane is included in the scope of this contract.

1.5.4 The availability of crane is likely to be hampered from time to time due to routine preventive maintenance or breakdown maintenance. Contractor has to make alternative arrangement or plan / modify / alter his activities to suit the above conditions and the contractor will not be liable for any compensation or extension of time due to this non-availability, for maintaining the erection schedule.

1.5.5 In the event of the crane not available for longer duration due to major breakdown or any other reasons, BHEL will reschedule the work in consultation with bidder and direct the bidder to concentrate on other areas till such time the cranes are made available.

1.5.6 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

1.5.7 All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at his cost.

1.5.8 Besides the T & P mentioned above, which is being made available to the contractor on free of hire charges, any additional crane and other T & P which may be required for successful and timely execution of the work covered within the scope of this tender shall be arranged and provided at site by the contractor at his cost. In case if the contractor fails to provide such equipments, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with

BHEL overheads, as applicable from time to time which may vary even during contract period.

VOLUME-IA PART – I CHAPTER-VI
TIME SCHEDULE

1.6.1 TIME SCHEDULE

1.6.1.1 The entire work of erection testing and commissioning as detailed in the Tender Specification shall be completed within **15 (fifteen) months** from the date of commencement of work at site.

1.6.1.2 During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.

1.6.1.3 The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding of the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

1.6.1.4 The contractor is required to refer Form 15 in Volume 1- BOOK 2 for all the instructions to be taken immediately after receipt of LOI.

1.6.2 COMMENCEMENT OF CONTRACT PERIOD

The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy the decision of BHEL engineer is final.

1.6.3 MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIOING ETC.,

The activities for erection, testing etc shall be started as per directions of Construction Manager of BHEL.

The contractor has to augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules:

Major Milestones:-

DESCRIPTION	MILESTONE MONTH
Likely Start of work	June ‘14
Boiler Light Up	Oct ’14
Barring gear	Dec’14
Synchronization	Dec’14

Trial Operation	Mar'15
Balance work completion ,pending points liquidation	Sep'15

1.6.4 In order to meet above schedule in general, and any other intermediate targets set, to meet customer / project schedule requirements, contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL.

1.6.5 In case the project is to be advanced, the erection works in the scope of the contractor is to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.

1.6.6 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **15 (fifteen) months** from the "COMENCEMENT OF CONTRACT PERIOD" as specified earlier.

1.6.7 GUARANTEE PERIOD

The guarantee period of twelve months shall commence from the date of handing over of the Unit to Customer or six months from the date of first synchronisation of the set, whichever is earlier (Provided all erection, testing, and commissioning works are completed in all respects).

VOLUME-IA PART – I CHAPTER-VII
TERMS OF PAYMENT

1.7.0 Terms of payment :

The progressive payment for erection, testing and commissioning on accepted rate / price of contract value will be released as mentioned below in Clause 1.7.1 & 1.7.2.

1.7.1 Progressive Payment against monthly running bills will be made upto 85 % of the value of the **erected items** in each package (unit) Pro rata as per Clause no 1.7.1.1.1 to 1.7.1.10.1 of the following table.

TERMS OF PAYMENT FOR C&I WORKS		
Sl. No.	**Activity / Work Description**	**% of unit rate**
1.7.1.	**PRO RATA PAYMENTS (85%)**	
1.7.1.1	**For all type of Instruments including Power Cylinder /Actuator**	
1.7.1.1.1	Receipt, transport to erection site, assembly, checking, calibration, fixing and clamping Adjustment, Alignment, on pro rata basis and protocol signed	60%
1.7.1.1.2	Pre-commissioning tests, checks, and making ready for energisation pro rata basis and protocol signed	15%
1.7.1.1.3	Completion of commissioning	10%
	Total =	**85%**
1.7.1.2	**Cable laying and cable termination**	
1.7.1.2.1	Laying/tagging/termination of cables / Wires	65%
1.7.1.2.2	Checking ,dressing and clamping	10%
1.7.1.2.3	Loop checking and commissioning	10%
	Total =	**85%**
1.7.1.3	**AC&DCDB/DCS/MMI/PLC system and all types of control panels including MMIPIS(DCS) Related Instrumentation**	
1.7.1.3.1	Receipt transport to erection site ,placement, assembly, fixing and clamping adjustment, alignment, grouting and electrical interconnections on prorata basis and protocol signed	65%
1.7.1.3.2	Pre-commissioning tests, checks and making ready for energisation on prorata basis and protocol signed	10%
1.7.1.3.3	Completion of Commissioning	10%
	Total =	**85%**
1.7.1.4	**For fabrication and installation of steel materials including LIR/LIE**	

1.7.1.4.1	Fabrication / Pre assembly and applying primer paint	45%
1.7.1.4.2	Erection, Alignment, welding/ bolting and if applicable chipping / grouting / painting	40%
	Total =	**85%**
1.7.1.5	**For UPS/Battery sets/charger**	
1.7.1.5.1	Receipt, transport to erection site, checking, placement, assembly, grouting, mounting and wiring of loose components	50%
1.7.1.5.2	Adjustment, alignment, inter connections and pouring of Alkali	20%
1.7.1.5.3	Pre-commissioning test checks and making ready for energisation	15%
	Total =	**85%**
1.7.1.6	**For cable trays, tray supports, Rigid and flexible conduits & copper tubes, earthing**	
1.7.1.6.1	On satisfactory completion of work on prorata basis	70%
1.7.1.6.2	On completion of drawing or area wise on prorata basis	15%
	Total =	**85%**
1.7.1.7	**For Impulse Pipes**	
1.7.1.7.1	On laying and welding on prorate basis and protocol signed	50%
1.7.1.7.2	On clamping and painting on prorata basis and protocol signed	20%
1.7.1.7.3	System Charging	15%
	Total =	**85%**
1.7.1.8	**Testing / Commissioning of Equipment erected by other agencies**	
1.7.1.8.1	On completion of commissioning of individual racks/skid/actuators/ Loop checking/Instruments etc. on prorata basis	70%
1.7.1.8.2	On completion of commissioning of main equipment/system on prorata basis	15%
	Total =	**85%**
1.7.1.9	**Other items (Misc Item)**	
1.7.1.9.1	Completion of work(erection, alignment & testing) of the respective item/equipment	75%
1.7.1.9.2	Completion of Commissioning of the respective item/equipment - on pro rata basis.	10%
	Total=	**85%**
1.7.1.10	**For Supply Items(if applicable)**	
1.7.1.10.1	On submission of running bill along with the Stores Receipt /Voucher/Stores endorsement issued by BHEL on prorata basis	85%
	Total=	**85%**

1.7.2 Further 15 % payment on pro-rata basis common to all PG shall be released on achievement of the following stage / milestones events for the **erected items** as mentioned in Clause no 1.7.2 of the following table.

1.7.2	**STAGE / MILESTONE PAYMENTS (15%)**	
1.7.2.1	Boiler Light Up	1%
1.7.2.2	ABO/EDTA cleaning	1%
1.7.2.3	Safety valve floating	1%
1.7.2.4	Rolling and Synchronisation	2%
1.7.2.5	Coal Firing	1%
1.7.2.6	Full Load	2%
1.7.2.7	Trial Operation of Unit	3%
1.7.2.8	Punch List points / pending points liquidation	1%
1.7.2.9	Submission of 'As Built Drawings'	1%
1.7.2.10	Monthly Material Reconciliation	1%
1.7.2.11	Completion of Contractual Obligation	1%
	Total for Stage / Milestone Payments (15%)	**15%**

Note:

1. **Recovery of Retention amount as per Cl. 2.22 of GCC (Volume IC).**
2. RA bill payments as per Chapter-X of SCC (Volume IB)
3. Payment for the first running bill will be released only on production of the following.
    i. PF Regn. No.
    ii. Labour License No.
    iii. Workmen Insurance Policy No.
    iv. Unqualified Acceptance for Detailed L.O.I.
    v. Security Deposit as per GCC
    vi. Rs 100 /- Stamp Paper for Preparation of Contract agreement.

VOLUME-IA PART – I CHAPTER VIII
TAXES AND OTHER DUTIES

1.8.0 TAXES

1.8.1 Value Added Tax (VAT) for the works

1.8.1.1 **Price quoted shall be inclusive of VAT except service tax.**

1.8.1.2 Notwithstanding the fact that this is only an erection service contract not involving any transfer of materials whatsoever and not attracting VAT liability, being labour oriented job work, for the purpose of VAT the contractor has to maintain the complete data relating to the expenditure incurred towards wages etc. in respect of the staff/workers employed for this work as also details of purchase of materials like consumables, spares etc., inter alia indicating the name of the supplier, address and VAT Registration No. and VAT paid for the purchases, etc

1.8.1.3 The bidder shall get registered with State VAT authorities and the registration certificate shall be forwarded to BHEL immediately after commencement of work. In case the bidder had already registered under respective State VAT, they must quote their registration Number and forward copy of Registration Certificate while submitting this tender.

1.8.1.4 The monthly/quarterly VAT return, duly incorporating the erection income from BHEL as turnover, should be submitted to BHEL at regular intervals with all annexure and details of payment of VAT (WCT).

1.8.1.5 You have to obtain VAT Clearance Certificate from the on concerned authorities as per the provisions of local VAT act, on completion of the project and submit along with the final bill.

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

1.8.2.0 Service Tax

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

1.8.3.0 **Other Taxes & Levies**

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

1.8.4.0 **New Levies / Taxes**

1.8.4.1 In case Government imposes any new levy / tax after award of the work during the tenure of the contract, BHEL shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / tax is applicable to this contract..

1.8.5.0 **Statutory variations**

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

1.8.6.0 **Direct Tax**

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

VOLUME-IA PART – I CHAPTER - IX
WEIGHT SCHEDULE/BOQ

1.9.1 CONTROL AND INSTRUMENTATION - BILL OF MATERIALS (BOM)

BELLARY UNIT – 3, 1X700 MW - C&I PACKAGE

BELLARY 1 X 700 MW UNIT -3			
BILL OF MATERIALS FOR ERECTION, TESTING AND COMMISSIONING OF C&I PACKAGE			
SL.NO	**DESCRIPTION**	**Qty**	**Unit**
A.0	**BHEL - TRICHY SCOPE**		
A.1.0	**FUEL OIL SYSTEM**		
A.1.1	Mass flow meters (HFO , LFO) with interconnecting cables, accessories and fittings	2	Sets*
A.1.2	Speed Regulator/ Air Lock Valves	20	Sets *
A.1.3	Air filter regulator	20	Nos.
A.1.4	OD 8 mm Copper Tube	125	Mtrs.
A.1.5	FSSS Local Oil Gun Maintenance Switch Box	16	Nos.
A.1.6	H.E.A. Ignitor box along with retractor assembly, flexible spark rod, spark tip, flexible cable assembly, S.S. Hose (1 Mtr long, 6.35 mm ID), Air Filter Regulator etc.	16	Sets*
A.1.7	Flame Scanner Head Assembly with fibre optic cable of length 130", Lens Barrel Assembly, Miniature 6 way Junction Box etc.	32	Sets*
A.1.8	Microprocessor based flame scanner amplifier 8Nos. of 19” Racks of size 482 x 263 x 134 (W x D x H) to be mounted in Flame Scanner Panel (CJF75/ 76) supplied by EDN	1	Set*
A.1.9.0	**COMMISSIONING OF THE FOLLOWING**		
A.1.9.1	Limit Switches (checking only).	56	Nos.$
A.1.9.2	Pneumatic Valves: Trip Valves	59	Nos.$
A.1.9.3	Pneumatic Valves: Regulating Valves	6	Nos.$
A.2.0	**AIR & FLUE GAS SYSTEM**		
A 2.1	K type thermocouples	2	Nos.

A 2.2	1" Air Filter Regulators- SADC	8	Nos.
A 2.3	I/P converters with AFR assembly	22	Sets*
A 2.4	¼" OD Copper tube	3350	Mtrs
A 2.5	¾" OD Copper tube	30	Mtrs
A 2.6	1" OD Copper tube	16	Mtrs.
A 2.7	¼" size Teflon Hose of 2M length	101	Nos.
A 2.8	1" size Teflon Hose of 3M length	4	Nos.
A 2.9	1/2" SS braided teflon hose	10	Nos.
A 2.10	Start/Stop Push Button Box for AH Blower	2	Nos.
A 2.11	Burner Tilt Shear Pin Failure Indication Junction Box Approx. Dimension: 490(W) x 240(D) x 360(H) mm; weight 10 kg each	4	Nos.
A 2.12	Heavy Duty Limit Switch (for Burner Tilt Shear Pin Failure Indication Purpose)	24	Nos.
A.2.13.0	**PNEUMATIC POWER CYLINDERS (REGULATING TYPE)**		
A.2.13.1	Power Cylinders for SADC (Weight 20 kg each)	88	Nos.
A.2.13.2	ID, FD & PA Fans Blade Pitch Control Damper (Approx.Weight 90 kg each)	6	Nos.
A.2.13.3	Cold Air Regulating Dampers (Approx. Weight 95 kg each)	7	Nos.
A.2.13.4	Hot Air Regulating Dampers (Approx.Weight 175 kg each)	7	Nos.
A.2.13.5	Dynavane Filter Bleed Air Damper (Approx.Weight: 100 kg)	1	Nos.
A.2.14	**PNEUMATIC ACTUATORS (ON/OFF TYPE)**		
A.2.14.1	Scanner Air Emergency Damper (Approximate weight: 60 Kg)	1	No.
A.2.15.0	**COMMISSIONING OF THE FOLLOWING**		
	Pneumatic Power Cylinder (Regulating type)		
A 2.15.1	Burner Tilt Power Cylinders (Weight 125 kg each)	8	Nos. $
A 2.15.2	Sofa tilt power cyclinders (50 Kg each)	4	Nos. $
	Pneumatic Actuators (On/Off Type)		
A.2.15.3	Cold Primary Air Gate	7	Nos. $
A.2.15.4	Hot Primary Air Gate	7	Nos. $

A.2.15.5	Feeder Outlet Gate	7	Nos. $
A.2.15.6	Seal Air to Mill	7	Nos. $
A.2.15.7	Air heater A&B flue gas Inlet damper Seal Air Knife Edge Gate	2	Nos. $
A.2.15.8	Air Heater-A&B Sec. Air & Pri.Air Outlet Damper - blower O/L knife edge gate	4	Nos. $
A.2.15.9	Electrical Actuators for valves/ dampers, including loop checking	103	Nos.$
A.3.0	**PULVERISER SYSTEM**		
A 3.1	1/4" Air Filter Regulators (for mill system)	7	Nos.
A 3.2	Purge Meter cum DP regulator	14	Nos.
A 3.3	Pneumatic Pressure Controllers including 1 No. Pneumatic Transmitter, 2 Nos. Air Filter Regulators etc.	2	Sets*
A 3.4	**Gravimetric Feeder Panel** Gravimetric Feeder Remote Power Cabinet including keyboard and display Size: 1200 x 600 x 2315 mm; weight: 300 kg each	7	Nos.
A 3.5	Coal flow monitor (Ultrasonic type) Ultrasonic Coal Flow Monitor, UCFM consisting of sensor transmitter and receiver probe, local JB, control unit, flexible conduit, mounting flanges, fasteners etc. The job includes providing holes in the spacer (spool) pipe at raw coal bunker outlet and welding of two mounting flanges to the pipe facing each other for fixing the instrument.	7	Sets*
A 3.6	Pulveriser Dynamic classifier VFD cabinet size : 914 x 610 x 1829(H) mm , size : 400 Kg	7	Nos.
A 3.7.0	**COMMISSIONING OF THE FOLLOWING**		
A 3.7.1	Calibration/ Commissioning of Gravimetric Feeder comprising of Feeder Mounted C&I Equipment like motion monitor sensor, micro switches, etc. along with Feeder Integral Cabinet, 2 Nos. LT Motors etc.	7	Sets * $
A 3.7.2	Bunker outlet Gate / Feeder inlet gate Limit Switches (Only checking)	28	Nos. $
A.4.0	**STEAM & WATER SYSTEM**		
A 4.1	**K TYPE THERMOCOUPLE**		

A 4.1.1	MTM T/Cs of route length 14 Mtrs (8 mm OD)	2	Nos.
A 4.1.2	MTM T/Cs of route length 15 Mtrs (8 mm OD)	25	Nos.
A 4.1.3	MTM T/Cs of route length 16 Mtrs (8 mm OD)	19	Nos.
A 4.1.4	MTM T/Cs of route length 17 Mtrs (8 mm OD)	28	Nos.
A 4.1.5	MTM T/Cs of route length 18 Mtrs (8 mm OD)	25	Nos.
A 4.1.6	MTM T/Cs of route length 19 Mtrs (8 mm OD)	10	Nos.
A 4.1.7	MTM T/Cs of route length 20 Mtrs (8mm OD)	56	Nos.
A 4.1.8	MTM T/Cs of route length 21 Mtrs (8 mm OD)	29	Nos.
A 4.1.9	MTM T/Cs of route length 22 Mtrs (8mm OD)	27	Nos.
A 4.1.10	MTM T/Cs of route length 23 Mtrs (8 mm OD)	67	Nos.
A 4.1.11	MTM T/Cs of route length 24 Mtrs (8mm OD)	34	Nos.
A 4.1.12	MTM T/Cs of route length 25 Mtrs (8 mm OD)	21	Nos.
A 4.1.13	MTM T/Cs of route length 26 Mtrs (8mm OD)	21	Nos.
A 4.1.14	MTM T/Cs of route length 27 Mtrs (8 mm OD)	9	Nos.
A 4.1.15	MTM T/Cs of route length 28 Mtrs (8mm OD)	6	Nos.
A 4.1.16	MTM T/Cs of route length 29 Mtrs (8 mm OD)	4	Nos.
A 4.1.17	MTM T/Cs of route length 30 Mtrs (8mm OD)	2	Nos.
A 4.1.18	MTM T/Cs of route length 31 Mtrs (8 mm OD)	2	Nos.
A 4.1.19	MTM T/Cs of route length 32 Mtrs (8mm OD)	3	Nos.
A 4.2	**BOILER CIRCULATING WATER PUMP INSTRUMENTS**		
A 4.2.1	K Type Duplex Thermocouple	5	Nos.
A 4.2.2	Flow Indicators (checking only)	2	Nos. $
A 4.2.3	Temperature gauges	1	No.
A 4.2.4	Pressure Gauges	2	Nos.
A 4.2.5	Flow elements	3	Nos.$
A 4.3	Start/ stop Push Button Box for Soot Blower	2	Nos.
A 4.4	ERV Controller with Pressure Switch Dimension: 400 x 190 x 350 mm; weight: 10 kg each	4	Sets*

A 4.5	HWL 1 & 2 and MEFcontrol valve panel Size : 600x600x210 mm ; Size : 100 Kg	1	No.
A 4.6	Furnace flame viewing system : consists of : Local control panel of size 1220 x 810 x 1410 (H) Approx weight : 125 Kg ,	1	No.
A 4.7	Furnace flame viewing consists of : remote retract control panel of size : 700 x 700 x 2100(H) , Approx weight : 400Kg	1	No.
A 4.8	Sonic tube leak detection system (BHEL- STLD), comprising the following Sensor Assembly along with head amplifier: 24 sets BHELSONIC Panel: 1 No. Size of the panel: 800 x 800 x 2315 mm; 500 Kg.	1	Set *
A.4.9	**COMMISSIONING OF THE FOLLOWING**		
A.4.9.1	Direct Water Level Gauges (Fixing of bulbs, holders, wiring and Commg)	2	Nos. $
A.4.9.2	Control Valves	10	Nos. $
A 4.10	**FIELD INSTRUMENTS (FUEL OIL SYSTEM, AIR & FLUE GAS SYSTEM, STEAM & WATER SYSTEM, PULVERISER SYSTEM etc..)**		
A 4.10.1	Pressure gauges	91	Nos.
A 4.10.2	Pressure switches	62	Nos.
A 4.10.3	Temperature gauges	17	Nos.
A 4.10.4	Temperature switches	4	Nos.
A 4.10.5	Level gauges	2	Nos.
A 4.10.6	Level switch (capacitance type)	1	No.
A 4.10.7	DP gauges	1	No.
A 4.10.8	DP switches	40	Nos.
A 4.10.9	Flow transmitters	3	Nos.
A 4.10.10	Flow switches (only checking)	14	Nos $
A 4.10.11	Flow elements	16	Nos $
A.5.0	**HARDWARE LIST**		
A.5.1.0	**CABLES (PVC, FRLS, Armoured cables for Scanner, Mill feeder, AC Control, and Instruments)**		

A.5.1.1	Flame Scanner Cable (2P x 1 sq.mm triple screened, unarmoured cable)	9000	Mtrs.
A.5.1.2	1P x 1.31 Sq.mm armoured instrumentation cable	2020	Mtrs.
A.5.1.3	2P X 0.5 sqmm, individual and overall shielded Instrumentation cable.	2300	Mtrs.
A.5.1.4	2P X 0.5 sqmm, overall shielded Instrumentation cablecable.	3000	Mtrs.
A.5.1.5	2P X 1.5 sqmm, individual and overall shielded instrumentation cable.	8300	Mtrs.
A.5.1.6	4P X 0.5 sqmm, individual and overall shielded instrumentation cable.	5500	Mtrs.
A.5.1.7	4P X 0.5 sqmm, overall shielded instrumentation cable.	10000	Mtrs.
A.5.1.8	8P X 0.5 sqmm, individual and overall shielded cable.	9200	Mtrs.
A.5.1.9	8P X 0.5 sqmm, overall shielded cable.	22500	Mtrs.
A.5.1.10	12P X 0.5 sqmm, individual and overall shielded cable.	1800	Mtrs.
A.5.1.11	12P X 0.5 sq. mm, overall shielded cable.	6800	Mtrs.
A.5.1.12	2C x 2.5 sq.mm Control cable	4270	Mtrs.
A.5.1.13	3C x 2.5 sq.mm Control cable	4300	Mtrs.
A.5.1.14	7C x 2.5 sq.mm Control cable	2300	Mtrs.
A.5.1.15	10C x 2.5 sq.mm Control cable	500	Mtrs.
A.5.1.16	16C x 2.5 sq.mm Control cable	4200	Mtrs.
A.5.1.17	19C x 2.5 sq.mm Control cable	6200	Mtrs.
A.5.1.18	4 C x 4 Sq.mm Armoured control cable	300	Mtrs.
A.5.1.19	20 C x 4 sq.mm armoured Control cable	300	Mtrs.
A.5.1.20	3C x 2.5 sq.mm copper power cable	2100	Mtrs.
A.5.1.21	3C x 6 sq.mm copper power cable	2100	Mtrs.
A.5.1.22	Compensating Cables (K type)	3100	Mtrs.
A.5.2.0	**CABLE TRAY**		
A.5.2.1	GI cable tray 50MM wide	1100	Mtrs.
A.5.2.2	GI cable tray 100MM wide	2150	Mtrs.
A.5.2.3	GI cable tray 150MM wide	3375	Mtrs.
A.5.2.4	GI cable tray 300MM wide	100	Mtrs.

A.5.3.0	**JUNCTION BOXES**		
A.5.3.1	JUNCTION BOX- 6 WAY Approx. weight : 2 Kg each	32	Nos.
A.5.3.2	JUNCTION BOX-24 WAY Approx. weight : 8 Kg each	66	Nos.
A.5.3.3	JUNCTION BOX-48 WAY (including MTM) Approx. weight : 10 Kg each	92	Nos.
A.5.3.4	JUNCTION BOX- 72 WAY (including MTM) Approx. weight : 14 Kg each	47	Nos.
A.5.4.0	**CHANNELS, PIPES, TUBES ETC.**		
A.5.4.1	Structural Steel for fabrication of supports consisting of angles, channels (ISA 40x40x5, ISMC 100x50x6, ISA 50X50X6 etc.)	7	MT
A.5.4.2	GI Flat 50 x 6 mm	250	Mtrs.
A.5.4.3	GI wire 1.219mm dia	1700	Mtrs.
A.5.5.0	**IMPULSE PIPES**		
A.5.5.1	GI Pipe	115	Mtrs.
A.5.5.2	CS pipe 26.7 x 3.91 mm	500	Mtrs.
A.5.5.3	CS pipe 33.4 x 4.55 mm	800	Mtrs.
A.5.5.4	AS pipe 26.7 x 3.91 mm	150	Mtrs.
A 6.0	LOCAL INSTRUMENT RACKS/ENCLOSURES		
A 6.1	Local instrument racks : (LIR 06 to LIR 18) size : 1650(W) x 800 (D) x 2150 (H), aprox. Wt. 400 Kg each	13	Nos.
A 6.2	Local instrument racks : size : 1200(W) x 725(D) x 1800 (H), aprox. Wt. 180 Kg each	5	Nos.
A 6.3	Local instrument enclosure size : 1200(W) x 725(D) x 2185H), aprox. Wt. 380 Kg each	1	No.
B.0	**BHEL- RANIPET SCOPE**		
B.1.0	**AIR PRE-HEATERS**		
B.1.1	Pressure gauges	10	Nos.
B.1.2	Temperature gauges (with thermowell)	2	Nos.
B.1.3	RTDs	8	Nos.
B.1.4	Pressure Switches	4	Nos.

B.1.5	Thermocouple Assembly consisting of 12 Nos. Cr-Al M. thermocouples along with integral terminal box	4	sets*
B.1.6	Rotor Stoppage Alarm Box- including sensors, interconnecting cables etc.	2	Sets*
B.1.7	Air heaters A& B Main control panel Size : 1830 x 611 x 1881(H) mm ; 363 Kg	1	No.
B.1.8	Air heaters A & B Leakage control system sector plate drive panel Size :645 x 205 x 610(H) mm , 45 Kg	6	Nos
B.1.9	ON/OFF Switch Box including light assembly and interconnecting cable	2	Nos.*
B.1.8.0	**COMMISSIONING OF FOLLOWING**		
B.1.8.1	Solenoid Valves	2	Nos.$
B.1.8.2	**Lub oil skids for Air Preheater:** The scope of work includes removal of instruments, calibration, refixing, checking cable connection from JB to instruments etc. The approximate quantity of instruments for each skidis givn below Pressure Gauges – 2 Nos. Temperature Gauges –2 Nos. Flow Switch - 1 No.	4	sets*$
B.2.0	**FANS**		
B.2.1	Fan Bearing RTDs	24	Nos.
B.2.2	Fan Bearing Temperature Indicators	24	Nos.
B.2.3	Position transmitters	6	Nos.
B.2.4	Junction boxes	8	Nos.
B.2.5	Local start/stop push buttons	4	Nos.
B.2.6	Opacity Monitor system consists of following : Measuring head - 1 no., Local control unit - 1 No., Reflector - 1 No., Airblower with hose - 1 No., fail safe shutters - 2 nos., field termination box - 1no., interconnecting cable, mounting accessories etc.. approx. weight : 132 Kg	4	Sets*
B.2.7	Fan Motor Bearing Temperature Indicators. (Removal,	12	Nos

	calibration and refixing only)		
B.2.8.0	**COMMISSIONING OF THE FOLLOWING**		
B.2.8.1	Fan Motor Bearing/ Winding RTDs (checking of healthines only)	84	Nos.$
B.2.8.2	Lub oil skids for FD Fans The scope of work includes removal of instruments calibration, refixing, checking cable connection from JB to instruments etc., motor connection, meggering, improving IR value of motor etc.. The approximate total quantity of instruments for the 02 Nos skids put together is given below: DP switch with local indicator - 02 Nos., Pressure Gauges – 6 Nos , Temperature Gauges – 4 Nos,Pressure Switches – 08 Nos, Level transmitters-02 Nos, Flow indicator with flow switch - 02 Nos. , LT motors - 4 nos.	2	sets* $
B.2.8.3	Lub oil skids for ID Fans The scope of work includes removal of instruments calibration, refixing, checking cable connection from JB to instruments etc., motor connection, meggering, improving IR value of motor etc.. **The approximate total quantity of instruments for the 02 Nos skids put together is given below:** DP gauge - 06 Nos., DP switch -2 Nos,Pressure Gauges – 08 Nos , Temperature Gauges – 06 Nos, Pressure Switches – 08 Nos, Level switches-02 Nos , LT motors - 4 nos.	2	sets* $
B.2.8.4	Lub oil skids for PA Fans The scope of work includes removal of instruments calibration, refixing, checking cable connection from JB to instruments etc., motor connection, meggering, improving IR value of motor etc.. The approximate total quantity of instruments for the 02 Nos skids put together is given below: DP switch with local indicator - 02 Nos., Pressure Gauges – 10 Nos , Temperature Gauges – 04 Nos, Pressure Switches – 08 Nos, Level transmitters-02 Nos, Flow indicator with flow switch - 06 Nos.,Flow switch-04 Nos , LT motors - 4 nos.	2	sets* $
B 3.0	**RODM PLANT**		

B 3.1	**RODM plant - Cables (PVC, FRLS, Armoured control /instrumentation cables)**		
B 3.1.1	2P x 0.5 sq.mm individual and overall shielded cable	1200	Mtrs.
B 3.1.2	4P x 0.5 sq.mm individual and overall shielded cable	2500	Mtrs.
B 3.1.3	4P x 0.5 sq.mm overall shielded cable	3700	Mtrs.
B 3.1.4	8P x 0.5 sq.mm individual and overall shielded cable	3000	Mtrs.
B 3.1.5	8P x 0.5 sq.mm overall shielded cable	17000	Mtrs.
B 3.1.6	7 C x 2.5 sq.mm control cable	1600	Mtrs.
B 3.2	Fabrication and erection of structural steel for supports	1	MT
C.0	**BHEL - PIPING CENTRE SCOPE**		
C.1.0	**LOCAL/FIELD INSTRUMENTS**		
C.1.1	Pressure Gauges	149	Nos.
C.1.2	Temperature Gauges with Thermowell (capillary/ stem type)	91	Nos.
C.1.3	Pressure Switches	4	Nos.
C.1.4	Level Switches	3	Nos.
C.1.5	Level gauges	7	Nos.
C.1.6	Sight flow indicators	53	Nos.
C.2.0	**JUNCTION BOXES**		
C.2.1	Junction Boxes, 12 way	2	Nos.
C.2.2	Junction Boxes, 24 way	3	Nos.
C.3.0	**IMPULSE PIPES**		
C.3.1	AS pipe Dia 21.3 x 3.73 Thk	150	Mtrs.
C.3.2	CS pipe Dia 21.3 x 3.73 Thk	330	Mtrs.
C.3.3	CS pipe Dia 21.3 x 4.78 Thk	200	Mtrs.
C.3.4	CS pipe Dia 21.3 x 7.47 Thk	30	Mtrs.
C.3.5	SS pipe Dia 26.7 x 7.82 Thk	60	Mtrs.
C.4.0	**COMMISSIONING OF THE FOLLOWING**		
C.4.1	Control Valves	3	Nos. $
D.0	**EDN SCOPE**		

D.1.0	**SG C&I PACKAGE**		
D.1.1.0	**BMS/SADC/FOPH/SBC/APRDS/HPBP PANELS**		
D.1.1.1	Panels : Suite of Two Cubicles (Panel no. CJF75 & 76, CJF53 &54 , CAF 38&39, CAF14&61,CAF 16&17, CJF34 & 35 , CAF41&42) Size: 1500 x 750 x 2415 mm; Approx. weight- 800 kg	7	Nos.
D.1.1.2	Panels : Suite of Three Cubicles (Panel no. CJF 06,07&08 , CJF 55,56 &57, CAF11,21&58, CAF12,22&59, CAF13,23&60, CJF58,59&60) Size: 2250 x 750 x 2415 mm; Approx. weight-1200 kg	6	Nos.
D.1.1.3	Panels : Suite of Five Cubicles (Panel no. CJF 01,02,03,04&05) Size 3750 x 750 x 2415 mm; Approx. weight-2000 kg	1	No.
D.2.0	**TG C&I PACKAGE**		
D.2.1.0	**PANELS**		
D.2.1.1	Single Cubicle Panels: (CJJ08,CJJ20, CJJ30, CCA 06) Size 750 x 750 x 2415 mm; Approx. weight- 400 kg	4	Nos.
D.2.1.2	Single Cubicle Panels : TSI for BFPDT -A & B (CWW01) Size 750 x 750 x 2415 mm; Approx. weight- 400 kg	1	No.
D.2.1.3	Panels : Suite of Two Cubicles (Panel no. CJJ 03&04 , CJJ 21&22 CJJ 23 & 24 , CJJ 31&32 , CJJ 33 & 34) Size: 1500 x 750 x 2415 mm; Weight. 1200 Kg	5	Nos.
D.2.2.0	**HART MANAGEMENT SYSTEM**		
D.2.2.1	**Hart Management System (HMS) Comprising of the following :** HART Panel- 02 nos., Desktop PC with 24" TFT Monitor- 01 no., Colour laser Printer 01 no., and other loose supplied items like Hart master, Hart slave, Patch boards, RS485/RS232 Convertor, interconnecting Cables, etc. **Approx. Size and Weight of the each Panel** 800(L) x 800(W) x 2415(H) mm; 250 Kg	1	set*
D.2.3.0	**CABLES**		
D.2.3.1	2 pair x 0.5 sq. mm PTFE cable	6000	Mtrs.

D.2.3.2	4 pair x 0.5 sq. mm PTFE cable	2000	Mtrs.
D.2.3.3	5 Core x 1.5 sq. mm PTFE cable	1000	Mtrs.
D.2.3.4	2 Pair x 0.5 sq. mm NiCr-Ni or NiAl Thermocouple Extension cable	16000	Mtrs.
D.2.4.0	**JUNCTION BOXES**		
D.2.4.1	64way Junction Box (SUV 12)	50	Nos.
D.2.4.2	Thermocouple Junction Box for K-type Thermocouple (NiCrNi)	5	Nos.
D.2.5.0	**CABLE DUCTS WITH COVERS (GI SOLID BOTTOM)**		
D.2.5.1	60x60x1000 mm	200	Nos.
D.2.5.2	180 x 100 x 1000 mm	100	Nos.
D.2.5.3	250 x 100 x 1000 mm	100	Nos.
D.2.6.0	**MOUNTING FRAMES to be assembled & erected**		
	Assembly and installation of Mounting Frames with loose supplied prefabricated materials of suitable size, like slotted angles, channels, base plates & fasteners etc.		
D.2.6.1	MFA 150 (1600 x 718 x 1700 mm)	6	Nos.
D.2.6.2	MFC 150 (1600 x 858 x 1700 mm)	12	Nos.
D.2.6.3	MWK 100 (1100 x 300 x 700 mm)	2	Nos.
D.2.6.4	MWG 200 (2100 x 470 x 1700 mm)	8	Nos.
D.2.6.5	MWG 250 (2600 x 470 x 1700 mm)	10	Nos.
D.2.6.6	MFA 100 (1100 x 718 x 1700 mm)	4	Nos.
D.2.6.7	MFA 200 (2100 x 718 x 1700 mm)	8	Nos.
D.2.6.8	MFA 300 (3100 x 718 x 1700 mm)	2	Nos.
D.2.6.9	MFZ 100 (1100 x 424 x 700 mm)	2	Nos.
D.3.0	**BOP C&I PACKAGE**		
D.3.1	**RELAY/ANNUNCIATOR/DCS PANELS**		
D.3.1.1	Interposing Relay Panels (Single Cubicle) - CTE01 ,CTE02 & CTE 03 Size: 750 x 750 x 2415 mm; Approx. weight- 400 kg	3	Nos.
D.3.1.2	Alarm annunciator panels (Suite of Two Cubicles) - CRD 01&02, CRD 03&04	2	Nos.

	Size: 1500 x 750 x 2415 mm; Approx. weight- 800 kg		
D.3.1.3	Transducer panel , AVT panel & interposing relay panel (Suite of Three Cubicles) - CFA01 & CTE04/05 Size: 2250 x 750 x 2415 mm; Approx. weight- 1200 kg	1	No.
D.3.1.4	Functional Group Control Panel (Suite of Two Cubicles) - CRE 13 &14, CRE 15 & 16, CRE 17&18, CRE 19&20, CRE 21 &22, CRE 47 & 48, CRE 49 &50 , CRE 64&65 , CRE 66&67, CRE 68 & 69 ,CRE 81&82, CRE 83 &84, CRE 71&72, CRE 73&74) Size: 1500 x 750 x 2415 mm; Approx. weight-800 kg	14	Nos.
D.3.1.5	Functional Group Control Panel (Suite of Three Cubicles) - CRE 1 to 3, CRE 4 to 6, CRE 7 to 9, CRE 10 to 12, CRE 23 to 25, CRE 26 to 28, CRE 29 to 31, CRE 32 to 34, CRE 35 to 37, CRE 38 to 40, CRE 41 to 43, CRE 44 to 46, CRE 61 to 63) Size: 2250 x 750 x 2415 mm; Approx. weight-1200 kg	13	Nos.
D 3.2	**RODM PLANT**		
D 3.2.1	Interposing relay panel (single cubicle) - CTE06 size : 750 x 750 x 2415(H) mm ; approx. weight : 400 Kg	1	No.
D 3.2.2	UF - electrical - DCS panel (Suite of 2 cubicles) - CRE 75/CRE 76 size : 1500 x 750 x 2415(H) mm ; approx. weight : 800 Kg	1	No.
D 3.2.3	RO-MB system - DCS panel (suite of 3 cubicles) - CRE77/CRE78/CRE79 size : 2250 x 750 x 2415(H) mm ; approx. weight : 1200 Kg	1	No.
D 3.2.4	Network Panel enclosure (NWENO1)- HMI system size : 600 x 600 x 500 weight 100 kg	1	No.
D 3.2.5	UPS for RODM Plant 7 KVA UPS - 2 x100 %, with ACDB, Bypass Servo controlled voltage stabiliser with redundant battery back up, battery rack etc ..	1	Set*
D 3.2.6	WORK STATIONS FOR RODM (OWS , EWS)	1	Set*

	Work stations - 2nos. (for operator work station & Engineer work station) Consists of PCs with 24" TFT color monitor and other loose items like Keyboard, mouse , network adaptors, Power distribution boards , inter - connecting cables etc.. **The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.**		
D.3.3.0	**FIELD INSTRUMENTS**		
D.3.3.1	Pressure Gauges	213	Nos.
D.3.3.2	DP Gauges	16	Nos.
D.3.3.3	Temperature Gauges (capillary type) with thermowell	165	Nos.
D.3.3.4	Thermocouples along with thermowell (K type/ R type)	239	Nos.
D.3.3.5	RTDs along with thermowell	120	Nos.
D.3.3.6	Pressure Switches	1	No.
D.3.3.7	DP switches (capacitance type)	2	Nos.
D.3.3.8	Level switches (capacitance type) with electronic unit	4	Nos.
D.3.3.9	Level switches (conductivity type) with probes - 4nos. ,Probe cable - 4 nos (each 10 Mtr length). , Electronic units - 2 nos. , Stand pipe Assy (OD 114.3X 13.49 mm) - 2 sets etc..	2	Sets*
D.3.3.10	Level Transmitters (DP type)	47	Nos.
D.3.3.11	Level transmitters	2	Nos.
D.3.3.12	DP Transmitters	36	Nos.
D.3.3.13	Pressure Transmitters	219	Nos.
D.3.3.14	Flow Transmitters	102	Nos.
D.3.3.15	I/P Converters	13	Nos.
D.3.3.16	Air Filter Regulators	13	Nos.
D.3.4.0	**GAS ANALYSERS**		
D.3.4.1	**Low temperature O2 Analyser (In-Situ type)**	11	Sets*

	Consisting of probe with Probe Protection tubes, Control unit, Auto calibration unit assembly consists of solenoid valves/rotameter, enclosure for control unit/auto cal unit , Double stage gas regulators, Zero gas cylinder, Span gas cylinder, instrument air connection and gas connection tubes, interconnecting power and Communication cable , fittings etc..		
D.3.4.2	**Opacity Monitor/Dust Analyser(In-Situ Cross duct type)** Opacity/Dust analyser : Consisting of Transceiver with 10 Mtr cable - 2nos, Power supply unit - 1 no. , Signal processing unit - 1 no. , Control units - 2 nos., Air purge unit - 2 nos., Fail safe shutter with 10 Mtr cable - 2 nos., Mounting hardware & flanges - 1 set. etc.. Accessories consists of : Solenoid unit for fail safe shutter ,01 No. Air blower Unit with air distribution Hose for purge air connection, 01 No.remote control unit (wall mounted) ,inter connecting power & control cables , intrconnectiong piping etc.. The analyser is to be installed at 106 ML of chimney Weight of compressor unit - 150 Kg (approx.)	1	Set *
D.3.4.3	**SO2/CO & NOX (Combined) analyser system** The system consists of probe, local control unit, interconnecting tubing , sampling panel(SO2/CO & NOX), SO2/CO analyser , NOX analyser etc… The tubing between probe and local control unit /sampling panel is heat traced . 2 Nos. junction boxes, 2 Nos. thermostat, zero gas cylinder and span gas cylinder, control unit, loose ¼ " SS tubes for field tubing and with field cabling. Sampling panel (So2/CO) & NOX) - 1 no. of size : 1200 x 200 x 2100(H) mm The Probe is located at 76 Mtr EL on chimney - flue & analysers are located at 0Mtr EL.	1	Set*
D.3.5.0	**STEAM AND WATER ANALYSIS SYSTEM (SWAS)**		
D.3.5.1	Steam and water analysis system, SWAS consisting of: **<u>Primary Cooler Rack: 02 Nos.</u>** One rack of app. size 1200(L) X 1000(W) x 2100(H) mm & weight 600 kg and the other rack of app. size, 2500(L) x 1000(W) x 2100(H) mm & weight 900kg	1	Set*

	Chiller Unit : 1 No. Approximate Size 3100(L) x 1800(W) x 2100(H)mm ; Dead weight of chiller unit: 1200 kg **Wet Panel : 1 No.** Approximate size 5500(L) x 1800(W) x 2300(H) mm; Weight 2000 kg **Dry panel: 01 No.** Approx. size 5000(L) x 900(W) x 2300(H) mm & weight 1000 kg Hotwell Conductivity rack : 01 no. Approx. size : 600(L) x 615(W) x 2000(H) mm & Weight 450 Kg The Wet Panel will be supplied along with associated cooler flow meters, indicators etc. The Dry Panel consists of sensors, electronic instruments etc. The SWAS System will have the following measurements. Conductivity analysers - 15 Nos. Dissolved Oxygen Analyzer : 3 Nos. Sodium Analyser : 1 No. pH Analysers : 9 Nos. Silica Analyser : 1 No. The scope of work includes erection of the above, including loose supplied instruments, if any, interconnection pipe between cooler, chiller and wet panel, cooling water connection pipes between cooler, chiller and wet panel etc.		
D.3.6.0	**MONITORING SYSTEMS**		
	VIBRATION MONITORING SYSTEM for BFP-DT, Pumps(BFP/CEP/ , Fans & Motors of Fans, CW Pumps, Mills)		
D.3.6.1	**VMS panels : 4 Nos.**	1	Set*

	Each panel Size: 800 x 800 x 2415(H) mm and approximate weight 500 kg each inlcuding instrument racks, vibration /powersupply modules etc..		
D.3.6.2	**Accessories for VMS** Vibration sensors with 10Mtr. Extension cable - 194 Nos. Proximity sensors/phase marker sensors along with 10 Mtr long Extension cable and signal conditioner - 37 sets . Junction Box : 137 Nos. with mounting accessories . ** Note : **Installation of sensors with mounting Pads / bracket/accessories & termination of sensor cable to local JB will be in the scope of vendor, arranged by BHEL.** However, assistance for installing the same like drilling, tapping etc., if required, shall be provided by the C&I contractor.	1	Set*
D 3.6.3	Coal bunker monitoring system (Ultrasonic type) Consists of : Level sensor - 7 nos. Ultrasonic type Level transmitters - 7 nos. Extension cable (PVC) - 190 Mtrs. Junction Box (Sensor cable to transmitter) - 9 Nos. Panel for transmitters - 2 nos.	1	Set*
D 3.6.4	CCTV system Consists of : panel of size 800 x 800 x 2415 mm , 300 Kg, with cameras, control rack monitor, laying & termination of coaxial cable (25 Mtrs),interconnecting cable etc.. ,	1	Set*
D.3.7.0	**MAIN UPS WITH ACDB & BATTERY**		
D.3.7.1	**2x150 KVA UPS comprising of the following :** UPS Panel-04 nos., Servo controlled voltage stabilizer panel, , Input Iso. Transformer ., Battery isolation box and accessories. **<u>Approximate Size & Weight :</u>** Each UPS Panel : 1200(L) x 1060(W)x2100(H)mm; 1500 Kg SCVS Cubicle: 1200(L) x 1060(W)x2100(H)mm;1300 kg	1	Set*
D.3.7.2	**ACDB :**	2	Nos.

	Supplied in shipping sections of 1050(L) x 1050(D) x 2100(H) mm; 700 kg.		
D.3.7.3	**UPS BATTERY :** 860 AH Nickel Cadmium Battery made up of around 192 cells, housed in wooden racks along with inter cell connectors, inter bank connectors , inter row connectors etc... Rack dimension: 7122(L) x 2000(W) x 9024(H) mm Approx. Wt. 10000 Kg	2	Sets*
D 3.7.4	24 V DC battery Battery is made up of around 12 cells (arranged in 2 rows) housed in suitable racks , alongwith intercell connectors etc..	1	set*
	Approx. rack dimensions : 2856(W0 x 378 (H)		
D 3.7.5	24V DC Battery charger Consists of float cum boost chargers 1&2, alongwith DCDBs(2 nos.) , interconnecting cables etc.. Overall dimension : 1600 (W) x 800 (D) x 2000 (H) mm	1	set*
D.3.8.0	**LOCAL INSTRUMENT ENCLOSURES/ RACKS**		
D.3.8.1	Local Instrument Enclosures (Type - D) Size: 1600(W) x 800(D) x 2200 (H) mm; Approximate weight: 1000 kg each	2	Nos.
D.3.8.2	Local Instrument Enclosures (Type - A) Size: 1450(W) x 800(D) x 2200 (H) mm; Approximate weight: 900 kg each	10	Nos.
D.3.8.3	Local Instrument Enclosures (Type - B) Size: 1100(W) x 800(D) x 2200 (H) mm; Approximate weight: 600 kg each	12	Nos.
D.3.8.4	Local Instrument Enclosures (Type - C) Size: 700(W) x 600(D) x 2200 (H) mm; Approximate weight: 400 kg each	12	Nos.
D.3.8.5	Local Instrument Racks (Type - D) Size: 1600(W) x 650(D) x 2200(H) mm; Approximate weight: 700 kg each	3	Nos.
D.3.8.6	Local Instrument Racks (Type - A)	23	Nos.

	Size: 1400(W) x 650(D) x 2200(H) mm; Approximate weight: 600 kg each		
D.3.8.7	Local Instrument Racks (Type - B) Size: 1100(W) x 650(D) x 2200(H) mm; Approximate weight: 400 kg each	21	Nos.
D.3.8.8	Local Instrument Racks (Type - C) Size: 800(W) x 650(D) x 1500(H) mm; Approximate weight: 250 kg each	7	Nos.
D.3.9.0	**CABLES**		
	T/C extension Cables		
D.3.9.1	2 pair x 16 AWG 'KX' type T/C cable	17500	Mtrs.
D.3.9.2	2 pair x 16 AWG 'RX' type T/C cable	1000	Mtrs.
D.3.9.3	4 pair x 16 AWG 'KX' type T/C cable	6000	Mtrs.
D.3.9.4	6 Pair x 16 AWG KX type, T/C cable	17000	Mtrs.
	PVC/FRLS, armoured, individually and overall shielded, Cu cables		
D.3.9.5	2 pair x 0.5 sq. mm cable	8000	Mtrs.
D.3.9.6	4 pair x 0.5 sq. mm cable	34280	Mtrs.
D.3.9.7	8 pair x 0.5 sq. mm cable	4000	Mtrs.
D.3.9.8	2 Triad x 0.5 sq.mm cable	7460	Mtrs.
D.3.9.9	4P x 1.5 sq.mm cable	1000	Mtrs.
	PVC/FRLS, armoured, Overall shielded, Cu Cables		
D.3.9.10	2 pair x 0.5 sq. mm cable	3500	Mtrs.
D.3.9.11	4 pair x 0.5 sq. mm cable	34500	Mtrs.
D.3.9.12	8 pair x 0.5 sq. mm cable	7000	Mtrs.
D.3.9.13	4P x 1.5 sq.mm cable	1000	Mtrs.
D.3.9.14	3C x 1.5 sq.mm cable	2000	Mtrs.
D.3.10.0	**CABLE TRAYS WITH COVERS**		
D.3.10.1	Perforated Cable Trays, 50 mm wide	3500	Mtrs.
D.3.10.2	Perforated Cable Trays, 100 mm wide	3500	Mtrs.
D.3.11.0	**JUNCTION BOXES**		

D.3.11.1	12 way Junction Boxes	31	Nos.
D.3.11.2	24 way Junction Boxes	79	Nos.
D.3.11.3	36 way Junction Boxes	42	Nos.
D.3.11.4	48 way Junction Boxes	21	Nos.
D 3.12.0	**IMPULSE PIPES**		
D.3.12.1	ASTM A335 P91 1/2" NB SCH 160	800	Mtrs.
D.3.12.2	ASTM A335 P22 1/2" NB SCH 160	620	Mtrs.
D.3.12.3	ASTM A335 P22 1/2" NB SCH 80	140	Mtrs.
D.3.12.4	ASTM A106 Gr C 1" NB SCH 80	100	Mtrs.
D.3.12.5	ASTM A106 Gr C 3/4" NB SCH 80	4200	Mtrs.
D.3.12.6	ASTM A 106 Gr C, 1/2" NB Sch XXS	1100	Mtrs.
D.3.12.7	ASTM A106 Gr C 1/2" NB SCH 160	500	Mtrs.
D.3.12.8	ASTM A106 Gr C 1/2" NB SCH 80	6650	Mtrs.
D.3.12.9	ASTM A312 TP316 1/2" NB SCH 40	1750	Mtrs.
D.3.12.10	ASTM A213 TP 316H PIPE 1/2" SCH 160	400	Mtrs.
D.3.12.11	ASTM A213 TP 316H PIPE 1/2" SCH 40	1000	Mtrs.
D.3.13.0	**OTHER ERECTION MATERIALS**		
D.3.13.1	Structural steel : 100 x 50 x 5 mm MS Channels, 50 X 50 X 5 MS Angles, 250 x 10 mm MS Flat, 500 x 3.15 mm MS Flat etc. (for pipe spports, JB Racks,, cable tray support, canopy etc..)	19	MT
D.3.13.2	½" NB Heavy duty GI pipes	4500	Mtrs.
D.3.13.3	1" NB Heavy duty GI pipes	150	Mtrs.
D.3.13.4	¼" OD x 1 mm thick SS Tubes	150	Mtrs.
D.3.14.0	**MASTER AND SLAVE CLOCK SYSTEM**		
D.3.14.1	Master clock System Panel Size: 800x 800 x 2415 mm; 300 kg approx.	1	No.
D.3.14.2	Slave clock Approximate Size: 700(W) x 100(D) x 200(H) mm	20	Nos.
D.3.14.3	GPS Antenna , Lightening Arrestor along with approx. 100 Mtrs of interconnecting cable(FRLS -unarmoured) from antenna to GPS receiver unit.	2	sets

D.3.14.4	Slave Booster	3	Nos.
D.3.14.5	Line Driver / Receiver	1	set.
D.3.14.6	RG 58 Coaxial Cable	2000	Mtrs.
D.3.14.7	RS 232 Data Cable	800	Mtrs.
D.3.14.8	Power Supply Cable.	1000	Mtrs.
D.3.14.9	Network Cable (RJ 45)	1000	Mtrs.
D.3.14.10	Flexible metal conduit pipe (GI)	200	Mtrs.
D.3.14.11	Junction Box	5	Nos.
D.4.0	**HMI PACKAGE**		
D.4.1	**UNIT CONTROL DESK** Unit Control Desk for housing Work Stations, CRTs, keyboards and mouse for the above etc. Approximate Total size 7085(L) x 1842(W) x 750(H) mm, in suitable shipping sections.	1	No.
D.4.2	**LARGE VIDEO SCREEN (LVS) SYSTEM** 67" Large Video Screens (6 nos.), Controller, along with CPU and other loose supplied items like Keyboard, mouse, interconnecting power & communication cables, Mounting stand / arrangement etc.	1	set*
D.4.3	**COMPUTER STATIONS** PCs along with 24" TFT monitor, and other loose supplied items like keyboard, mouse, modems, 1kVA UPS, printer & print servers, interconnecting power and communication cables etc. The PCs are for various specific functions like Engineer Workstation (Programmer Station/ system documentation station),Shift Incharge Station, 'maxStorian' Station (Information system), Operator Work Stations ('maxOperator' Stations), SOE station, maxLINK Stations, TSC Operator Workstation, Performance calculation stations etc. **The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.**	20	Sets*
D.4.4	Network Panels (DCS A&B)/ Power dist cum llnk panel etc.(NWPA01,02,03 & PDNL01)- Single cubicle	4	Nos.

	Dimension: 750 x 750 x 2415 mm; approx Wt: 400 Kg		
D.4.5	Network Enclosures (Wall Mounted type), along with loose supplied Ethernet switches. Dimension: 600 x 600 x 500 mm; Approximate Weight: 50 kg	2	Nos.
	Cables for HMI Package		
D.4.6	Ethernet Cable (CAT5e UTP 24AWG)	6000	Mtrs.
D 4.7	Power Cables: 4 C x 1.5 sq. mm cables	1000	Mtrs.
D 4.8	Fibre optical cable along with HDPE conduit (Splicing , laying , clamping and dressing by the contractor)	25000	Mtrs.
D 5.0	**PADO system**		
D 5.1	PADO SYSTEM Consists of the following :		
	PADO Server 2 nos. with 24" TFT monitor and other loose items like keyboard, mouse, 240 V redundant hot plug power supply, interconnecting power and communication cables etc..	1	Set*
	Work stations - 7 nos. (for operator work stations - 5 nos., interface to max network - 2 nos.) Consists of PCs with 24" TFT color monitor and other loose items like Keyboard, mouse , network adaptors, 240 V power supply, Modem (1 No.), Printer (1 no.), Power distribution boards (12 Nos.), UTP pre-fab interconnecting cable (20 nos.) etc..		
	Wall mounted rack - 1no. , Ethernet switches - 3 Nos.		
	The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.		
D 5.2	Fibre optical cable along with HDPE conduit (Splicing , laying , clamping and dressing by the contractor)	1400	Mtrs
D 6.0	**SCADA system**		
D 6.1.	RTU Panel (suite of 2 cubicles) - CAR11 & 12 size 1500(W) x 750(D) x 2415 (H) mm . Weight - 800 Kg	1	No
D 6.2	Relay panel (suite of 2 cubicles) - CAR13 & 14 size 1500(W) x 750(D) x 2415 (H) mm . Weight - 800 Kg	1	No.
	HMI for SCADA system		

D 6.3	Work stations - 4nos. (for operator work stations - 2 nos.,Engineer work stations - 2 nos.) Consists of PCs with 24" TFT color monitor and other loose items like Keyboard, mouse , network adaptors, 3 KVA UPS, 8 nos. battery for 3 KVA UPS, , Modem (1 No.), Printer (1 no.), Power distribution boards (12 Nos.), UTP pre-fab interconnecting cable (4 nos.) etc.., enclosure for UPS - 1 no. **The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.**	1	Set*
D 6.4	52" industrial grade LCD monitor . Size 1250(w)x 150(D)x 720(H) mm	2	Nos.
D 6.5	GPS master clock panel size : 800 x 800 x 2415 mm ; Weight - 300Kg	1	No.
D 6.6	Fibre optical cable along with HDPE conduit (Splicing , laying , clamping and dressing by the contractor)	3000	Mtrs
E.0	**BHEL-HYDERABAD SCOPE**		
E.1.0	**PUMPS (TDBFP, MDBFP, CEP)**		
E.1.1	**INSTRUMENTS**		
E.1.1.1	Miniature RTD along with thermowells	24	Nos.
E.1.1.2	RTD along with thermowells	75	Nos.
E.1.1.3	Temperature Indicators of BFP, CEP motors (Removal, calibration & re-fixing only)	10	Nos.
E.1.2.0	**IMPULSE TUBES**		
E.1.2.1	Impulse Tube, Dia 16 x 2.6, CS	1900	Mtrs.
E.1.3.0	**JUNCTION BOXES**		
E.1.3.1	Electrical Junction Box, 24 terminals	6	Nos.
E.1.4.0	**CABLES/ CABLE TRAYS**		
E.1.4.1	4 Pair, 0.5 sq. mm cable	500	Mtrs.
E.1.4.2	Perforated cable tray, 50 mm wide	80	Mtrs.
E.1.4.3	Perforated cable tray, 150 mm wide	45	Mtrs.

E.1.5.0	**LOCAL GAUGE BOARD (LGB) / LOCAL INSTRUMENT RACK (LIR) (including removal, calibration and re-fixing of LGB mounted instruments)**		
E.1.5.1	LGB Assembly for Feed Water Service for TDBFP/MD BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs. Approximate Size 1400 x 550 x 1900 mm ; Weight = 200 kg each. Quantity of instruments per set is Pressure Gauge: 4 Nos. DP Gauges: 2 Nos. Temperature Gauges: 2 Nos. Pressure switch- 1 No (for MD BFP LGB only)	3	Nos.
E.1.5.2	LGB Assembly for Oil, Seal and Cooling Water Service of TD/MD BP & BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs. Approximate Size 1400 x 550 x 1900 mm ; Weight = 200 kg each. Quantity of instruments per set is Temperature Gauges: 12 Nos. Pressure Gauge - 6 Nos.(for MD BFP) and 4 Nos for TD BFP	3	Nos.
E.1.5.3	LGB Assembly for 3 Nos. CEP Suction side including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs. Approximate Size 1400 x 550 x 1900 mm; Weight = 200 kg Quantity of instruments per set is Pressure Gauges: 3 Nos. Diff. pressure Gauges: 3 Nos.	1	No.
E.1.5.4	LGB Assembly for 3 Nos. CEP Discharge side including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs. Approximate Size 1400 x 550 x 1900 mm; Weight = 200 kg each. Quantity of instruments per set is Pressure Gauges: 6 Nos.	1	No.

	Temperature Gauges: 3 Nos.		
E.1.5.5	Local instrument rack (LIR) assembly for TDBFP/MDBFP, including transmitters, tubing, fittings, JBs, Main-fold valves and wiring from JBs to transmitters. Approximate Size 2000 x 650 x 2200 mm; Weight = 300 kg each. Quantity of instruments per set is DP transmitters: 02 Nos. Pressure transmitter : 03 Nos.	3	Nos.
E.1.5.6	Local Instrument Rack (LIR) assembly for CEP-A,B&C, including Transmitters, tubing, fittings, JBs, Manifolds Valves and wiring from JBs to transmitters Approximate Size: 2000 x 600 x 1500 mm; Weight = 300 kg Quantity of instruments per set is Pressure transmitters: 6 Nos	1	No.
E.1.5.7	Local Instrument Rack (LIR) assembly for CEP-A,B&C, including Transmitters, tubing, fittings, JBs, Manifolds Valves and wiring from JBs to transmitters Approximate Size: 2000 x 600 x 1500 mm; Weight = 300 kg Quantity of instruments per set is Differential Pressure transmitters: 3 Nos.	1	No.
E.1.6.0	**SUPPORT MATERIALS**		
E.1.6.1	Structural steel (ISMC 100 x 50 mm, Angle 45 x 45 x 5 mm etc.)	1	MT
E.1.7.0	**CHECKING AND COMMISSIONING OF THE FOLLOWING**		
E.1.7.1	RTDs fixed on BFP, CEP motors (Checking healthiness only)	56	Nos. $
E.1.7.2	Hydraulic Coupling of MDBFP - The scope of work covers A) Removal, calibration &refixing of instruments. The approximate quantity of instruments is as follows. Pressure Indicators: 2 Nos. DP Indicator: 1 No.	1	Set *$

	Temperature Indicators: 14 Nos. Pressure Transmitters: 6 Nos. Level transmitter: 1 No. DP transmitter: 1 No. RTDs (Checking only): 18 Nos. B) Fixing of I/P Convertors, Air filter, Copper tubing & feedback transmitter, adjustment and calibration of scoop mechanism etc. C) Commissioning of Speed Indicators etc.		
E.2.0	**BFP DRIVE TURBINE**		
E.2.1.0	**INSTRUMENTS (LOCAL/FIELD MOUNTED)**		
E.2.1.1	Pressure Gauges	114	Nos.
E.2.1.2	DP Gauges	6	Nos.
E.2.1.3	Pressure Transmitters/DP transmitters	74	Nos.
E.2.1.4	Pressure Switches	8	Nos.
E.2.1.5	DP Switches	6	Nos.
E.2.1.6	Temperature Gauges with thermowell (capillary type)	44	Nos.
E.2.1.7	RTDs with thermowell	26	Nos.
E.2.1.8	Cr-Al Thermocouples with thermowell	24	Nos.
E.2.1.9	Level Transmitters (capacitance type, top mounted) along with probes, electronic unit etc.	4	Sets*
E.2.1.10	Speed measuring loop, with probe, proximeter unit, local field cable etc. for Governing System	12	Sets*
E.2.1.11	I/P Converter	8	Nos.
E.2.1.12	Level gauges	2	Nos.
E.2.2.0	**PANEL / FIELD MOUNTED INSTRUMENTS**		
E.2.2.1	**Vibration monitoring system for BFP Drive Turbine consisting of the following-** 1 No. Monitor rack with modules (to be mounted on panel) approximate wt 40 kg /rack . 18 Nos. of Vibration/Axial displacement probes with probe extension cables, 16 Nos. of proximeters, proximeter housings ,Flexible conduit, interconnecting cables etc.	2	Sets*

E.2.2.2	Fabrication of Local Instrument Racks, each of size 1500 x1700 mm, with the following materials : Channel ISMC 100 x 50 mm, Angle 50 x 50 x 6 mm, Plate 10mm thick (375 x 770 mm), Sheet 4 mm thick (400 x 120 mm) etc.	2	MT
E 2.2.3	Open type transmitter racks (each of Size : 2000 x 1250 x 600 mm)	12	Nos.
E.2.3.0	**IMPULSE PIPES & FITTINGS**		
E.2.3.1	CS Pipe, 21.3 x 3.73	800	Mtrs.
E.2.3.2	CS Pipe, 60.3 x 3.91	120	Mtrs.
E.2.3.3	Cr-Al Pipe 21.3 x 3.73	660	Mtrs.
E.2.3.4	SS tube, 12.7 x 2.1 mm	1400	Mtrs.
E.2.3.5	SS tube, 6 x 1.5 mm	60	Mtrs.
E.2.4.0	**CHECKING AND COMMISSIONING OF THE FOLLOWING**		
E.2.4.1	Control Valves	12	Nos. $
E.2.4.2	Position Transmitters	8	Nos. $
E.2.4.3	**Governing Console Board** The scope includes removal, calibration and refixing of Instruments, wiring etc. The approximate quantity of instruments is Pressure Gauges: 10 Nos. Pressure Switches: 24 Nos.	2	Sets*$
E.3.0	**HEAT EXCHANGERS (LPH 2,3&4, HPH 6A,6B,7A ,7B,8A&8B) , DEAERATOR & DRAIN COOLERS ..**		
E.3.1	Pressure Gauges	11	Nos.
E.3.2	Temperature Gauges with thermowell (capillary type)	44	Nos.
E.3.3	Level Switches (float type)	3	Nos.
E.3.4	Level gauges	4	Nos.
E.3.5	Level transmitters	4	Nos.
E.4.0	**PULVERISER**		
E.4.1	RTDs along with thermowell	42	Nos.
E.4.2	Temperature Indicators (Removal, calibration and refixing only)	14	Nos.

E.4.3.0	**COMMISSIONING OF FOLLOWING**		
E.4.3.1	**Mill Motor RTDs - bearing/ winding (Checking healthiness only)**	98	Nos. $
E.4.3.2	**Pulveriser Lub Oil Skids** Removal, calibration and re-fixing of following instruments,meggering, improving IR value of motors , checking of wiring from skid junction box to equipment in lub oil skid. **<u>Equipment per set</u>** Level transmitter – 1 No. Pressure transmitter - 2 Nos. DP transmitter - 1 No. DP indicator - 1 No. Pressure gauge - 3 Nos. Temperature Gauges- 3 Nos. Level gauge -1 No. Flow switch - 2 Nos. RTDs – 10 Nos. LT motors - 2 Nos.	7	Sets*$
	Pneumatic Actuators of On/Off type		
E.4.3.3	Purge Air to Pulveriser Coal pipes	7	Nos. $
E.4.3.4	Mill Discharge Damper	28	Nos. $
F.0	**BHEL-PEM SCOPE**		
F.1.0	**INSTRUMENTATION CABLES**		
	Individual & Overall Shielded screened, Twisted Pair, Armoured cables		
F.1.1	4 Pair x 0.5 mm2	60000	Mtrs.
F.1.2	8 Pair x 0.5 mm2	15000	Mtrs.
F.1.3	12 Pair x 0.5 mm2	10000	Mtrs.
	Overall Screened, Twisted Pair, Armoured cables		
F.2.1	2 Pair x 0.5 mm2	36000	Mtrs.
F.2.2	4 Pair x 0.5 mm2	48000	Mtrs.

F.2.3	8 Pair x 0.5 mm2	88000	Mtrs.
F.2.4	12 Pair x 0.5 mm2	4000	Mtrs.
F.3.0	**COMMISSIONING OF FOLLOWING**		
F.3.1	Control Valves	32	Nos. $
F.3.2	Loop Checking of Electrical Actuators (this includes Actuators supplied by Hyderabad/ Hardwar also)	360	Nos. $
F.3.3	**Oxygen Dosing Skid** Removal, calibration and refixing of following instruments Approximate qty of instruments per skid is Pressure Gauges: 3 Nos. Pressure Transmitter: 3 Nos. Flow controller - 1 No. Solenoid Valves (checking only) - 2 Nos.	2	Sets *$
F.3.4	**Ammonia Dosing Skid** Removal, calibration and re-fixing of following instruments,meggering, improving IR value of motors etc.. Approximate qty of instruments per skid is Pressure Gauges: 3 Nos. Level Gauge- 2 Nos Pressure switch : 1 No. Pressure transmitter- 1 No. DP indicator: 1 No. Level Transmitters: 1 No. Level switch- 1 No. LT motors - 3 Nos.	1	Sets *$
F.3.5	**NaOH Dosing Skid** Removal, calibration and re-fixing of following instruments,meggering, improving IR value of motors etc.. Approximate qty of instruments per skid is Pressure Gauges: 2 Nos. Level Gauge- 1 No.	1	Sets *$

	Pressure Transmitter: 1 No. Level Transmitter: 1 No. Level switch - 1 No. LT motor - 1 No.		
F.3.6	**Bulk Ammonia transfer system** Removal, calibration and re-fixing of following instruments,meggering, improving IR value of motors etc.. Approximate qty of instruments per skid is Pressure Gauges: 3Nos. Level Gauge- 1 No. Pressure Transmitter: 1 No. Level Transmitter: 1 No. Level switch - 1 No.	1	Sets *$
G.0	**BHEL- HARDWAR SCOPE**		
G.1.0	**GENERATOR**		
G.1.1.0	**GENERATOR AUXILIARY CONTROL CABINETS**		
G.1.1.1	Gas Analyser Cabinet including sensor, analyser etc.(CWX01C, CWX01D) Approx. size & weight: 1200 x 800 x 2110(H) mm; 450 kg	2	Nos.
G.1.1.2	Generator End Winding Vibration Monitoring System comprising of Panel, pre-amplifer units, special cables for interconnecting the probes and amplifiers, PC based vibration monitor, printer, etc. Approximate size & weight of the panel : 800 x 800 x 2200 mm; 150 Kg.	1	No.
G.1.1.3	Moisture Measurement System for Generator, including indicator cum controller (144 x 72) , sampling system panel of size : 760x600x 210 mm . Approximate weight of panel : 100 Kg.	1	Set*
G.1.1.4	Grounding Brush Monitor with detector unit Approx. size & weight : 400 x 320 x 120 mm ; Weight : 10 KG (approx.)	1	No.
G.1.2.0	**GENERATOR INSTRUMENTS:**		

G.1.2.1	Pressure Transmitters	26	Nos.
G.1.2.2	Pressure Gauges	27	Nos.
G.1.2.3	Pressure Switches	1	No.
G.1.2.4	Differential Pressure Transmitters	1	No.
G.1.2.5	DP switches	3	Nos.
G.1.2.6	Temperature Gauges	13	Nos.
G.1.2.7	Level Transmitter	1	No.
G.1.2.8	Level gauges	4	Nos.
G.1.2.9	Level Switches (capacitance type)	16	Nos.
G.1.2.10	RTDs	4	Nos.
G.1.2.11	Thermocouples (NiCrNi) (Generator Bearing Temp: 12 Nos.& Exciter Bearing Temp: 6 Nos.)	18	Nos.
G.1.3.0	**REMOVAL, CALIBRATION & RE-FIXING OF GENERATOR INSTRUMENTS**		
G.1.3.1	Pressure Gauges	13	Nos.
G.1.3.2	DP Gauges	2	Nos.
G.1.3.3	Temperature Gauges	9	Nos.
G.1.3.4	Pressure Transmitters	10	Nos.
G.1.3.5	Differential Pressure Transmitters	5	Nos.
G.1.3.6	Pressure Switches	8	Nos.
G.1.3.7	Level Switches	7	Nos.
G.1.3.8	Flow Meters (commissioning only)	6	Nos. $
G.1.3.9	Conductivity Cells	3	Nos
G.1.3.10	PW Conductivity Indicator	1	No.
G.1.3.11	Flow Indicators (commissioning only)	1	No.$
G.1.3.12	Flow Switches	1	No.
G.1.3.13	**Checking the healthiness of the following RTDs/Thermocouples** Temperature- Stator Core (Pt 100 RTD) : 12 Nos. Temperature- Stator Slot (Pt 100 RTD): 24 Nos.	198	Nos.$

	Temp upper bar PW O/L(Pt 100 RTD): 42 Nos Temp lower bar PW O/L(Pt 100 RTD):42 Nos Temperature- PW outlet manifold (Pt 100 RTD): 6 Nos. Temp- Hot Gas before H_2 Coolers (Pt 100 RTD): 4 Nos. Temp- Cold Gas After H_2 Coolers (Pt 100 RTD): 12 Nos. Temp- Cold Gas (Pt 100 RTD): 4 Nos. Temp- Cold Air Main Exciter (Pt 100 RTD): 2 Nos. Temp- Hot Air Main Exciter (Pt 100 RTD): 6 Nos. Temp- Hot Air Rectifier Wheel (Pt 100 RTD): 2 Nos. Temp at I/L of PW Cooler (Pt 100 RTD) : 2 Nos. Temp- PW at I/L to SW (Pt 100 RTD): 6 Nos. Temp - SW at O/L (Pt 100 RTD): 2 Nos. Temp after M. Bushing(Pt 100 RTD): 2 Nos. Temp CO_2 Flash Evap. (Pt 100 RTD): 2 Nos. Temp. of H2 side S.Oil Drain(Pt 10 RTD) - 4 Nos. Temp. Of S.oil before S.oil cooler(Pt 100 RTD)- 2 Nos Temp. Of S.oil after duplex fliter(Pt 100 RTD)-2 Nos Temp at O/L of PW coolers(Pt100 RTD)-4 Nos Temp at I/L of PW coolers(Pt100 RTD)-2 Nos Temp before H2 coolers (Pt 100 RTD): 4 Nos. Temp after H2 coolers (Pt 100 RTD): 10Nos.		
G.1.4.0	**LOOSE SUPPLIED INSTRUMENTS FOR GENERATOR PIPING**		
G.1.4.1	Vacuum Switches	2	Nos.
G.1.4.2	Pressure Gauges	7	Nos.
G.1.4.3	Pressure Switches	1	Nos.
G.1.4.4	Pt RTD, Duplex	2	Nos.
G.1.4.5	Bimetallic Dial Thermometer	5	Nos.
G.1.5.0	**LOOSE SUPPLIED INSTRUMENTS FOR H2 COOLER PIPING**		
G.1.5.1	Pressure Gauges	8	Nos.
G.1.5.2	Pressure Switches	1	No.
G.1.5.3	Pt RTD, Duplex	7	Nos.

G.1.5.4	Bimetallic Dial Thermometer	4	Nos.
G.1.5.5	Moisture Sensor Probes	1	No.
G.1.6.0	**LOOSE ITEMS TO BE MOUNTED ON UCB**		
G.1.6.1	Digital Indicators	10	Nos.
G.1.6.2	Bar Graph Indicators	5	Nos.
G.1.6.3	Pressure Indicators (Moving Coil Type)	1	No.
G.1.6.4	Temperature Indicators (Moving Coil Type)	2	Nos.
G.1.6.5	Vibration Indicator along with Selector Switch	4	Nos.
G.1.7.0	**IMPULSE PIPES (Generator)**		
G.1.7.1	CS pipe 21.3 x 2.3	200	Mtrs.
G.1.7.2	AS pipe 21.3 x 2.3	250	Mtrs.
G.1.7.3	SS pipe 21.3 x 2.3	800	Mtrs.
G.1.7.4	CS pipe 13.5 x 2.6	100	Mtrs.
G.1.7.5	AS pipe 13.5 x 2.6	50	Mtrs.
G.1.7.6	SS pipe 13.5 x 2.6	100	Mtrs.
G.1.7.7	CS pipe 17.2 x 1.8	20	Mtrs.
G.2.0	**STEAM TURBINE**		
G.2.1.0	**Instruments/Sensors**		
G.2.1.1	RTDs	8	Nos.
G.2.1.2	Thermocouples	82	Nos.
G.2.1.3	Pressure Transmitters/ Absolute Pressure Transmitters	55	Nos.
G.2.1.4	Pressure Switches	15	Nos.
G.2.1.5	Pressure indicators	43	Nos.
G.2.1.6	DP Transmitters	9	Nos.
G.2.1.7	DP Switches	7	Nos.
G.2.1.8	Temperature Switches	2	Nos.
G.2.1.9	Temperature indicators	15	Nos.
G.2.1.10	Level transmitters with amplifier, bar probe	3	sets*
G.2.1.11	Level Switches (float type)	20	Nos.

G.2.1.12	Level indicators	5	Nos.
G.2.1.13	Position Transmitters	36	Nos.
G.2.1.14	Speed sensors/detectors	6	Nos.
G.2.2.0	**PRESSURE INSTRUMENTS RACKS (IR1 to IR7)** Assembly/welding and installation of Instrument Racks with loose supplied prefabricated materials of suitable size, like equal/unequal angles, canopy mounting plates, LHS/RHS stands etc., necessary welding, fixing with fasteners and grouting Total wt. of loose supplied items for 7 racks: Approx. 2 Tonnes		
G.2.2.1	Rack of Size 2150 x 700 x 2150 (WXDXH) mm	3	Nos.
G.2.2.2	Rack of Size 1250 x 700 x 2150 (WXDXH) mm	3	Nos
G.2.2.3	Rack of Size 2000 x 700 x 2150 (WXDXH) mm	1	No.
G.2.3.0	**IMPULSE PIPES**		
G.2.3.1	Carbon Steel Tube D= 88.9X4	20	Mtrs
G.2.3.2	Carbon Steel Tube, D=33.7 x 3.38	2	Mtrs
G.2.3.3	Seamless CS Tube, D=13.5 x 2.6	425	Mtrs
G.2.3.4	Seamless CS tube D=21.3 x 2.3	140	Mtrs
G.2.3.5	Seamless S.S. tube D=21.3 x 2.77	380	Mtrs
G.2.3.6	Seamless S.S. tube D=13.5 x 2.6	26	Mtrs
G.2.3.7	Seamless alloy steel tube D=21.3 x 2.77	310	Mtrs
G.2.3.8	Seamless alloy steel tube D=13.5 x 2.6	105	Mtrs
G.2.4.0	**JUNCTION BOXES**		
G.2.4.1	Junction Box	3	Nos.
G 2.5	**Turbine - package : SIEMENS SCOPE OF SUPPLY**		
G 2.5.1	Instrumentation & control panels (10CJJ11 ,10CJJ22,10CRV01) Size :1200(L) x 800(D) x 2200(H) , approx. wt : 300 Kg	3	Nos.
G 2.5.2	Instrumentation & control panel (CJJ21) Size :900(L) x 800(D) x 2200(H) , approx. wt : 300 Kg	1	No.
G 2.5.3	ET 200M I/O measurement panels (10CPB01, 10CPB02,10CPB03)	3	Nos.

	Size :1200(L) x 800(D) x 2200(H) , approx. wt : 300 Kg		
G 2.5.4	LAN Cabinet (10CRY01) Size :900(L) x1000(D) x 2200(H) , approx. wt : 300 Kg	1	No.
G 2.6	**Instruments /other equipments (Siemens supply)**		
G 2.6.1	Temperature transmitters	1	No.
G 2.6.2	Junction box (with mounted accelerometers, proximity transducers) , interconnecting cables etc..	17	Sets
G 2.6.3	Fire push button	4	Nos.
G 2.6.4	Emergency stop push buttons	3	Nos.
G 2.7	**HMI SYSTEM**		
G 2.7.1	HMI SYSTEM Consists of the following : Application server/DR server - 2 nos. with other loose items like keyboard, mouse, 24 V power supply rack, ,server links, network adapters , interconnecting power and communication cables etc.. Work stations - 5nos. (operator work stations/Engineer work stations) Consists of PCs with 24" color monitors and other loose items like Keyboard, mouse , network adaptors, Modem, Printer , Power distribution boards ,interconnecting cables etc.. **The scope of work includes erection of the above including associated PC/printer furniture & operator chairs, integration of the system and commissioning.**	1	Set*
G 2.8	**INSTRUMENTS FOR HEAT EXCHANGERS (CONDENSER, GSC, LP HEATER-1, TOC, CFC)**		
G 2.8.1	Level Switches (Float type)	5	Nos.
G 2.8.2	Temperature Gauges with thermowell	20	Nos.
G 2.8.3	Pressure Gauges	4	Nos.
G 2.9	**CABLES**		
	PVC/FRLS, armoured, individually and overall shielded cables		
G 2.9.1	4P x 0.5 sq.mm cable	4700	Mtrs.
G 2.9.2	8P x 0.5 sq.mm cable	7000	Mtrs.
	PVC/FRLS, armoured, Overall shielded Cables		
G 2.9.3	2P x 0.5 sq.mm cable	13000	Mtrs.

G 2.9.4	4P x 0.5 sq.mm cable	9000	Mtrs.
G 2.9.5	8P x 0.5 sq.mm cable	3500	Mtrs.
G 2.9.6	12P x 0.5 sq.mm cable	4000	Mtrs.
G 2.9.7	2P x 0.5 sq.mm overall shielded (copper braided) cable	4500	Mtrs.
G 2.10	**STRUCTURAL STEEL** (for both turbine and generator instruments)	1	MT
G.3.0	**COMMISSIONING OF THE FOLLOWING**		
G.3.1	**Condenser Vacuum Pump** Removal, calibration and commissioning of CVP skid mounted instruments including CVP PLC and motor mounted on the skid. The approximate quantity of skid mounted instruments shall be Pressure Indicators – 2 Temperature Indicators - 2 Flow Indicator – 1 Flow Switch – 1 Level Switches – 2 DP Switch – 1 Pressure Switch – 1 Temperature Switch- 1 Limit Switch – 1 Solenoid Valve – 2	2	Sets*$
G.3.2	**Oil Centrifuge Unit** Removal, calibration and refixing of all instruments mounted on centrifugal unit, checking and commissioning of the system.	2	Nos.$
G.3.3	NRV Valves, Stop Valves, Control Valves, HP/LP Bypass Valves	40	Nos. $
G.3.4	Position Transmitters (Removal, calibration and re-fixing)	19	Nos.
G.3.5	Limit Switches (checking only)	76	Nos. $
G.3.6	Solenoid Valves (checking only)	30	Nos. $
G.3.7	**Hydraulic Speed Control Equipment Rack (LR1)** Removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc. The approximate quantity of instruments is as below: Pressure Gauges : 9 Nos. Pressure Switches : 4 Nos.	1	set*$

G.3.8	**LP Bypass Control Rack/Skid** Removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc. The approximate quantity of instruments is as below Transmitters(Pressure, Temp&Level)-8 Nos. Switches(Pressure, DP& Flow)-7 Nos.	1	set*$
G.3.9	**Supply Unit Racks for HP Valve-1, HP Valve-2, IP Valves (SU1, SU2 & SU3)** Removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc. Total quantity of instruments for all 3 racks is as below: Pressure Gauges : 17 Nos. Pressure Switches: 12 Nos DP Switches : 3 Nos.	3	sets*$
G.3.10	Seal Oil Rack	1	set*$
G.3.11	Stator Water Rack	1	set*$
G.3.12	Seal Oil Level / PrTxr Instrument Rack	1	set*$
G.3.13	Stator Water DP Instrument Rack	1	set*$
G.3.14	H2 Dryer Unit	1	set*$
G.3.15	Gland Steam And Seal Steam Oil Supply Units	2	sets*$
G.3.16	TD BFP Pump Coupling Engage Oil Supply Unit	2	sets*$
H.0	**FOR EDTA CLEANING**		
H.1.0	Calibration (as required), Erection, Removal and Handing Over to BHEL Stores		
H.1.1	MTM thermocouple length 10 mtrs	12	Nos.
H.1.2	Junction boxes - 12 way/ 6 way/ 24 way	10	Nos.
H.1.3	Compensating cables 2 P x 0.5 sq. mm	200	Mtrs.
H.1.4	Compensating cables 6 P x 0.5 sq. mm	300	Mtrs.
H.1.5	Pressure gauges	15	Nos.
H.1.6	MTM thermocouple adaptor fabrication - 1/4" NPT(M) x 1/4" OD SS	2	sets
H.1.7	16 P x 0.5 sqmm cable for Teletel Separator level indication	500	Mtrs.

H.1.8	3c x 2.5 sqmm power cable Teletel Separator level indication	100	Mtrs.
H.1.9	9 port lamp indication at control room and 9 port switching at Drum floor	1	set
H.1.10	Switchboards with switches	3	Nos.
H.1.11	Dial Thermometers	5	Nos.

NOTE:

1. The BOQ Ref. no given above may be linked with the BOQ Ref no in Price bid.
2. The Price bid contains the consolidated list of BOQ with brief description of items.
3. Rates are to be filled only in the Price bid.
4. Before filling the Rates in the Price bid, the bidder shall go through the detailed specification of all items of BOQ as well as Scope of Work as specified in relevant Clause of this document.
5. The quantity indicated in the BOQ / Price bid is approximate only and is liable for variation. Payment will be as per actual quantity erected / commissioned as certified by BHEL Engineer.
6. * Lump sum rate to be quoted
7. $ Rate to be quoted for commissioning only

VOLUME-IA PART –I CHAPTER -X

GENERAL

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.10.1 **In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following.**

1.10.1.1 BOCW Act & BOCW Welfare Cess Act

1.10.1.1.1 The Contractor should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice Of Commencement / Completion of Building other Construction Work) to the respective Labour Authorities i.e.,

a) Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.–NTPC, NTPL etc.

b) Inspector of Factories in respect of the project premises which is under the purview of State Govt.

1.10.1.1.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL

1.10.1.1.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc

1.10.1.1.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.

1.10.1.2 PROVIDENT FUND & MINIMUM WAGES

1.10.1.2.1 The contractor is required to extent the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of this letter of intent. Incase you are exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of your failure to

comply with the provisions of said Act, if recoveries therefore are enforced from payments due to us by the customer or paid to statutory authorities by us, such amount will be recovered from payments due to you.

1.10.1.2.2 The contractor shall ensure the payments of minimum labour wages to the workmen under him as per the rules applicable from time to time in the state.

1.10.1.2.3 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.

1.10.1.3 OTHER STATUTORY REQUIREMENTS

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

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

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

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

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

1.10.1.3.6 In case of any dispute prolonged/pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor

indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

1.10.2 **GENERAL**

1.10.2.1 The scope of specification covers the installation, testing and commissioning of the erected equipment / instrument along with accessories as detailed in Bill of Quantity.

1.10.2.2 Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting the equipment, aligning, fastening, supporting, cleaning, checking and carrying out statutory tests as required, trial operation, pre-commissioning, commissioning and post-commissioning activities up to the time of completion of commissioning activities and commercial operation of the unit and handing over to customer or till completion contract period (including extended period) whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.

1.10.2.3 Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc., in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.

1.10.2.4 It is not the intent to specify herein all details of material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

1.10.2.5 The contractor shall have valid ELECTRICAL LICENCE as required to carry out the scope of work indicated in the BOQ

1.10.2.6 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.

1.10.2.7 Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc will decide the sequence of erection/commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection/commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.

1.10.2.8 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in

accordance with drawings, specifications and manufacturer's recommendations and Field quality plans of BHEL.

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

1.10.2.10 During the course of erection, testing and commissioning certain rework / modification / rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and/ or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously and the same shall be deemed to be part of the scope of work.

1.10.2.11 The work shall be executed under the usual conditions without affecting power plant construction and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.10.2.12 If any item or equipment not covered but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.

1.10.2.13 After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in a packed condition to BHEL stores. In case of any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

1.10.2.14 Contractor shall, transport all materials to site and unload at site / working area, or pre-assembly yard for inspection and checking. All material handling equipment required shall be arranged by the contractor.

1.10.2.15 Contractor shall retain all T&P / Testing instrument / Material handling equipments etc., at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.

1.10.2.16 Contractor shall remove all scrap materials periodically generated from his working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by

BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc., shall be returned to the BHEL stores / customer's stores by the contractor.

1.10.2.17 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.,

1.10.2.18 Until such time the work is taken over by BHEL, the contractor shall be responsible for proper protection including proper fencing, guarding, lighting, flagging, and watching. The contractor shall during the progress of work properly cover up and protect any part of the work liable to damage by exposure to the weather and shall take every reasonable precaution against accident or damage to the work from any cause.

1.10.2.19 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.

1.10.2.20 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However completion time for erection agreed will be subject to the condition that contractor's work is not hampered by the agencies.

1.10.2.21 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.

1.10.2.22 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.

1.10.2.23 Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.

1.10.2.24 Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the

milestones are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.

1.10.2.25 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

1.10.2.26 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe/tubes, and handrails etc for any temporary supporting or scaffolding works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.

1.10.2.27 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.

1.10.2.28 No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.

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

1.10.2.30 For other agencies, such as piping, Boiler, ESP, TG, Electrical, insulation etc., to commence their work from/on the equipments coming under this scope, Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence/continue the work so as to keep the overall project schedule.

1.10.2.31 The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.

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

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

1.10.2.34 Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.

1.10.2.35 All the equipments /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect.

1.10.2.36 It is the responsibility of the contractor to do the alignment, checking, etc., if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.

1.10.2.37 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.

1.10.2.38 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost. Also refer the clause - ELECTRICAL INSPECTORATE'S APPROVAL **below**

1.10.2.39 **ELECTRICAL INSPECTORATE'S APPROVAL:**

1.10.2.39.1 Contractor is responsible for getting Electrical Inspector/statutory authority's approval for all electrical installation covered in his scope. This also includes the Electrical equipments that are erected by mechanical contractor for which commissioning assistance is to be provided by the Electrical contractor.

1.10.2.39.2 All electrical installation covered in contractors scope which also includes equipments covered in commissioning assistance are to be inspected/approved by the electrical inspector/statutory authority. For getting electrical inspector approval, contractor shall arrange the following:

a) Work Completion certificate for all the equipment covered in the contract

b) Details of Equipments (specification)

c) Test results conducted at site for all the equipments including electrical equipment erected by Mechanical contractor.

d) Any other documents as required by statutory authority. Any expenditure related to documentation shall be borne by contractor.

1.10.2.39.3 Contractor shall carry out the modifications/rectifications if any as suggested by the authority at his cost. However, it is not applicable for equipment erected by Mechanical contractor.

1.10.2.39.4 Contractor shall also have valid electrical installation license on his company as well as for individuals acceptable to respective state electrical inspectorate requirement.

1.10.2.39.5 The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at his cost. However BHEL shall pay all other fees (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES, ETC).

1.10.2.40 Any modification work required by inspector shall be attended by the contractor. Modifications which are arising due to execution deficiencies are at the cost of contractor and modifications which are due design shall be treated as extra work.

1.10.2.41 SITE INSPECTION

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

1.10.2.41.2 The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.

1.10.2.41.3 BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.

1.10.2.41.4 Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

1.10.2.42 **MANPOWER REQUIREMENT**

1.10.2.42.1 Manpower requirement for Erection and Commissioning shall as follows:

a. There shall be a Resident manager as Site In-Charge at site, under whom there shall be sufficient area engineers who shall take care of the erection activities.

b. Resident Engineer should have a minimum qualification of Engineering Degree or Diploma in Engineering with minimum 15 years of experience in Thermal Power Station.

c. Supervisor should have a minimum qualification of Diploma in Engineering or any graduate with minimum 5 years of experience in Thermal Power Station.

d. Lab Technicians should have experience in Thermal Power Stations.

e. Contractor should have one Store Keeper and one Transport Supervisor for the safe transportation of materials.

f. Planning / safety Engineers should have experience in construction field especially in power plant.

1.10.2.42.2 There shall be three separate Erection In-charges, each for Boiler, TG Station C&I. They shall work independently with required manpower, T&P etc., including storage facilities. Each Erection In-charge shall have minimum two erection engineers with adequate Supervisors and Technicians. Besides the above, there shall be separate engineers for Planning, Safety and Quality.

1.10.2.42.3 Each area engineer shall be provided with minimum four supervisors and adequate number of Technicians / electricians and other erection staff and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately for each area and the minimum requirement shall be as indicated in previous Clause.

1.10.2.42.4 The above manpower is only tentative and for any additional manpower as per site requirement the same shall be arranged by the contractor.

1.10.2.42.5 The testing Engineers / supervisors / electricians shall be identified separately for each area as per the site requirement.

1.10.2.42.6 Planning / safety Engineers should have experience in construction field especially in power plant.

1.10.2.42.7 The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.

1.10.2.42.8 All instructions from BHEL / Customer will be directed to the contractor through the Site in-charge and he shall be responsible for all the contractor's activities at site. The contractor shall name his authorized representative prior to or immediately on commencement of operations at site

1.10.2.42.9 The Site In charge shall be present at site during all normal working hours and his contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.

1.10.2.42.10 The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed suffering delay on this account.

1.10.2.42.11 The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of his duties the contractor shall remove them from site as directed by Site Engineer.

1.10.2.42.12 The contractor shall ensure that all his supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.

1.10.2.42.13 The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.

1.10.2.43 DOCUMENTATION

1.10.2.43.1 The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval

a) Bar chart covering planned activities at site

b) Detailed organization chart

c) Details of T&P available with contractors with documents proofs.

1.10.2.43.2 The following information shall be furnished by the bidder after testing and inspection:

1.10.2.43.3 Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan.

As built drawings:

1.10.2.43.4 After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual

work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.

1.10.2.43.5 VOLUME-IA PART- II CHAPTER -4 of this booklet contains general guidelines for Erection and Commissioning of C&I package

VOLUME-IA PART –I CHAPTER -XI

FOUNDATIONS, GROUTING AND CIVIL WORKS

1.11.1 Foundation for the equipments to be erected shall be provided by BHEL/ clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipments plants shall be carried out by the contractor.

1.11.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., de-watering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form/shuttering work are within the scope this work.

1.11.3 The contractor at his cost shall arrange for grouting of foundation bolt holes of equipments as specified in the drawings / specification or as advised by the Engineer of BHEL after preparing the foundation top surface for grouting, all the materials for grouting (sand, gravel & cement including special Cement) shall be arranged by the contractor. The grouting has to be done upto basement level. The required consumables like Portland cement, gravel, sand etc., have to be provided by the contractor at his cost. The required special cement like conbextra, GP1, GP2, PAGAL, shrinkomp etc., or its equivalent as approved by BHEL if required shall be arranged by the contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements

1.11.4 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates/shims, and may be required for the erection of the equipment/plants will have to be carried out by the contractor without extra cost.

1.11.5 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments

1.11.6 Foundation pockets are to be cleaned thoroughly before placing the equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.

1.11.7 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed

with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.

1.11.8 The certificates of the grout are to be submitted to BHEL. If necessary test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc to be arranged by the contractor including the fine aggregates.

1.11.9 Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates/sheets at site by the contractor to meet site requirement. However machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.

1.11.10 Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.

1.11.11 The contractor at his cost shall arrange for grouting of anchor points of T & Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.

1.11.12 Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.

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

1.11.14 **PROCEDURE FOR GROUTING :**

Contractor has to carry out the grouting as per the work instructions for grouting available at site.

VOLUME-IA PART –I CHAPTER -XII
MATERIAL HANDLING AND SITE STORAGE

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.12.1 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS

1.12.1.1 BHEL shall issue materials covered in BHEL scope from their stores at site. The contractor shall collect such materials from BHEL stores and transport to site of work at his cost.

1.12.1.2 The contractor shall inspect such materials as soon as received by the contractor and shall bring to the attention of the Engineer-in-Charge any shortage / damage or other defects noticed before taking over the materials. Materials once takenover will be deemed to have been received in good condition and in correct quantities except for intrinsic defects which cannot be observed by visual and dimensional inspection and weighing.

1.12.1.3 Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.

1.12.1.4 All materials issued by BHEL shall be properly stored and systematic records of receipts, issue and disposal will be maintained. Periodic inventory shall be made available to BHEL Engineer-in-Charge.

1.12.1.5 All materials issued by BHEL shall be utilized as directed by Engineer-in-Charge or most economically in the absence of such direction. The contractor shall be responsible for the return to BHEL Stores of all surplus material, as determined by the Engineer-in-Charge.

1.12.1.6 If the materials issued by BHEL are lost, damaged or unaccounted, the cost of such items shall be recovered from payments to the contractor. However, the contractor shall raise FIR and inform BHEL all details.

1.12.2 STORAGE

1.12.2.1 The equipment should be preferably in its original package and should not be unpacked until it absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.

1.12.2.2 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 the packing with fork lift truck.

1.12.2.3 Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when decolonization takes place or regenerated. BHEL shall supply the material and contractor shall replace.

1.12.2.4 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.

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

1.12.2.6 Contractor shall keep BHEL informed about such problem and try to rectify the problem at his risk and cost.

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

1.12.2.8 Packing material shall be retained if the cubicle to be repacked after inspection

1.12.2.9 All sub-assemblies should be kept in a separate place where it is easily accessible.

1.12.2.10 Sub-assemblies should have a protective cover in case it is stored without wooden packing/case to prevent accumulation of dust. Silica gel packets should also be kept along with it. Sub-assemblies should not be stacked one above the other.

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

1.12.3 **Sub-Assemblies**

a) All sub-assemblies should be kept in a separate place where it is easily accessible.

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

c) Sub-assemblies should not be stacked one above the other.

1.12.4 **Loose items (wherever applicable)**

1.12.4.1 The loose items supplied for the main equipment falling into various categories like tools, cables, recorders and display units, cable glands, frames etc. are to be categorised and stored separately.

1.12.5 Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.

1.12.6 Sometimes it may become necessary for the contractor to handle certain unrequired components at Customer's / BHEL's stores in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

1.12.7 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components at site.

1.12.8 Contractor has to arrange required fire resistant tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

1.12.9 The contractor shall take delivery of item, materials and consumables from the storage yard / stores / sheds of BHEL / customer which are within a radius of 5 kms, after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer. He shall also make arrangements for safe custody, watch and ward of equipment after it has been handed over to him till they are fully erected, tested and commissioned.

1.12.10 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators. Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.

1.12.11 The equipments / materials from the storage yard shall be moved in sequence 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.

VOLUME-IA PART – I CHAPTER- XIII
SCOPE OF C&I WORKS-DETAILED

THE SCOPE OF THE WORKS WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

It is not the intent to specify herein all details of material. Any item related to this work, not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

1.13.0 DETAILED SCOPE OF C&I WORK

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

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

1.13.1.1 The different types of Microprocessor based panels like PLC/DCS Panels, Instrument Panels, unit control desk etc. are covered in the scope of work for erection and commissioning.

1.13.1.2 The unit rate quoted for Installation of control panels shall include fixing of anti-vibration pads, levelling and alignment, welding, grouting, drilling of bottom gland plates for cable entry as required, closing control panels bottoms with suitable flame proof compounds wherever required and checking of internal wiring, instruments, components etc. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels except the Instruments identified in the BOQ.

1.13.1.3 Panels are normally supplied in suite of one / two / three/ four cubicles with bottom base frame and these panels are to be mounted on separate site fabricated base frames as per site condition. The base frames to be properly grouted to the concrete floor or to be TIG welded to the embedded insert plates. The structural steel material for the above will be supplied by BHEL. For fabrication and erection of frame, unit rate shall be paid be as quoted in rate schedule, on tonnage basis.

1.13.1.4 For panels to be mounted on trenches, if any channel supports are required, the same shall be provided across the cable trenches over which the base frames of the panels shall be mounted. Similarly for the panels to be mounted on false flooring, if mounting frames are not provided, same shall be fabricated at site. The contractor shall carry out fabrication and erection of these support structures on tonnage rate basis. For fabrication and erection of frame, unit rate shall be paid be as quoted in rate schedule, on tonnage basis.

1.13.1.5 The panels which are supplied for various control systems have to be erected at different places like unit control room/ near the equipment/ various operating floors as per site layout. The contractor shall take the panels to the desired locations either through floor openings or temporary openings. No claims will be entertained for taking the panels to the location owing to change of route or non-availability of openings as per nearest route.

1.13.1.6 If any minor grinding is to be carried out on the cut-outs provided in the panels for mounting instruments like recorders, indicators, console etc., the same shall be carried out by the contractor at no extra cost.

1.13.1.7 All the panels and JBs shall be electrically earthed to the nearest earth grid by means of GI wire/Flats as per the instructions of BHEL engineer.

1.13.1.8 Painting of fabricated parts and earthing conductors of panels shall be part of the work. Touch up painting for panels, including supply of paints shall be carried out by the contractor within the quoted rate.

1.13.1.9 Closing the Panel openings and unused drilled holes with non-flammable sealant materials, including supply of above material, shall be part of erection work.

1.13.1.10 For panels/ equipment erected by other agencies, commissioning work and troubleshooting are to be carried out by the contractor as per the rate quoted in the schedule.

1.13.1.11 Normally the panels shall be supplied with instruments / modules mounted and wired. No separate payment shall be made for commissioning of any instrument/ cards/ components. If dismantling of the above such instruments and rewiring is needed at site, the same shall be carried out at no extra cost. If any instruments/ cards/ components supplied as loose items for safe transit, the same shall be mounted and wired at no extra cost unless specified otherwise in the BOQ. Similarly, if any loose supplied instruments /modules are to be mounted and wired on customer panels or any other panels not erected by contractor, the same shall be carried out at no extra cost unless otherwise specified in the BOQ. However, if any major installation/modification/wiring are involved, the same may be carried out as extra work. The decision of BHEL Engineer shall be final in respect of above extra works.

1.13.1.12 Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Any

variation within ±20% shall not be considered for payment. However, for variations beyond ±20%, payment shall be considered proportional to the length of the panel. Variations in depth, height or weight of the panel shall not be considered for payment.

1.13.1.13 UPS, AC & DC DB AND OTHER ELECTRICAL CONTROL PANELS

1.13.1.14 The erection & commissioning scope of above panels will be in line with clauses above in 1.13.1.

1.13.2 SCOPE OF WORK OF DCS PACKAGE / PADO SYSTEM / SCADA WITH RELATED INSTRUMENTATION:

1.13.2.1 BHEL will supply sophisticated MAX-DNA DCS system. The tentative details of are furnished in the BOQ.

1.13.2.2 The scope of DCS system includes erection of sophisticated microprocessor based systems, maxDNA control panels, I/O panels, Ethernet switching panels, Network Enclosure cabinets, CPU, Engineers workstations, operator workstations, CRTs, server, printers, portable UPS power supply, furniture and interconnecting cables like Ethernet/Fibre-optic etc.

1.13.2.3 The scope of work for DCS Panels will generally be in line with that for C&I Panels as detailed in Clause 1.13.1

1.13.2.4 Unit rate quoted for DCS equipment shall cover installation & integration of all the above said equipment and providing necessary commissioning assistance. No separate unit rate applicable for installation of loose items/ modules/ components or accessories including furniture etc, which is not explicitly mentioned in the BOQ, but comes as part of the system.

1.13.2.5 Separate rate shall be applicable for laying and termination of all cables including Ethernet as detailed in the scope of work for cabling. Termination of fibre optic cables is excluded from the scope of this contract.

1.13.3 SCOPE OF WORK FOR UPS, BATTERY AND BATTERY CHARGER

The charger and batteries are of heavy duty type. The cells will be mounted on insulators carried on suitable wooden / fibre stands. Tentative details are given in the BOQ.

BHEL will provide vendor's technical support for commissioning of Battery and Battery charger. The contractor shall carry out the works as per instructions of BHEL/ Vendor Engineer.

Lumpsum shall be quoted for Erection and commissioning of UPS and Battery. No additional payment shall be made for any variation in the number of cells. The unit rate quoted for erection of UPS and battery will include the following works.

1.13.3.1 Filling the individual cells with Acid/alkali – if applicable.

1.13.3.2 Arranging suitable resistive load banks for charging and discharging during charging and discharging cycles.

1.13.3.3 Arranging manpower in shift during battery charging and discharging cycles that may be carried out round the clock as per the code of practice, and conducting other routine tests as per IS under the supervision of BHEL Engineer.

1.13.3.4 Modifications or changes if any for the loose supplied items or any minor changes in wiring.

1.13.3.5 Arranging necessary tools, T&P, Testing equipments required for erection and commissioning of the battery.

1.13.3.6 For laying and termination of cables of battery/ battery charger system, separate rate shall be applicable as per rates in Rate Schedule.

1.13.3.7 SCOPE OF WORK FOR BATTERY CHARGER PANELS

The scope of work will be in line with scope of work for control panels, as detailed under Clause above in 1.13.1.

1.13.4 SCOPE OF WORK FOR INSTRUMENTS:

1.13.4.1 The type of instruments to be erected and commissioned shall be as detailed below:

1.13.4.1.1 Panel mounted Instruments like indicators, recorder, electronic modules etc.

1.13.4.1.2 All types of transmitters like temperature, pressure, flow, level and position feedback transmitters etc.

1.13.4.1.3 Local mounted pressure gauges, DP gauges, thermocouples, RTDs, temperature gauges, temperature switches, pressure switches, DP switches, flow switches and limit switches and flow indicator level switches etc.

1.13.4.1.4 Air filter regulator sets, Air lock off valve, Power cylinders etc.

1.13.4.1.5 Panel/ Control desk mounted Instruments like indicators, recorder, console and electronic modules etc.

1.13.4.1.6 I/P converters and local controllers.

1.13.4.1.7 Special instruments like vibration sensors, proximity sensors, electronic water level indicator, Steam and water analysis system (SWAS), Gas analyser, Coal Flow Monitor, PC based instruments etc.

1.13.4.1.8 Pneumatic operated control valves, trip valves, solenoid valves, and electrically operated valves. (commissioning only)

1.13.4.1.9 Prior to installation, all the Instruments (local & remote), I/P converters, etc. shall be calibrated. Similarly, the healthiness of RTDs and thermocouples, limit

switches, flow switches, level switches, solenoid valves, air filter regulator, purge meters, etc. shall be checked for proper operation.

1.13.4.2 Unit rate quoted for each instrument shall include calibration, installation, loop checking, commissioning and troubleshooting until satisfactory performance as per operational and system requirement and maintenance till the end of contract period or trial operation whichever is earlier. In case any instrument requires recalibration to achieve the expected performance, the same shall be carried out at no extra cost. If any re-calibration or replacement of instruments and rechecking of cable termination is found necessary during commissioning, the same shall be done at no extra cost. The unit rate shall also cover marking Tag numbers of instruments or Racks, either by paint or a separate tag plate as per BHEL Engineer's directive.

1.13.4.3 Unit rates have been asked item-wise for instruments, gauges, switches, indicators, recorders etc. as indicated in BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items of work of the rate schedule.

1.13.4.4 Unit rate quoted for erection of pressure/ differential pressure transmitters, gauges, switches, shall include fixing the instruments on the racks / supports along with manifolds, and associated fittings and clamps.

1.13.4.5 Unit rate quoted for Temperature transmitters, I/P converters, Air filter/ Air lock off valves, Purge meters, Rotameters, position transmitter, probes etc shall include fixing the instruments on the racks / supports along with associated fittings and clamps.

1.13.4.6 Unit rate quoted for control room mounted instruments shall cover mounting of instruments on panels / desk wiring, minor grinding on the cut out of panels for proper fixing.

1.13.4.7 Unit rate quoted for erection of Casing temperature thermocouple of turbine/ metal temperature thermocouple (MTM) shall cover laying, dressing and clamping, supply and fixing of tag plates, etc. Welding of MTM pads shall be carried out by mechanical contractor. Necessary tray supports for routing of MTM thermocouples shall be erected as part of tray erection covered in the tender. Proper care shall be taken during cleaning the crevices where MTM Thermocouples are inserted.

1.13.4.8 Unit rate quoted for erection and checking of thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells, seal welding of thermowell, wherever required as per BHEL specification and directive of site engineers.

1.13.4.9 Unit rate quoted for erection and checking of temperature switches, gauges, thermocouple, RTD etc. shall include cleaning of thermowell stubs threads using tap sets, fixing of thermowells, seal welding of thermowell, wherever required as per BHEL specification and directive of site engineers.

1.13.4.10 If any instrument is to be relocated for reasons not attributable to the contractor, but required for satisfactory performance, the same shall be carried out on extra works basis.

1.13.4.11 Level switches supplied shall be of different types- float type or fixed contact type (Electronic type). The scope of work for float type Level switches shall include fixing of switches on float chambers and fixing of float chambers on stand pipe, providing supports wherever required etc. The scope of work for Electronic type Level switches includes fixing of Electrode standpipe, Electrodes, Electronic unit, integration of all loose supplied items etc Any minor modification require to match Float chamber / Electrode standpipe with tapping point same shall be carried out at no extra cost. Uniform unit rate shall be quoted for Erection and commissioning of various types of level switches, irrespective of their type.

1.13.4.12 The unit rate quoted for erection and commissioning of Electronic type Level switches includes fixing of Electrode standpipe, Electrodes, Electronic unit, any minor modification required to match Float chamber/ Electrode standpipe with tapping point, integration of all loose supplied items etc.

1.13.4.13 Unit rate quoted for erection / commissioning of special instruments like, Flame scanner, H.E.A Igniters systems, Vibration monitoring System, Sonic Tube Leak Detection system, SWAS, Gas analyser, PC based instruments etc. shall include installation of all loose items which are not explicitly mentioned, but comes as part of the system, integration of total system and commissioning. Lump sum rate shall be quoted as mentioned in the BOQ. No separate rate shall be payable for loose items including furniture. The quantity of loose supplied items is approximate only. No proportional rate will be applicable for any variation in quantity or for any additional items supplied as part of equipments.

1.13.4.14 If any surface finishing / tapping is required to fix the sensors for Vibration Monitoring System, the same shall be arranged by the contractor at no extra cost.

1.13.4.15 Some of the Gas Analysers are to be installed at Chimney 65 / 106 ML as indicated in BOQ. For the erection of associated hardware for these analysers, like cables, trays, GI pipe etc. that are to be routed from the analyser panels at 65 / 106 ML of Chimney to zero meter level, payment will be made at twice the unit rate quoted against each item.

1.13.4.16 For Coal Bunker level monitor, fixing / erection of the sensors onto legs of Bunkers is in the scope of Vendor and arranged by BHEL. However, the contractor shall provide necessary approach platforms with ladders and any other assistance for erection of these sensors.

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

1.13.4.18 Temporary protection by thermocol, polythene sheet, GI sheets shall be provided by the contractor for safe guarding the instruments against damages. The protective materials shall be supplied by the contractor at no extra cost.

1.13.4.19 In case the Instruments are mounted and supplied along with main equipment and the BOQ calls for Erection & Commissioning, the contractor shall carry out removal, calibration, re-fixing and commissioning of same. Payment shall be made only for removal, calibration, re-fixing and commissioning, in line with rate quoted for removal, calibration and re-fixing of Instrument of similar type.

1.13.4.20 In case the Instruments are supplied as loose items, and the BOQ calls for removal, calibration, re-fixing and commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made only for Erection and commissioning in line with rate quoted for Erection and Commissioning of Instruments of similar type.

1.13.4.21 The scope of work for panels for TSS System, Sonic Tube Leak Detection System, Furnace Flame Viewing System, Master Clock System etc. will be in line with the scope of work of C&I panels covered under clause above in 1.13.1

1.13.5 SCOPE OF WORK FOR IMPULSE PIPES:

1.13.5.1 Different types of impulse pipes, like alloy steel, carbon steel, stainless steel of different sizes and thickness shall be supplied with suitable fittings like coupling, sockets, root valves, drain valves, manifold, condensing pots, syphons, tees, bends, nut and tail piece.

1.13.5.2 Unit rate quoted for impulse piping shall include site routing using reducers (at root valve) unions, connector Nuts and tail pieces, sockets, nipples, equal tees, couplings, condensing pots, siphons, root valves, isolation valves cold bending, tig / arc welding. etc., fixing of manifolds and supporting with suitable fixtures and 'U' clamps and painting as per BHEL specification and site engineer's instructions. No separate rate shall be paid for the Impulse pipe fittings. The unit rate also includes supply of U clamps, fasteners, paints, etc. For impulse pipe support materials viz. Angles/ Channels, the rate shall be paid on tonnage basis. The above support materials shall be supplied by BHEL. For scope of painting, please refer Scope of Painting clause. Welding of impulse pipe for High Pressure Lines shall be carried out by High Pressure welder. Suitable root valves will be provided by BHEL on the tapping point wherever required

1.13.5.3 TIG-welding sets, welding transformer/generator rectifier, Hydraulic bending machines, DPT kits, Hydraulic testing pumps required for pressure testing of impulse pipes shall be arranged by the contractor. Similarly, consumables such as welding electrodes, gas, Tungsten rods, filler wire etc., shall be arranged by the contractor within the quoted rate.

1.13.5.4 For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer.

1.13.5.5 Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work.

1.13.5.6 The contractor shall obtain necessary approval for welding electrodes, filler wire from BHEL welding engineer at site.

1.13.5.7 Impulse pipes Welder shall undergo test and get approval from BHEL welding engineer according to the nature of welding.

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

1.13.6.1 If the frame or rack is supplied as a pre-fabricated item like LIR, same shall be erected, grouted and painted as per site requirement.

1.13.6.2 If any frame or support or rack supplied as semi-fabricated item, same shall be assembled at site either by welding or bolting and erected, grouted and painted as per site requirement.

1.13.6.3 Unit rate quoted for such pre-fabricated /semi-fabricated items like LIE/LIR and enclosure shall be on Number basis. Unit rate shall cover installation, grouting, painting and supply of nuts, bolts, anchor fasteners, grouting materials such as cement, sand etc as required. Unit rate shall also include full painting of impulse line fitted and supplied along with LIR/LIE/LGB.

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

1.13.7 SCOPE OF WORK FOR COPPER / STAINLESS STEELTUBES:

1.13.7.1 Different sizes of copper tubes of different thickness with or without PVC coating shall be supplied in standard lengths of 15 meter Coils and Stainless Steel tube shall be supplied in standard length of 6meter. The connectors and tees will be of brass / Stainless Steel of different sizes as per site requirement.

1.13.7.2 The unit rate quoted on meter basis shall cover site routing, bending, providing supports, fixing of connectors, unions, valves, tees, etc. and connecting to the instrument airline instruments. The unit rate shall also include providing tag plates on instruments / power cylinders.

1.13.7.3 If copper / Stainless Steel tube length is more than half meter, suitable support shall be provided either by angle or trays. Protective angles to be used for

copper tube routing. The support materials shall be supplied by BHEL. For fabrication and installation of steel supports and frames, the rate shall be as quoted in BOQ for fabrication and installation of steel Tonnage basis.

1.13.7.4 Copper / Stainless Steel tubes shall be clamped with suitable clamping materials. Supply of suitable Aluminium clamps and tag plates are under contractor's scope. The unit rate quoted for laying of copper tube shall cover the supply of clamping materials also. For SADC system copper tube, tag plates shall be provided near instruments, Tees and Power cylinders. Leak test shall be carried out after completion of tubing works as per guidelines.

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

1.13.8.1 Different type of GI pipes of different thickness class shall be supplied along with GI fitting accessories like union, coupling, tee, reducers, elbow, valves, etc.

1.13.8.2 Unit rates on length basis for erection of instrument air lines includes site routing, providing supports, fixing "U" clamps, fixing of loose supplied GI accessories mentioned as above as per the drawings, providing fresh threading as required for jointing with unions, valves and all type of other fittings as required in the system. Unit rate also shall include supply of U clamps, Teflon tapes and bolts, etc.

1.13.8.3 Teflon tapes shall be used for tightening all the joints. No bending, welding etc. is allowed. No separate rate shall be paid for erection of GI fittings / accessories and U clamps.

1.13.8.4 After installation of instrument airlines, the line shall be blown and leak test shall be conducted for all the joints as per the guidelines given elsewhere in this tender.

1.13.9 SCOPE OF WORK OF ELECTRIC & PNEUMATIC ACTUATORS:

1.13.9.1 Different types of pneumatic actuators like regulating type, on-off type, of different stroke length shall be supplied. Some of them may be fitted and supplied with main equipment.

1.13.9.2 The unit rate quoted for erection & commissioning scope of electrical and pneumatic actuators includes fabrication and installation of base frame, modification of linkage mechanism wherever required and connecting the same with driven equipment, fixing of all accessories like air sets, Solenoid valves, air lock off valves, limit switches, if supplied loose item as part of power cylinders, replacing the damaged copper tubes or any other accessories like gauges, solenoid valves, limit switches, etc. connecting to airline, and adjusting the stroke length. No separate rate shall be paid for the above works. For all pneumatic and electrical actuators, the necessary Linkage Mechanism shall be supplied by BHEL as part of actuators. No separate rate shall be paid for erection of linkage

mechanism. For fabrication and erection of steel supports and frames, the rate shall be paid on Tonnage basis.

1.13.9.3 The link rods have to be adjusted to suit the opening and closing position. This adjustment has to be repeated number of times till proper operation is obtained. If BHEL site engineer desires to remove the accessories like position transmitters, air locks, positioners, limit switches, solenoids etc. prior to erection either at BHEL stores or at site to avoid damages/pilferage, keep in safe custody and remount the same prior to commissioning, this shall be part of scope of work for power cylinders.

1.13.9.4 For calibration of any Pneumatic Actuator at field, temporary air supply if required shall be arranged by the contractor.

1.13.9.5 In case the power cylinder is supplied in assembled condition along with main equipment and the BOQ calls for Erection & Commissioning of the same, payment shall be made only for commissioning, in line with rate quoted for commissioning of pneumatic power cylinder of similar type.

1.13.9.6 In case the power cylinder is supplied as loose item, and the BOQ calls only for commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made in line with rate quoted for Erection and Commissioning of power cylinder of similar type.

1.13.9.7 Erection and Commissioning of MCCs and laying of power cables to bi-directional electrical actuators shall be done by other agency. The C&I Contractor shall provide necessary support for checking the remote operation of Electric actuators and loop checking of command and feedback signals from DCS to the actuator. The Contractor shall co-ordinate with the other agencies to ensure that all feedback and command signals and settings are made available for bi-directional.

1.13.10 SCOPE OF WORK FOR CABLES:

1.13.10.1 BHEL will supply LT, 1.1 kV, armoured/ unarmoured, Copper PVC FRLS insulation, Power, Control and Instrumentation cables of different sizes. The special cables supplied shall be Compensating cable, Ethernet cables and Fibre-optic cable of different sizes and type.

1.13.10.2 The cables covered in the BOQ may be appearing either in BHEL's C&I cable schedule or in BHEL's Electrical cable schedule. The contractor shall lay and terminate all the cables covered in the BOQ, as per directive of BHEL Engineers.

1.13.10.3 The scope of work includes laying & termination of cables, fixing of glands, ferrules, tag plates with necessary numbering and dressing of cable, as per BHEL specification and BHEL engineer's instructions. A composite rate covering laying and termination shall be applicable for cables, except for higher size

cables. Separate rate will be applicable for termination of higher size cables and the same will be indicated specifically in the Rate Schedule / price bid / BOQ.

1.13.10.4 Unit rate quoted for cable shall cover laying, termination, drilling of holes on the gland plates of the panels/JB or Enlargement of cable entry holes by tapping or any modification required, fixing of cable glands, fixing of glands, ferrules, termination and providing tag plates and dressing.

1.13.10.5 Unit rates quoted for cabling shall also include supply of clamping/ dressing materials such as Aluminium/GI strips or PVC ties, ferrules, tag plates, lugs upto2.5 sq.mm. apart from the work mentioned above. Supply of above material shall conform to the specification detailed elsewhere in this tender.

1.13.10.6 Uniform unit rate shall be quoted for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.

1.13.10.7 Ethernet cables and Fibre optic cables shall be isolated from other cables and laid in a separate cable tray as directed by site Engineer. Wherever required I/O Box shall be installed for Ethernet cable termination and Punch Down crimping tools shall be used for Ethernet cable termination.

1.13.10.8 The scope of work for Fibre Optic cable shall be laying only. Termination of Fibre optic cables shall be carried out by the cable vendor and the contractor shall provide necessary assistance to the vendor during cable termination. Wherever required, the Fibre optic cable shall be laid through HDPE Conduit.

1.13.10.9 The contractor shall provide Tools/ equipment required for the connections and termination of cable wherever necessary. No separate rate shall be paid for cable terminations. For cable joining, if any, separate rate shall be considered on extra works basis.

1.13.10.10 The contractor shall carry out cable dressing and clamping for all the cables laid by the contractor. However, if any other agency laid cables of lesser quantity for which no separate trays have been allotted, the contractor shall do clamping along with the cables.

1.13.10.11 Wherever cable entry holes have not been provided for equipment installed by another agency, the contractor shall co-operate to get the same done.

1.13.10.12 During testing and commissioning, if the equipment on which the cables are terminated (including electrical drives) is not functioning, it is the responsibility of the contractor to check and establish in coordination with the commissioning agencies that there is no defect in the cabling. The contractor shall promptly depute his supervisor or technicians to assist the commissioning agencies to check the interconnecting cables at no extra cost.

1.13.10.13 Contractor shall carefully plan the cutting schedule for each cable drum in consultation with Engineer such that wastage is minimized and any resultant short lengths can be used where appropriate route lengths are available.

1.13.10.14 If the cables are to be laid on the angles or routed in conduit pipe as per site condition, the unit rate for erection of angles and conduit pipes shall be as per the rate quoted elsewhere in the tender.

1.13.10.15 Any fabrication required at site for cable support shall be carried out at the rate quoted for fabrication.

1.13.10.16 Cable installation shall be properly coordinated at site with other services and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the building, structures, equipment, utilities and services any such adjustment shall be done with the approval of Engineer.

1.13.10.17 The approximate number of termination for the purpose of estimation to be assumed as follows: The average RUN length shall be considered as 150 metres. However, for 10% of the 2 pair and below, the average length shall be considered as 30 metres.

1.13.10.18 SCOPE OF CABLE TERMINATION

1.13.10.18.1 Laying and termination of all cables including Ethernet is part of the scope. However, termination of fibre optic cables is excluded from the scope of this contract.

1.13.10.18.2 The scope of termination shall include termination of cables on various panels / JBs / Push buttons / equipment etc. including those installed by other agencies.

1.13.10.18.3 Re-termination, if required during testing/ commissioning shall be carried out without additional cost.

1.13.10.18.4 Scope of termination shall include supply of insulating sleeves. The sleeves shall be fire resistant, long enough to over pass conductor insulation and properly sized.

1.13.10.18.5 Contractor shall arrange all type of termination and crimping Tools/ equipments required for the connections/terminations.

1.13.10.18.6 Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.

1.13.10.18.7 After cable terminations, the debris shall be removed then & there.

1.13.10.18.8 Also refer clause 1.13.10.2 above.

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

1.13.11.1 CABLE TRAYS

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

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

a. Different Junction The unit rate for erection of trays shall be on meter basis. The unit rate quoted for erection of tray shall also include erection of all tray accessories such as elbow, cross, Tees, bends such as vertical and Horizontal, reducers, coupler plates/fixing plates, anchor bolts, fasteners etc.

b. For routing of trays standard tray accessories supplied by BHEL shall be used. However if above standard tray accessories are not supplied, the same shall be fabricated and installed at no extra cost.

c. If standard tray accessories like Tees, Reducers, Bends, cross etc. require any modification to suit the tray routing, the same shall be carried out at no extra cost.

d. The unit rate quoted for trays shall also cover making of offsets by means of cutting standard tray sections and inserting suitable trays to match with the existing arrangement.

e. Site fabrication / modification of trays or on tray accessories will be paid on extra work basis.

f. The contractor shall quote a uniform rate on meter basis for erection of trays and Tray accessories like Tees, Reducers, Bends, cross etc.

g. Tray covers are to be erected after completion of cable laying and no separate payment will be made for fixing these covers. GI strip clamps are to be used for fixing the tray covers.

h. Welded Joints of trays shall be painted with red lead and aluminium paint in turn with bitumen as per IS 3043. The unit rate shall also include supply of paints, thinner, other consumables and brush etc.

1.13.11.2 RIGID & FLEXIBLE CONDUITS

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

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

c. Unit quoted on meter basis for GI rigid conduit includes supply of suitable clamps / fasteners / tag plates etc.

d. The scope of work includes drilling of holes on the plates, fixing of end connectors, providing suitable supports and fixing tag plates as required by BHEL. Supply of suitable clamps, fasteners and tag plates are covered in the unit rate.

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

1.13.12.1 Different Junction Boxes/ Push Button boxes with gland plates shall be supplied by BHEL.

1.13.12.2 The unit rate quoted for erection of junction boxes/push button boxes shall cover the following also.

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

1.13.12.3 All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.

1.13.12.4 For CJCBs/ RJCBs, the rate for Junction Boxes similar size, as per Rate Schedule, will be applicable.

1.13.12.5 For fabrication and fixing of supports/Frame, rate shall be paid on tonnage basis.

1.13.13 SCOPE OF WORK FOR FABRICATION & ERECION OF STEEL MATERIALS:

1.13.13.1 Scope of steel fabrication and installation covers, fabrication and installation of various type of supports for cable tray, instruments, impulse pipes, GI pipes, support angles for copper tubing, mounting frames for JB, Control Box/Panel, local PB Stations, canopy for local instruments and local instrument rack etc. wherever required.

1.13.13.2 The fabrication steel materials such as angles, channels, plates, etc shall be supplied in standard lengths by BHEL. Fabrication shall be carried out by the contractor as per schemes in consultation with site engineers.

1.13.13.3 Immediately after fabrication, primer shall be applied to prevent corrosion. The installation shall be carried out only after applying the primer as detailed in painting clause.

1.13.13.4 All fabricated steel materials shall be painted as detailed in the scope of painting.

1.13.13.5 A composite rate shall be quoted for fabrication and installation of steel, on tonnage basis. The above rate shall include supply of paints and painting, grouting and grouting material as required.

1.13.14 SCOPE OF EARTHING

1.13.14.1 The scope of earthing covered in this contract is above ground earthing i.e equipment earthing. Scope of earthing covers earthing of field Instruments, JBs, Branch trays, LIR/LIE, JB, Push Button boxes etc. All DCS and its accessories, PLC/Instrumentation panels/systems etc, shall be earthed to a separate Electronic earth grid.

1.13.14.2 Different type of earthing materials shall be supplied and same shall be erected as per site requirement.

1.13.14.3 The scope of work shall include supply of fasteners, lugs, minor civil works etc.

1.13.14.4 All connections from the equipment to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the contractor at site.

1.13.14.5 The unit rate shall be quoted for earthing on metre basis. The rate shall cover supply of fasteners, lugs, minor civil works, painting the welded joint etc.

1.13.15 SCOPE OF CALIBRATION:

1.13.15.1 The contractor shall calibrate all the local instruments, panel mounted instruments including transducers, protective relays, recorders, Indicators etc. that will be supplied along with equipments mounted in or in loose.

1.13.15.2 Contractor has to calibrate all the instruments covered in their scope at site with their own calibration and testing equipments under the supervision of BHEL / Customer Engineers and maintain the calibration records as per the BHEL prescribed format / relevant FQP formats.

1.13.15.3 All testing Instruments / Equipment deployed for calibration shall be calibrated before taking into service. All testing instruments shall have calibration certificate issued by recognized /accredited agencies. A copy of calibration certificate shall be submitted to the engineer for his verification and approval.

1.13.15.4 BHEL shall provide vendor supports for proprietary type of microprocessor – based instruments, protective relays, which requires software loading and programming etc. However overall responsibility lies with contractor and contractor shall provide all supports like manpower ,standard T&P, Instruments etc., for calibration and testing of above proprietary instruments.

1.13.15.5 If BHEL is unable to provide or arrange vendor support for proprietary instruments, contractor shall carry out the calibration through authorized agency, at extra cost. The actual cost of such calibration carried out by the outside agency shall be reimbursed by BHEL. However if above such calibrator is available with BHEL at site, the calibration shall be carried out by the contractor with in quoted rate.

1.13.16 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

1.13.16.1 For all payment purposes, measurement shall be made on the basis of the execution of drawings/physical measurements. Physical measurements shall be made by the contractor in the presence of the Engineer.

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

1.13.16.3 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.

1.13.16.4 All materials returned to stores should carry an aluminium tag indicating the size and type. More than 5 metres length termed as serviceable material and shall be returned size wise and category wise to the owner's stores/yard. Cable of serviceable length being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum(s) shall be noted and certified by the Engineer-in-charge. This shall be applicable only for the purpose of accounting the cables issued for installation.

1.13.16.5 While carrying out material reconciliation with contractor, all the above points will be taken into account. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity (ies) will be taken as the net quantity (ies) issued to the contractor. Material appropriation shall be done and allowable scrap quantity calculated as per wastage allowance specified below. 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.

1.13.16.6 For all site-fabricated steel items such as supports, racks, frames, Canopy etc. physical measurement shall be made and then converted to tonnage. For steel

material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.

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

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

1.13.16.9 The erection contractor shall make every effort to minimize wastage during erection work. The wastage allowances as permissible for various items are indicated in the following table. Cutting and wastage allowance shall be computed on the lengths and weight of materials actually used, measured and accepted. In any case, the wastage shall not exceed the following limits.

Sl. No	**Item**	**% wastage on issued quantity**
a)	Fabrication steel	2
b)	Each size of power cables	1
c)	Each size of control / instrumentation cables	2
d)	Impulse pipe / tubes / GI pipes / copper tube	1

NOTE:

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

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

VOLUME-IA PART – I CHAPTER - XIV

PROGRESS OF WORK

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.14.1 Refer forms F -14 to F-18 of volume I D (Forms & Procedure) of volume -I book-II. Plan and review will be done as per the formats.

1.14.2 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.

1.14.3 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding erection progress, labour availability, equipment deployment, testing, etc.

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

1.14.5 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

1.14.6 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.

1.14.7 The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required.

1.14.8 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes / ferrules / lugs) report, cranes availability report and other reports as per Performa considered necessary by the Engineer as per the BHEL formats.

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

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

1.14.11 The monthly report shall be submitted at the end of every month as a booklet and shall contain the following details :-

a. Colour Progress photographs.

b. Erection progress in terms of tonnage, percentage of work completion, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.

c. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan

d. Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operations, store keepers, lab technicians, helpers, security etc. Data shall be split up under the work areas like Boiler (pressure parts, structures) Rotating machines, Electro static precipitator, Insulation, Piping, Steam turbine, Condenser, Generator etc.

e. Consumables report giving consumption of all types of gases and electrodes during the previous month.

f. Availability report of cranes & T&Ps

g. Safety implementation report in the format

h. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

1.14.12 The contractor to reflect actual progress achieved during the month and will be submitted to BHEL, so that slippages can be observed and necessary action taken in order to ensure that the situation does not get out of control will update the construction schedule forming part of this contract each month.

VOLUME-IA PART - I CHAPTER- XV

TESTING AND COMMISSIONING

THE SCOPE OF THE WORKS WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

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

1.15.1 The scope of commissioning works covers commissioning of all instruments covered in the BOQ including loop checking and establishing the operation of instruments / systems to meet plant commissioning / operation. The contractor shall be responsible for overall commissioning of all the instruments and systems covered in the BOQ.

1.15.2 Scope of pre-commissioning / commissioning starts with the commissioning of various equipments erected by the contractor and making them available to commission various materials / systems and main power plant. The scope of work of various commissioning activities of the main plants is referred below:

a. Trial run of various equipments.
b. Light up of boiler.
c. Boiler EDTA / Chemical Cleaning.
d. Turbine barring gear.
e. Steam blowing of piping.
f. Turbine rolling.
g. Safety valve floating.
h. First synchronization
i. Trial Operation / Full load.

1.15.3 The above 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.

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

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

1.15.6 Contractor shall arrange experienced commissioning engineers, supervisors including electricians / instrument mechanics in each area to be associated with BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted. It shall be specifically noted that above employees of the contractor may have to work round the clock along with BHEL commissioning engineers involving considerable payment of overtime, which forms part of Contractor's Scope.

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

1.15.8 After erection of various equipments prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers.

1.15.9 For electrical works, 415 volts and above, the contractor has to bring qualified electricians and the total work has to be certified by electrical license holder. The expenditures towards work certificate and all statutory requirements connected towards the high voltage system shall be borne by the contractor.

1.15.10 In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost. If during commissioning, any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.

1.15.11 During commissioning activities and carrying out various tests, if any of the instruments has to be temporarily erected and commissioned to suit the commissioning activities, the contractor have to carry out the erection of the same. After completion of activities the temporary systems have to be removed and returned to stores and no extra rate shall be paid for this.

1.15.12 All the T&P instruments required for commissioning are to be arranged by the contractor. However, any special instruments, which are of proprietary nature, shall be arranged by BHEL.

1.15.13 It shall be the responsibility of the contractor to arrange and complete all the testing, pre-commissioning and commissioning activities for the particular equipment as per relevant standard, code of practice, manufacturer's instructions

and BHEL norms. All the above will be witnessed by the BHEL engineers and reports signed shortly. Contractor shall follow checklist of BHEL and testing & commissioning activities shall be carried out in accordance with the checklist.

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

1.15.15 The mobilization of testing team shall be planned in time and shall be undertaken round the clock. The contractor shall discuss on day to day / weekly / monthly basis the requirement of testing 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 the cost shall be recovered from contractor.

1.15.16 Prior to commissioning and after commissioning, protocols have to be made with BHEL / customer. The formats shall be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL commissioning engineers which may involve over time payment which forms part of Contractors Scope

1.15.17 Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost.

1.15.18 Commissioning Engineers also shall be identified separately for each package and the minimum requirement shall be as indicated below (Requirement given below is per Package).

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

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

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

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

1.15.22 T & P / instruments required for testing are to be arranged by the contractor.

1.15.23 All commissioning / testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall follow the checklist of BHEL prior to taking up testing & commissioning activities and the activities shall be carried out in accordance with the checklist. All the above shall be witnessed by BHEL engineer and the reports signed jointly.

1.15.24 The scope of commissioning assistance to be provided by the contractor shall cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ.

1.15.25 **Scope of commissioning of equipment erected by the mechanical contractor**

The scope of commissioning assistance to be provided by the contractor will cover the equipment / drives erected by the mechanical contractors as detailed in the BOQ.

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

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

1.15.25.1 **PNEUMATIC (ALL TYPES OF VALVES AND POWER CYLINDERS)**

a) Calibration and checking of instruments mounted on the actuators and setting stroke length of the actuator.

b) Servicing of positioners, position transmitters, limit switches, solenoid valves, air lock-off valves, removing/replacement of defective components, copper tubes etc., if necessary.

c) If the actuator is to be removed for attending to any mechanical problems, removing of copper tubes, cables etc. reconnecting and re-commissioning of the actuators is to be done.

d) Testing and checking the remote / local operation in Auto as well as Manual mode.

e) Fixing of instruments if supplied as loose items.

f) Attending to any defects till the contract period.

1.15.25.2 FLOW METERS / SWITCHES

a) Checking the calibration and servicing if required.

b) Setting the alarm value

c) Replacement of defective components if any

1.15.25.3 LIMIT SWITCHES & LEVEL SWITCHES

a) Checking the operation

b) Replacing defective components if required

1.15.25.4 SOLENOID VALVES

a) Checking the healthiness of coil

b) Checking the operation

c) Replacement of defective components if required.

1.15.25.5 TEMPERATURE ELEMENTS (MOTORS AND GENERATORS WINDING AND BEARING)

a) Checking the healthiness

b) Replacement of defective element (only for bearing)

1.15.25.6 DIRECT WATER LEVEL GAUGES (REMOTE & LOCAL)

a) Checking the calibration

b) Fixing of bulbs and extending Power supply

c) Replacing defective components

1.15.25.7 INSTRUMENTS MOUNTED ON THE EQUIPMENTS / SKIDS / PANELS

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

1.15.26 All testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall follow the checklist of BHEL prior to taking up testing & commissioning activities and the activities shall be carried out in accordance with the checklist. All the above will be witnessed by BHEL engineer and the reports signed jointly.

1.15.27 All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. These tests / activities may not have been listed in these specifications. Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However contractor has to take proper care of the equipment issued to him.

1.15.28 All the tests at various stages shall be repeated till all the equipment satisfy the requirement of BHEL / Customer. Any rectifications required shall have to be done / redone by the contractor at his cost.

1.15.29 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

1.15.30 It shall be specifically noted that the contractor and employees of the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers / customer officials. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including engineers / supervisors.

1.15.31 In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.

1.15.32 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

1.15.33 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance till handing over of sets to customer.

1.15.34 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

1.15.35 The contractor shall carryout any other test not listed in the tender as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

1.15.36 It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, even if commissioning of equipments is delayed due to reasons not attributable to the contractor.

VOLUME-IA PART- I CHAPTER-XIX
PAINTING

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

1.16.0 FINAL PAINTING

1.16.1 The scope of work shall also include supply and application of final painting of all the components, other equipments etc., erected under the scope of this tender. The painting shall be as required and specified in the **painting schedule** for power plant equipment, structures, piping etc. which forms the part of this tender book.

1.16.2 The scope also includes supply of paints, primers, tools/consumables like brushes, rollers, emery papers, thinner etc., at no additional cost.

1.16.3 In the case of steel fabricated items, raw steel after fabrication has to be cleaned and subsequent painting to be carried out.

1.16.4 All the exposed metal parts of the equipments including structures, etc., wherever applicable after installation unless otherwise specified the surface protected, are to be first painted with at least one coat of suitable primer and required number of finish coats as indicated in the Painting Specification which matches the shop primer paint used, after thoroughly cleaning the dust, rust, scales, grease oil, and other foreign materials by wire brushing scrapping and chemical cleaning and the same being inspected and approved by BHEL engineers for painting. Afterwards the above parts shall be finished with as per the instructions of BHEL/Customer official.

1.16.5 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.

1.16.6 Paint shall be applied by brushing or by spray painting as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimal.

1.16.7 If needed and insisted either by BHEL / Customer in certain cases, spray painting has to be carried out within the Quoted rates. Spray painting gun and compressed air arrangement has to be made by the contractor himself.

1.16.8 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.16.9 Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,

1.16.10 The scope of painting includes application of colour bands, lettering the names of the systems equipments; tag Nos of valves, marking the directions of flow and other data required by BHEL within the quoted rate.

1.16.11 All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps,

streaks, runs, sags and uncoated spots. Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.

1.16.12 Finish coat paint, No of coat and DFT shall be as indicated in the painting specification issued during execution / relevant BHEL document/ customer's specifications. The painting specification which is forming part of this tender as in TCC shall be used as guidelines.

1.16.13 The actual colour to be applied shall be approved by the customer before starting of actual painting work.

1.16.14 Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only, and the paints should be as per the customer painting specification. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities.

1.16.15 No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.

1.16.16 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.

1.16.17 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.16.18 PRESERVATION / TOUCH UP PAINTING

1.16.18.1 Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other consumables like wire brushes, emery paper, cotton waste, cloth etc., at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.

1.16.18.2 Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint is to be applied on all the bare /

unpainted surfaces. Touch up painting is generally required for trays, control panels.

1.16.18.3 All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.

1.16.18.4 Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipments under this tender specification right from pre- assembly stage to till the equipment is cleared for final painting.

1.16.18.5 Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with touch up coat of red oxide primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.

1.16.18.6 Equipment / items/ components supplied during storage and handling, may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour.

VOLUME-IA PART – II CHAPTER 1

CORRECTIONS / REVISIONS IN GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

Sl No: 1

The clause no 1.15.13 published in General Conditions of Contract (Volume I Book-II) is revised as below:

1.15.13 Additional security deposit (SD) shall be submitted by the successful bidder with value as follows :

If the final price of successful bidder is lesser by 'more than 20%' of BHEL's estimates then only, 'Additional Security Deposit' will be required to be submitted by the successful bidder with value as follows:

Additional Security Deposit = 30 % of (A-B) will be calculated as below:

A = 80 % of BHEL estimate

B = The final offered price of successful bidder through Reverse Auction (In case of Reverse Auction)

OR

Sealed paper price bid of successful bidder (in case of paper bid)

Additional security deposit may be furnished in any form as applicable for Security Deposit. This 'Additional Security Deposit' shall have the same validity as that of the 'Security Deposit' and shall be revalidated / released in the manner as spelt out for the 'Security Deposit' as per relevant clause of GCC.

The BHEL's estimated value shall be disclosed to successful bidder (on request) in case 'Additional Security Deposit' is applicable

Sl No: 2

2.1.1 PRICE VARIATION COMPENSATION (PVC) AS IN CLAUSE 2.17 OF GCC

The following clauses in PRICE VARIATION COMPENSATION clause **2.17 in GCC** (PVC published in General Conditions of Contract (Volume I Book-II) are revised as under.

2.1.1.1 **Clause 2.17.5 is revised as under:**

Base date shall be first of the consecutive first month to the month in which contract period completes. (Explanatory statement: PVC shall not be applicable for the contract period and also for the portion of the days remaining after the contract period in the contract completion month. For example if the contract period completes in any day in the month of June 2014 the PVC shall be applicable July onwards with base index of July 2014.)

2.1.1.2 **Clause 2.17.9 is revised as under:**

PVC shall be applicable as defined in Clause 2.17.5. However the Total Quantum of Price Variation amount payable/recoverable shall be regulated as follows:

2.1.1.3 **Clause 2.17.9 (i) is revised as under:**

For the portion of backlog attributable to the contractor, No PVC shall be applicable.

2.1.1.4 **Clause 2.17.9 (iv) is deleted:**

2.1.2 OVERRUN COMPENSATION (clause 2.12 in GCC)

The following clause in OVERRUN COMPENSATION **2.12 in GCC** (ORC published in General Conditions of Contract (Volume I Book-II) is revised as under.

2.1.2.1 **Clause 2.12.3 in the GCC is revised as under:**

The amount of increase payable per month due to rate revisions is subject to a minimum of Rs 1,00,000/-(One lakh) per month and a maximum of Rs 5,00,000/- (Five Lakhs) per month.

Sl No: 3

The following note shall be added as footnote to form No: F-15 (Rev 01) published in 'Forms and Procedures' of Volume I Book-II

Note:

1) It is only indicative and shall be as per the online format issued by BHEL time to time.
2) No request will be entertained after specified date of the current month with respect to changes requested in the scores of immediate previous month.

Sl No: 4

The chapter Reverse auction procedure published in 'Forms and Procedures' of Volume I Book-II is revised as below:

REVERSE AUCTION

RA 1 **REVERSE AUCTION**

RA 1.1 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 (Annexure RA VIII). Non-acceptance to participate in RA may result in non-consideration of their bids in RA**.

RA 1.2 BHEL may opt for Reverse auction depending on situation as per company policy. **For this tender, Reverse auction will be conducted only if minimum four bidders are participating in reverse auction.** In case BHEL opts for RA, then the price bids of bidders who fulfil all the following conditions only shall be opened.

RA 1.2.1 The bidders should have qualified techno-commercially

RA 1.2.2 The bidders should have submitted their acceptance to participate in the RA vide enclosed format.

RA 1.3 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."

RA 1.4 The start price intimated by BHEL may be displayed to the bidders during reverse auction bidding process as 'L1 price' or 'start / base price'. In cases where the start price mentioned by BHEL is not displayed as L1 price and no bidder accepts that price, RA is to be treated as failed and sealed envelope price bids of all the techno-commercially qualified bidders shall be opened and the tender processed accordingly. Wherever the techno-commercially acceptable bidder(s) had agreed to participate in the RA and had failed to submit the online sealed bid, the envelope sealed bids of such bidder(s) shall not be entertained.

In such cases, no cognizance of online sealed bids shall be taken. In case the L1 bidder of "sealed envelope price bid" has quoted a lesser price in the "on-line sealed bid", cognizance of the same shall be taken for price negotiations.

RA 1.5 In case BHEL decides not to conduct RA, the envelope sealed price bids of all techno commercially qualified bidders, along with price impact, if any, shall be opened and processed as per company Policy.

RA 2 TERMS & CONDITIONS OF REVERSE AUCTION

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).

RA 2.1 For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

RA 2.2 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.

RA 2.3 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.

RA 2.4 In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.

RA 2.5 Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.

RA 2.6 Bidders have to fax the Compliance form (annexure- RA IV) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.

RA 2.7 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 non-compliance 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.

RA 2.8 Reverse auction will be conducted on scheduled date & time.

RA 2.9 At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.

RA 2.10 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- RA VII) as provided on case-to-case basis to Service provider within two working days of Auction without fail.

RA 2.11 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.

RA 2.12 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.

RA 2.13 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.

RA 2.14 The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.

RA 2.15 In case BHEL decides to go for Reverse Auction, the H1 bidder (whose quote is highest in online sealed bid) shall not be allowed to participate in further RA process.

RA 3 BUSINESS RULES FOR REVERSE AUCTION - TENTATIVE

(The business rules given here are only for information and the authorized rules shall be intimated before reverse auction by service provider)

RA 3.1 This has reference to tender no {tender number….date…}. BHEL shall finalise the Rates for the supply of {item name} through Reverse Auction mode. BHEL has made arrangement with M/s. {Service provider}, who shall be BHEL's authorized service provider for the same. Bidders should please go through the guidelines given below and submit acceptance of the same.

The technical & commercial terms are as per

(a) BHEL Tender Enq. No. {…} dated {...},

(b) Bidders‟ technical & commercial bid (in case of two part bid) and

(c) Subsequent correspondences between BHEL and the bidders, if any.

RA 3.2 **Schedule for reverse auction:**

The Reverse Auction is tentatively scheduled on {*date}:*

- **Online Sealed Bid:-**

  - *{Start Time**:***
  - *Close Time: }*

- **Online Reverse Auction:-**

  - *{Start Time**:***
  - *Close Time**:}***

RA 3.3 **Auction extension time:** If a bidder places a bid in the last {…} minutes of closing of the Reverse Auction and if that bid gets accepted, then the auction's duration shall get extended automatically for another {…} minutes, for the entire auction (i.e. for all the items in the auction), from the time that bid comes in. Please note that the auto-extension will take place only if a bid comes in those last {…} minutes and if that bid gets accepted as the lowest bid. If the bid does not get accepted as the lowest bid, the auto-extension will not take place even if that bid might have come in the last {…} minutes. In case, there is no bid in the last {…} minutes of closing of Reverse Auction, the auction shall get closed automatically without any extension. However, bidders are advised not to wait till the last minute or last few seconds to enter their bid during the auto-extension period to avoid complications related with internet connectivity, network problems, system crash down, power failure, etc.

The above process will continue till completion of Reverse Auction.

Complaints / Grievances, if any, regarding denial of service or any related issue should be given in writing thru e-mail / fax to M/s. {Service provider} with a copy to BHEL within 15 minutes from the initial closing time of Online Reverse Auction.

RA 3.4 **Bid price:** The Bidder has to quote the F.O.R. destination Price inclusive of Packing & Forwarding charges, all the routine & type tests as per tender scope, ED + cess, CST against C-form, Freight (bidder to provide original Freight paid receipt), insurance charges, etc. including loading (if indicated by BHEL due to deviations in commercial terms) for the Items specified. Details are as shown in Excel Sheet for calculation of Landed cost.

Note: For the consideration of L1 bidder, the bid value shall be reduced by loading amount, if applicable.

RA 3.5 **Bidding currency and unit of measurement:** Bidding will be conducted in {Indian Rupees per Unit} of the material as per the specifications {...}

In case of foreign currency bids, exchange rate (TT selling rate of State Bank of India) as on scheduled date of tender opening (Part-I bid in case of two part bid) shall be considered for conversion in Indian Rupees.

RA 3.6 **Validity of bids:** Price shall be valid for {… days} from the date of reverse auction. These shall not be subjected to any change whatsoever.

RA 3.7 **Lowest bid of a bidder:** In case the bidder submits more than one bid, the lowest bid at the end of Online Reverse Auction will be considered as the bidder's final offer to execute the work.

RA 3.8 **Post auction procedure:** BHEL will proceed with the Lowest Bid in the Reverse Auction for further processing.

RA 3.9 **Procedure of Reverse Auctioning**

RA 3.9.1 **Online Sealed Bid:** This duration of online sealed bid will be {…} minutes. All bidders to submit their online sealed bids during this period.

RA 3.9.2 **Online Reverse Auction:** The "opening price" i.e. start price for RA and "bid decrement" will be decided by BHEL.

RA 3.9.3 If BHEL decides the lowest online sealed bid as the starting price, then the lowest bidder in online sealed bid shall be shown as current L1 automatically by the system and no acceptance of that price is required. System shall have the provision to indicate this bid as current L1.

RA 3.9.4 Bidders by offering a minimum bid decrement or the multiples thereof can displace a standing lowest bid and become "L1" and this continues as an iterative process.

RA 3.9.5 After the completion of the online reverse auction, the Closing Price (CP) shall be available for further processing.

RA 3.9.6 If no bid is received in the auction system / website within the specified time duration of the online RA, then BHEL will scrap the online reverse auction process and proceed with the conventional mode of tendering (opening of the envelope sealed bids earlier submitted by the bidders).

In cases where no bidder accepts the start price, the RA may be treated as failed and sealed envelope price bids of all the techno-commercially qualified bidders shall be opened and the tender processed accordingly. Wherever the techno-commercially acceptable bidder(s) had agreed to participate in the RA and had failed to submit the online sealed bid, the envelope sealed bids of such bidder(s) shall not be entertained.

Wherever, the evaluation is done for individual items of the package, and no bid is received for some of the item(s), RA will be considered as failed for these item(s), re-reverse auction/ retendering will be conducted for these items.

RA 3.9.7 Only those bidders who have submitted the "online sealed bid" within the scheduled time shall be eligible to participate further in RA process. However, the **H1 bidder (whose quote is highest in online sealed bid) may / may not be allowed to participate in further RA process.**

RA 3.9.8 Any commercial / technical loading shall be intimated to bidders prior to RA. The excel sheet provided in this regard shall cover all these aspects. Commercial / technical loading if any, shall be added by the respective bidder in its price during online sealed bid & Online Reverse Auction. Modalities of loading & de-loading shall be separately intimated to the bidders.

RA 3.9.9 Computerized reverse auction shall be conducted by BHEL (through M/s {Service Provider}), on pre-specified date, while the bidders shall be quoting from their own offices / place of their choice. Internet connectivity shall have to be ensured by bidders themselves.

RA 3.9.10 During the RA if a bidder is not able to bid and requests for extension of time by fax/ e-mail/ phone then time extension of additional 15 minutes will be given by the service provider provided such requests come before 5 minutes of auction closing time. However, only one such request per bidder can be entertained.

Despite this extension if bidder fails to upload his prices due to extreme case of failure of Internet connectivity, (due to any reason whatsoever may be) it is the bidders' responsibility / decision to send fax communication immediately to M/s. {*Service provider}*, furnishing the price the bidder wants to bid online with a request to the service provider to upload the faxed price on line so that the service provider will up load that price on line on behalf of the Bidder. It shall be noted clearly that the concerned bidder communicating this price to service provider has to solely ensure that the fax message is received by the service provider in a readable / legible form and also the Bidder should simultaneously check up with service provider about the clear receipt of the price faxed. It shall also be clearly understood that the bidder shall be at liberty to send such fax communications of prices to be up loaded by the service provider only within the closure of Bid time and under no circumstance it shall be allowed beyond the closure of Bid time / reverse auction. It shall also be noted that the service

provider should be given a reasonable required time by the bidders, to upload such prices online and if such required time is not available at the disposal of the Service provider at the time of receipt of the fax message from the bidders, the service provider will not be uploading the prices and either BHEL or the service provider are not responsible for this unforeseen circumstances. In order to ward-off such contingent situation bidders are requested to make all the necessary arrangements / alternatives whatever required so that they are able to circumvent such situation and still be able to participate in the reverse auction successfully. Failure of power or loss of connectivity at the premises of bidders during the Reverse auction cannot be the cause for not participating in the reverse auction. On account of this, the time for the auction cannot be extended and neither BHEL nor M/s. {*Service provider*} is responsible for such eventualities.

RA 3.9.11 **Proxy bids:** Proxy bidding feature is a pro-bidder feature to safe guard the bidder's interest of any internet failure or to avoid last minute rush. The proxy feature allows bidders to place an automated bid in the system directly in an auction and bid without having to enter a new amount each time a competing bidder submits a new offer. The bid amount that a bidder enters is the minimum that the bidder is willing to offer. Here the software bids on behalf of the bidder. This obviates the need for the bidder participating in the bidding process until the proxy bid amount is decrementally reached by other bidders. When proxy bid amount is reached, the bidder (who has submitted the proxy bid) has an option to start participating in the bidding process.

The proxy amount is the minimum amount that the bidder is willing to offer. During the course of bidding, the bidder cannot delete or change the amount of a proxy bid.

Bids are submitted in decrements (decreasing bid amounts). The application automates proxy bidding by processing proxy bids automatically, according to the decrement that the auction originator originally established when creating the auction, submitting offers to the next bid decrement each time a competing bidder bids, regardless of the fact whether the competing bids are submitted as proxy or standard bids. However, it may please be noted that if a manual bid and proxy bid are submitted at the same instant manual bid will be recognized as the L1 at that instant.

In case of more than one proxy bid, the system shall bid till it crosses the threshold value of "each lowest proxy bid" and thereafter allow the competition to decide the final L1 price.

Proxy bids are fed into the system directly by the respective bidders. As such this information is privy only to the respective bidder(s).

RA 3.9.12 Bidders are advised to get fully trained and clear all their doubts such as refreshing of Screen, quantity being auctioned, tender value being auctioned etc.

RA 3.9.13 M/s. {Service provider}, shall arrange to demonstrate/ train the bidder or bidder's nominated person(s), without any cost to bidders. M/s. {Service provider}, shall also explain the bidders, all the rules related to the Reverse Auction / Business Rules Document to be adopted along with bid manual. Bidders are required to give their compliance on it before start of bid process.

RA 3.9.14 Successful bidder shall be required to submit the final prices, quoted during the Online Reverse Auction in Annexure - RA VII after the completion of auction to M/s. Service provider besides BHEL, duly signed and stamped as token of acceptance without any new condition other than those already agreed to before start of auction.

RA 3.9.15 Any variation between the final bid value and that in the confirmatory signed price breakup document will be considered as tampering the tender process and will invite action by BHEL as per extant guidelines in vogue.

RA 3.9.16 Bidders bid will be taken as an offer to execute the work / supplies the item as per enquiry no. {…} dt. {…}. Bids once made by the bidder, cannot be cancelled/ withdrawn and bidder shall be bound to execute the work as mentioned above at bidder's final bid price. Should bidder back out and not execute the contract as per the rates quoted, BHEL shall take action as per extant guidelines in vogue.

RA 3.9.17 Bidders shall be assigned a **Unique User Name & Password** by BHEL or M/s. {Service provider}. Bidders are advised to change the Password and edit the information in the Registration Page after the receipt of initial Password from BHEL / M/s. {Service provider} to ensure confidentiality. All bids made from the Login ID given to the bidders will be deemed to have been made by the bidders / bidders' company.

RA 3.9.18 Bidders shall be able to view the following on their screen along with the necessary fields during Online Reverse Auction:

a. Leading (Running Lowest) Bid in the Auction (only total price of package)

b. Bid Placed by the bidder

c. Start Price

d. Decrement value

RA 3.9.19 After receipt of the system report from the Service Provider after completion of the Online Reverse Auction, BHEL will decide upon the winner. BHEL's decision on award of contract shall be final and binding on all the Bidders.

RA 3.9.20 BHEL reserves the right to cancel the Reverse Auction process / tender at any time, before ordering, without assigning any reason.

RA 3.9.21 BHEL shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause. In such cases, the decision of BHEL shall be binding on the bidders.

RA 3.9.22 Other terms and conditions shall be as per bidder's techno-commercial offers and other correspondences, if any, till date.

RA 3.9.23 Bidders are required to submit their acceptance to the terms / conditions / modalities before participating in the Reverse Auction in the process compliance Form as per Annexure- RA IV.

RA 3.9.24 BHEL can decide to extend, reschedule or cancel any Auction with prior intimation to all bidders.

RA 3.9.25 **If there is any clash between this business document and the FAQ available, if any, in the web site of M/s. {Service provider} the terms & conditions given in this business document will supercede the information contained in the FAQs. Any changes made by BHEL / service provider (due to unforeseen contingencies) after the first posting shall be deemed to have been accepted if the bidder continues to access the portal after that time.**

VOLUME-IA PART – II CHAPTER 2
PAINTING SCHEDULE

Customer's painting Scheme available in next three pages

1.0 SCOPE

1.1 This section covers the painting requirements for the power plant equipment, structures, piping etc. and any other surface required to be painted.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job :

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of piplines
IS:1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:2338	:	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:6278	:	Code of practice for white washing and colour Washing
IS:3140	:	Code of practice for painting asbestos cement building products
IS:158	:	Ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and heat resisting
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS: 2932	:	Enamel , synthetic, exterior (a) undercoating (b) finishing

2.0 PREPARTION OF SURFACES

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations were power tool cleaning cannot be carried out, sand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the OWNER / ENGINEER.

4.0 PRIMER PAINT

After the surface is prepared, one coat of Zinc Phosphate primer conforming to IS:2074 shall be applied. After this first coat is dried up completely, second coat of red oxide primer shall be applied. Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be minimum 30 microns.

5.0 FINISH PAINT

Synthetic enamel paint conforming to IS:2932 shall be used for finish coats. The colour/shade shall be as approved by the OWNER. After cleaning the dust on the dried up primer, first coat of synthetic enamel shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.

6.0 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5 Grade	COLOUR (BAND)	IS-5
1.0	Structures, platforms, galleries, ladders and handrails	Dark Admirality Grey	632	-	-
2.0	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.0	Crane				
3.1	Crane structure	Golden Yellow	356	-	-
3.2	Trolley and hook	Crimson	540	-	-
4.0	Fans, pumps, motors, compressors	Light Grey	631	-	-
5.0	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7.0	Switchgear	Light grey	631	-	-
8.0	Control & relay panels	Light grey	631/70 78 of IS 1650	-	-
9.0	Turbine	Golden Yellow	356	-	-

SL. NO.	ITEM/SERVICE	COLOUR	IS-5 Grade	COLOUR (BAND)	IS-5
10.0	Generator & exciter	Light grey	631	--	-
11.0	Transformers	Aluminium	-	-	-
12.0	Machinery guards	Signal red	537	-	-
13.0	Piping (without insulation and cladding_)				
13.1	Water System				
	Boiler feed	Sea green	217	-	-
	Condensate	Sea green	217	Light brown	410
	D M Water	Sea green	217	Light orange	557
	Soft water	Sea green	217	French blue	166
	Bearing cooling water	Sea green	217	French blue	166
	Potable & filtered water	Sea green	217	French blue	166
	Service & clarified water	Sea green	217	French blue	166
	Raw water	Sea green	217	White	-
	Cooling water	Sea green	217	French blue	166
13.2	Air System				
	Station air	Sky blue	101	-	-
	Control air	Sky blue	101	White	-
13.3	Oil system				
	Fuel oil	Light brown	410	French	166
	Light oil	Light Brown	410	Brilliant green	221
	Lubricating oil	Light brown	410	Light grey	631
	Transformer oil	Light brown	410	Light orange	557
13.4	Gas system				
	Carbon dioxide	Canary yellow	309	Light grey	631
	Hydrogen	Canary yellow	309	Signal red	537
13.5	Fire services	Fire red	536	-	-
13.6	Ash slurry pipes	Black	-	-	-
13.7	Vacuum pipes	Sky blue	101	Black	-
13.8	Fuel pipes (pulverised coal)	Light brown	410	-	-
13.9	Drainage	Black	-	-	-

Notes :

1. This colour code basically refers to IS:2379 for piping with necessary modifications

2. Where band colour is specified, same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

VOLUME-IA PART- II CHAPTER -3
DATA SHEET

2.3.1 SPECIFIC TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS

1.	Clamps			
	a.	Material & Type		Nylon self locking ties aluminium strips clamps as mentioned in Chapter-III of Technical Conditions of Contract (Volume-IA Part-I in Book-I)
	b.	Sizes		To meet the requirements mentioned in Chapter-III of Technical Conditions of Contract (Volume-IA Part-I in Book-I)
2.	Ferrules			As as mentioned in Chapter-III of Technical Conditions of Contract (Volume-IA Part-I in Book-I)
3.	Tag			
	a.	Material		Aluminium / Fibre / Stainless Steel
	b.	Markings		Engraving / Embossing / Printing
	c.	Size		As required.
4.	Cable lugs			Copper / Aluminium (crimping type)
5.	**CLAMP SPACING:**			
	a	**Trefoil Clamps**		
		i	Horizontal run spacing	1000 mm (max)
		ii	Vertical run spacing	1000 mm (max)
		iii	Axial spacing between adjacent trefoils	Double the diameter of larger cable or 150mm Whichever is less
	b	**Other Clamps**		
		A.Power Cables:		
		Above 35mm OD		
		i) Horizontal runs		Individually clamped at 3000 mm Interval (max)
		ii) Vertical runs		Individually clamped 3000mm intervals (max).
		Upto 35 mm OD		
		i) Horizontal runs		Collectively clamped at 3000 mm intervals (max)
		ii) Vertical runs		Collectively clamped at 2000 mm interval (max)
		B.Control Cables:		
		i) Horizontal runs		Collectively clamped at 3000 mm interval (max)
		ii) Vertical runs		Collectively clamped at 3000 mm interval (max)
		C.Spacing for cables		

		supported along structure / ceiling	
		Clamping Spacing:	
		i) In horizontal runs	750mm (max)
		ii) In vertical runs	750mm (max)
		Spacing between cables	30 mm (min)
		Note: a. Supports shall also be provided at each bend. b. For any change in above spacing, prior approval of Engineer shall be taken.	
6.	**Cable termination:**		
	Type of Lugs:		
	a	Power Cables	Copper / Aluminium / Both crimping type
	b	Control Cables	Copper pin type, copper screw type, Direct termination
	c	Special Cables	Pin type, maxi-termi type.
7	**Wastage Allowances**		
	a.	HT Cables	1%
	b.	LT cables above 70mm	1%
	c.	LT cables upto 70mm	1%
	d.	Control & Special cables	2%
	e.	Fire Survival cables	1%
	f.	Steel materials (for cable trays / tray support installation)	2% by weight

2.4.1 Guidelines for Installation of C & I Equipments

2.4.1.1 Instruments location shall be decided to the convenience of operation and maintenance. The location shall have least mechanical vibration and placed where corrosive, toxic and explosive gases and dust particles will not deposit and the place is not subject to high-temperature atmosphere or radiation. However, actual location shall be decided in consultation with customer / consultant.

2.4.1.2 Maintenance platforms & approach facilities shall be provided for all sensing & primary devices wherever possible.Instruments shall be located in weatherproof enclosures and wherever required suitable canopy shall be provided.

2.4.1.3 High & Low pressure impulse lines shall not be grouped and run together. Also impulse lines for explosive & inert gases shall not run together.

2.4.1.4 Impulse lines of high pressure steam, harmful gases, etc. shall not be brought into the control room, as far as possible.

2.4.1.5 Intrinsically safe circuits shall be used for explosion hazardous areas.

2.4.1.6 Separate cable routing shall be followed for high and low voltage lines.

2.4.1.7 All electrical equipments shall meet the requirements of Indian Electricity Rules.

2.4.1.8 Wherever severe vibrations are expected, shock absorbers shall be provided

2.4.1.9 Installation of instruments with radioactive isotopes, mercury and other toxic substances shall be as per statutory regulations provided by authorities.

2.4.1.10 Compensating cables should be connected directly to instruments, i.e. no junction boxes shall be used if CJCBs are not provided.

2.4.1.11 Orifice plates or flow nozzles must be provided with at least 10D upstream and 5D downstream straight length of pipe from bends tees, branch pipes & control valves.

2.4.1.12 Pressure gauges shall be provided with snubbers, syphons (for more than 100°C), three way valve manifolds wherever applicable.

2.4.1.13 For pneumatic instruments, air shall be dry & free from oil. Air must be supplied from oil-free compressors specially erected for this purpose. After drying, air must

be stored in receiver. Pressure gauges must be provided on each supply line and after the pressure reducer.

2.4.1.14 Correct level (height) between detecting element and tapping point and transmitter shall be maintained.

2.4.1.15 The equipment shall maintain its normal posture (level, perpendicular, front and back).

2.4.1.16 Connection between detecting element/tapping point and transmitter shall be maintained at short distances wherever practicable to avoid any time lag.

2.4.1.17 Orifice plates and control valves shall be mounted on process piping, only after completion of cleaning of the process piping in order that these instruments may not suffer damage from metal waste, etc.

2.4.1.18 For details of installing each measuring instruments, instruction manual issued by the respective manufacturer of instruments may be referred to, wherever necessary.

2.4.1.19 The drain pipes shall be terminated in a common closed header and finally the common header shall be connected to plant open drain.

2.4.1.20 Impulse pipe material shall be identified for each individual pipe prior to its use at site. For this purpose coloring is to be done immediately after receipt.

2.4.2 Guide Line for Erection of Impulse Lines

2.4.2.1 All impulse lines burrs and airlines shall be thoroughly cleaned of any foreign matter by cleaning with compressed air and the same shall be done before installation.

2.4.2.2 The routing of pipelines shall include sufficient flexibility near tappings to allow for thermal expansion of the process equipment.

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

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

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

a) ¼" OD / ⅜" OD Copper - Continuous

b) ½" NB Pipe / Tube - 5'

c) ¾" NB Pipe / Tube -5'

d) 1" NB Pipe / Tube -8'

2.4.2.6 All impulse line welding shall be done through welding generator/rectifier and only structural welding could be done through welding transformer.

2.4.2.7 Impulse pipe of Alloy Steel / Stainless Steel / Carbon Steel shall be TIG welded wherever required. Welding of impulse pipe shall be carried out in accordance with BHEL welding procedure. The welding electrodes shall be approved by BHEL welding Engineers. Impulse pipes welders shall undergo welding Test and approved by BHEL welding engineer at site.

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

2.4.2.9 The impulse pipe laying is recommended to be limited to a maximum of 10 metres (each limb) generally, unless otherwise specified, to have optimum response from the transmitter. However, this will depend upon plant layout.

2.4.2.10 Where the tapping point is subjected to mechanical shift due to heating / cooling of main equipment, care should be taken to route the impulse pipe in such a way as to absorb the shift of tapping point without straining the impulse piping. To accommodate this, sufficient loop for the impulse pipes can be provided near to the tapping point.

2.4.2.11 Alternatively hose assembly - S.S. flexible may be used for connection between tapping point and impulse pipe.

2.4.2.12 The expansion bends are to be avoided as far as possible, as these act as air/sedimentation traps hampering the system performance.

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

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

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

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

2.4.3 Impulse Piping for Air & Flue Gas System

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

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

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

2.4.4 Impulse Piping for Vacuum Measurement

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

2.4.5 Impulse Piping for Steam and Water System

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

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

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

2.4.5.4 In case 2 way manifold used and connected with nipple and coupling, it is necessary to provide tee with plug for purging or venting. The impulse pipe connection to the transmitter from the main pipe may be either upper side or lower side of the transmitter. In any case sufficient slope shall be maintained.

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

2.4.5.6 It is always preferable to mount the instrument below the tapping points because the condensate shall protect the instruments against high temperature. In any case, the temperature entering the instrument should not exceed 150 F. In case the instrument is installed above tapping, before opening the process root valves, the impulse pipe shall be filled with water.

2.4.5.7 In the case of high temperature steam applications, sufficient length or siphon shall be provided to ensure certain length of condensate is formed thereby protecting breaking the measuring instruments from high temperature. Snubbers can also be provided if there is likely to be any pulsating of the medium measured.

2.4.6 Bending

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

2.4.6.2 Use of 45° elbow and 90° bends (ready-made) is restricted to bare minimum to minimise the number of joints in a system. Hot bending is not to be used as this leads to flattening of pipes at the bends and also results in thinning of walls, apart from introducing changes in metallurgical properties of the pipe material.

2.4.6.3 Hot bending may be permitted for carbon steel pipe for low pressure service as instructed by supervisor only when it cannot be avoided. In the case of 90° bending radius shall be more than 3 times the outside diameter of pipe and in the

case of 'u' bending, radius of bending shall be 5 times the outside diameter of pipe. When the radius of bending becomes small, elbow fitting shall be used.

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

2.4.7 Cutting

- Pipe cutter or wheel grinder shall be used for pipe cutting.
- Gas cutting shall be avoided.
- Burr inside the cut end shall be removed.
- The cutting surface shall be as perpendicular to the axis as possible.

2.4.8 Impulse Pipe Welding

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

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

2.4.9 Testing

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

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

2.4.10 Guidelines for Installation of Pneumatic Line

2.4.10.1 Copper tubing shall be connected with Olive type of compression fittings,

2.4.10.2 When two or more lines run together, the joint in the adjacent alternate line shall be a offset.

2.4.10.3 In case of copper tubing, the single run copper tube may be supported with an angle. However, suitable trays shall be used for more than one tubing.

2.4.10.4 Multi-core copper tubing shall not to be bend less than 10 deg and D is the OD if the multi-core copper.

2.4.10.5 All air distribution, main and branch lines shall be galvanised internally as well as externally and the galvanised pipe, never, shall be braced or welded.

2.4.10.6 The joints shall be screwed with Teflon tapping wherever the pipes are to be removed frequently for cleaning and other purposes and suitable union fittings shall be used.

2.4.10.7 Care shall be taken while taking a branch pipe to see that the line is not taken from the lower part of the main line or main header in order to avoid entry of any drain or dust into the system.

2.4.10.8 Instrument airline should not be routed where severe vibration, high temperature exists and adequate space should be available for maintenance.

2.4.10.9 Care shall be taken when removing the PVC sheeting, while connecting the copper tube. The exposed portion after jointing shall not be excessive and also while removing PVC, the tube should not get damaged. Pipe cutters should not be used for cutting the copper tube, instead the specific copper tube cutter shall be used. Similarly, for bending copper tubes, specific copper tube bender should be used and the radius of the bending shall be more than 2.5 times of the OD of the copper tube.

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

2.4.10.11 In locations where the copper tube is likely to be damaged from outside, the copper tube can be routed near a different pipe. While laying copper tube either inside angle or trays, the tube shall be supported at least at every one metre distance.

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

2.4.11 Instrument Air line Testing

- All instrument air lines shall be isolated from the instruments and pressurised pneumatically to maximum working pressure. It shall then be isolated from the source of pressure and fall shall be less than 1 psi in 20 minutes.
- All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurised pneumatically 20 psi, and checked with soap solution for leak.

2.4.12 General Guidelines on Installation of Flexible Hoses

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

2.4.12.2 Under pressure, a hose may change in length. Always provide some slack in the hose to allow for this shrinkage or expansion. (However, excessive slack in hose lines is one of the most common causes of poor appearance).

2.4.12.3 At bends, provide enough hose for a wide radius curve. Too tight a bend pinches the hose and restricts the flow. The line could even kink and close entirely. In many cases, use of the right fittings or adapters can eliminate bends or kinks.

2.4.12.4 In applications where there is considerable vibration or flexing, allow additional hose length. The metal hose fittings, of course, are not flexible and proper installation protects metal parts from undue stress, and avoids kinks in the hose.

2.4.12.5 Hose assemblies in service should be inspected frequently for leakage, kinking, corrosion, abrasion or any other signs of wear or damage. Hose assemblies that are worn or damaged should be removed from service and replaced immediately.

2.4.12.6 The service life expectation of a flexible hose mainly depend on the correct installation layout. In most cases, when flexible hoses fail prematurely, the reason of failure may be found in an incorrect layout.

2.4.12.7 As a rule, the hose is not to be bent over its limit of elasticity. The choice of the right hose length is of crucial importance. The hose should not be subject to torsion. Torsion can be usually eliminated by changing the layout.

2.4.13 General Notes on Installation of Local Instrument Racks and JB Frames

2.4.13.1 In cases where the local instrument stands are to be installed on a concrete foundation, it shall be fixed by anchor bolts.

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

2.4.13.3 Installation of local junction boxes shall be installed in such a way that they are fixed on a column by welding or by fixing bolts.

2.4.13.4 Local Instrumentation rack, which shall be installed utilising the Beam and Structure, shall be fixed by welding. Care shall be taken while deciding the location in order to ensure that no hindrance is caused to the maintenance personnel in their moving space within the work area. Further, as a standard practice, it should be ensured that no instrument stands/racks/JBs shall be

supported by/welded on to any of the working equipments, or even hand grilled or floor grilled, as peer safety norms.

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

2.4.14 General Guideline on Flow Instruments Installation

2.4.14.1 Extreme care shall be taken when welding and assembling the flow element on the pipe. Any misalignment or rough particle or edge inside the welded area may cause inaccuracy and this will increase as the flow increases.

2.4.14.2 Flow elements should always be located in upstream from any valve. Downstream side of valve shall no longer be a homogenous mixture and this may cause erratic behaviour of reading periodically.

2.4.14.3 Care shall be taken while welding the impulse pipe. Improper arrangement of piping of DP instruments can create error in the reading and even it gives an indication of negative flow of steam even though the flow is to be positive. Inadequate exchange of steam and condensate in the piping may cause negative flow. The presence of burr or dirt in the pipe can impede the flow of condensate back to the pipe, and when this happens, the pipe becomes full of water and has the effect of creating negative head.

2.4.14.4 Always ¾" to 1" pipe is recommended for free flow condensate. Gate valve shall be used for the tapping and pipe should be insulated up to condensing pot.

2.4.14.5 The Measuring instrument shall be located close to the flow-sensing element. The speed of response is reduced if there is a long run,

2.4.14.6 The orifice plates shall be installed such that the extreme face is perpendicular to the axis of the pipe within the +2 deg or -2deg. and it should be ensured that when the extreme face is facing the direction of flow, invariably the sign of positive (+) is marked on the upstream.

2.4.14.7 Location of Flow element should have clear straight run of 10D in upstream and 5D in downstream.

2.4.14.8 For non-viscous liquid flow measurements, the best location for the instruments shall be below the pipeline, If the instrument is above the line, more maintenance will be involved. Suitable vapour traps shall be provided.

2.4.14.9 In the case of air and gas flow measurement system, as part of basic requirement, it should be transmitted to the instruments without any change in the differential head due to leakage.

2.4.14.10 If the flow of any dry gases are to be measured, the location of instrument can be kept above or below the tapping points.

2.4.14.11 For air flow measurements, it is always preferable to install the instruments above the pipeline. Incase, if the instrument must be installed below the duct/pipeline, suitable Dust Collection Chamber can be installed.

2.4.14.12 The condenser pot should be located nearer to the tapping point and both condenser chamber should be at the level of upper tapping,

2.4.14.13 The unequal level will cause significant error due to false heads. If the flow nozzle is installed in vertical pipe, the lower tapping pipe which is bent and taken up to upper tapping in order to align with the upper condensate pot, must be insulated, otherwise, error is created when the bent pipe fills with condensate. The error may add or subtract depending upon the direction of flow.

2.4.14.14 For flow measurements, the instruments should always be located below the condenser pot, otherwise, the condensate will be lost from the system and the instrument will reach 'O' during the shutdown and the total system must be vented after the start up of the boiler in order to remove Air and Vapour which might have got entrapped.

2.4.14.15 In an installation where the instruments must be located above the tapping points and the condensing chamber should be equally located above the instruments the pipeline up to the condensing pot should be insulated.

2.4.14.16 In the case of viscous fluids, flow measurements which are likely to freeze or concealed in the pressure pipe or like such corrosive type fluids, suitable sealing chamber shall be used, the sealing liquid should not mix or react with the medium to be measured.

2.4.14.17 The commonly used sealing liquid includes water, light oil, glycerol, ethylene glycol and mixtures of the last two with water.

2.4.14.18 The sealing chambers, in each pressure pipe, should be installed at the same level and as close as possible to the pressure tappings.

2.4.14.19 The general arrangement for pressure tappings from the Sealing Chamber to the instrument is shown in the sketch.

2.4.14.20 The flow elements should be inspected before installation to find out the presence of any corrosion/rusting or any blockage on the pressure tapping holes or any deposits on the face of the orifice plate.

2.4.15 General Guideline on Installation of Valves

2.4.15.1 Primary isolating valves (root valves) must be located at the tapping which can be of globe valves.

2.4.15.2 These valves shall be installed where access is possible.

2.4.15.3 Secondary isolating valves shall be located at the end of inter-connecting pipe. It should be as nearer as possible to the measuring instruments and should be of needle type.

2.4.15.4 For pressure more than exceeding 40 kg, 2 isolating valves shall be provided.

2.4.15.5 In the case of heavy duty isolating valves, suitable support shall be provided to avoid any loading on the stubs.

2.4.15.6 In viscous fluids, suitable steam tracing shall be provided.

2.4.15.7 These valves are always located as nearer to the measuring device as possible.

2.4.16 Blowdown Valves or Drain Valves

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

2.4.17 PAINTING

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

2.4.18 GUIDELINES FORCABLE LAYING

2.4.18.1 In the plant building, substations, switchgear rooms, control rooms etc. Power and control cables shall generally be laid on cable trays installed in concrete trenches, tunnels, cable basements, cable vaults, cable shafts or along building and structures as the case may be.

2.4.18.2 In case of multicore cables of diameter upto 20 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of more than 300 mm.

2.4.18.3 Power & control cables installed along buildings and structures, ceilings, walls, etc. which are required to be protected against mechanical damage shall be taken in G.I. conduits.

2.4.18.4 GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.

2.4.18.5 In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy-duty PVC pipes shall be provided.

2.4.18.6 Entry of cables through trenches/tunnels into buildings shall be by means of one of the methods indicated in drawing as applicable for different buildings.

2.4.18.7 Cables laid exposed in racks / trays and routed through trenches / tunnels / basements etc. to individual drive / control devices etc. shall be taken in embedded surface exposed rigid GI conduits and or flexible conduits unless directly terminated to the equipment in the panels located, above trenches, tunnels or basement.

2.4.18.8 All cables routed along walls or in equipment rooms shall be protected by means of laying them through GI pipes or by providing sheet metal covers up to a height of 2000mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be of enclosed type.

2.4.18.9 Tray covers shall not be provided for the cable trays within trenches, tunnels and basements. Non-perforated type sheet steel covers shall be provided for the trays in the areas susceptible to accumulation of coal dust/atmospheric abuses etc.

2.4.18.10 Cable trays shall be supported on ISA 50 X 50 X 6mm MS / GI brackets. Brackets shall be welded to steel plate inserts in the trenches / tunnels or supporting channel angle / inserts in other areas.

2.4.18.11 Wherever direct heat radiation exists, heat isolating barriers (subject to customers approval), for cabling system shall be adopted.

2.4.18.12 For 415V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded / exposed GI conduits or rigid PVC pipes as applicable.

2.4.18.13 If required, a few number of cables in exceptional areas may be directly buried into the earth.

2.4.18.14 Wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth as decided by Engineers.

2.4.18.15 At certain places where hazardous fumes / gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.

2.4.18.16 In corrosive atmosphere, PVC conduits shall be used for cables.

2.4.18.17 Single core cables, when pulled individually shall be taken through PVC pipes only.

2.4.18.18 Laying and installation of power, control and special cables shall generally conform to IS : 1255

2.4.18.19 The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).

2.4.18.20 In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks / trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. Only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.

2.4.18.21 Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.

2.4.18.22 Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of cable. The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS 1255.

2.4.18.23 All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Tags shall be fixed at both ends of cables (both inside & outside of panel) both sides of floor / wall crossings, every 25m spacing for straight runs or as specified by Engineer for easy identification of cable.

2.4.18.24 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.

2.4.18.25 Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material.

2.4.18.26 Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacings not less than one cable diameter of bigger diameter cable.

2.4.18.27 All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanised MS saddles / aluminium strips / nylon cable ties. Cables above 35mm diameter shall be clamped individually.

2.4.18.28 Control cables shall be laid touching each other and wherever required may be taken in two layers. All control cables shall be clamped with a common clamp / tie.

2.4.18.29 Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formation:

a. HT cables shall be laid in the top tier(s)

b. LT power cables to be laid in the tray(s) below the HT cable trays.

c. LT control cables to be laid in the Tray(s) next below to the LT power cable tray(s)

d. Special control cables including screened control cables to be laid in the bottom most tray(s).

2.4.18.30 For vertical formations, the trays closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed. However, where there is no clear distinction of bottom / top trays, the order convenient for linking the horizontal and vertical formations shall be followed.

2.4.18.31 When it may not be possible to accommodate the cables as per the criteria indicated in the two clauses indicated above, the following rules shall override the criteria. However, prior approval of the Engineer will be required.

In hierarchical order:

a. Control cables are mixed up with the special control cables with clear minimum gap of 100mm between them.

b. LT power cables are mixed up with control cable with clear minimum gap of 150mm between them.

c. LT power cables are mixed up with HT power cables with clear minimum gap of 200mm between them.

d. LT power cables are mixed up with special control cables with clear minimum gap of 200mm between them.

2.4.18.32 In case of duplicate feeders to essential loads, the respective cables shall be laid through separate raceways. Alternatively, such cables shall be laid on the opposite sides of a trench/tunnel/basement.

2.4.18.33 For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanised.

2.4.18.34 For laying cables along concrete walls, ceilings etc. The cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using raw plus and MS flat spacers of minimum 6mm thickness.

2.4.18.35 To facilitate pulling of cables in GI conduits, powdered soft stone, plastic scoap or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.

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

2.4.18.37 In case of a 3 phase, 4 wire system, more than one single phase circuit, unless originating from the same phase shall not be taken in the same GI conduit.

2.4.18.38 Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for consideration by BHEL.

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

2.4.19 Support Spacings & Clampings

Support spacing and clamping suitably provided and as required.

2.4.20 Laying of cables directly buried in ground

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

2.4.21 Codes and Standards

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

IS 1255 Code of practice for installation and maintenance of power cables upto and including 33 kV rating.

IS 732 Electrical wiring installation (system voltage not exceeding 650 V).

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

IS 226 Structural steel (Standard quality).

IS 800 Code of practice for use of structural steel.

IS 316 Code of practice for use of metal arc welding for general construction in mild steel.

IS 1363 Hexagonal bolts, nuts and screws

IS 1572 Electroplated coatings of cadmium on iron and steel.

IS 2629 Code of practice for hot dip galvanising for iron and steel.

IS 2633 Method of testing uniformity of coating on zinc coated articles.

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

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

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

2.4.22 Guidelines For Erection of Cable Trays, GI Pipes, Supports and Accessories

2.4.22.1 Constructional details and supporting arrangement for the cable trays shall be as shown in the drawings which will be handed over to the successful bidder. All cable trays, vertical raceways and supporting steel work shall be installed along the routes as indicated in the drawings and as per the instructions of the Engineer-in-charge. The contractor has to fabricate and install complete tray supporting structures as per the drawing / site requirement.

2.4.22.2 Wherever specified or directed by Engineer, the contractor shall install galvanised MS sheets covers over cable trays. The width of the covers shall be same as that of cable trays. Bolting shall be done to fasten covers to the cable trays, elbows, reducers, tees, crosses etc.

2.4.22.3 The contractor shall install all angles, channels, beams, hangers, brackets, clamps etc. as may be necessary to suit the actual site conditions to support the cable trays.

2.4.22.4 Straight pieces of standard MS angles / channels shall be used for fabrication of supports / racks. All welded joints shall be smooth enough to provide a good appearance and shall not cause injury to working personnel.

2.4.22.5 Cable trays within cable trenches, tunnels and basements shall be of ladder type. Bottom most tray within plant buildings for overhead runs of trays shall be of perforated type. Cable trays in the areas exposed to coal dust shall be installed in vertical formation. Wherever due to layout constraints, it is not possible to install the trays in vertical formation with Engineer's prior permission installing the trays in horizontal formation may be considered.

2.4.22.6 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way or maintenance of adjacent equipment.

2.4.22.7 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.

2.4.22.8 For equipment and devices having GI conduit entry arrangement other than standard GI conduit adopter, adopters shall be provided as required to enable the GI conduit to be properly terminated, between conduit end and motor T.B.

2.4.22.9 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.

2.4.22.10 The entire G.I. conduit system shall be firmly fastened in position. All boxes and fittings shall generally be secured independently from the Gi pipes entering them.

2.4.22.11 Bends of G.I. pipes / conduits shall be made without causing damage to the pipes / conduits.

2.4.22.12 Occupancy of conduits shall not be greater than 40%.

2.4.22.13 The adopter for coupling rigid GI pipe / conduits and flexible conduit shall be of aluminium or galvanised steel.

2.4.22.14 Transportation and storage of cable drums

2.4.22.15 Transportation and storage of cable drums shall generally conform to the requirements of IS : 1255

2.4.22.16 All the cables shall be supplied to the contractor free of cost from BHEL / Customer's store / storage area. Transportation of cables from storage area to the work site shall be the responsibility of the contractor.

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

2.4.23 Guidelines for Cable Termination and Jointing

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

2.4.23.2 When the equipment are provided with undrilled gland plates for cable / conduit entry into the equipment, drilling and cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site and drawings shall be prepared and take engineer's approval before driling holes. Cutting shall not be allowed.

2.4.23.3 Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the contractor. Looping of cores / wires at terminals as shown in interconnection diagrams is to be done by the column at no extra cost as part of the termination.

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

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

2.4.23.6 Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals.

2.4.23.7 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes / nylon ties and suitably

supported to keep them in position at the terminal block. All spare cores shall be connected to spare terminals wherever possible. If spare terminals are not available, spare cores shall be neatly dressed and suitably taped at both ends.

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

2.4.23.9 Individual cores of control cables shall have ferrules for identification. Ferrule numbers shall be provided as per the control schemes and other related documents supplied.

2.4.23.10 End sealing / termination of cables shall be done by means specified on the specification for terminations. The system shall be suitable for types of cable specified and complete with stress relief system.

2.4.23.11 Termination and jointing of aluminium / copper conductor power cables shall be done by means of compression method using compression type aluminium / tinned copper lugs.

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

2.4.23.13 Cable joints shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit, subject to BHEL's approval of Engineer shall be taken for deciding location of joint.

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

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

2.4.24 Design Requirements of Items supplied for cabling installation work (if supply is covered in contractor scope).

2.4.24.1 Strip Cable Clamps

a. Strip Clamps shall be of aluminium alloy or cast steel or M.S. and shall be used to fasten the group of multicore cables on the tray.

b. Clamps shall be of simple construction, made of 4 mm thick, 25 mm wide strip to cover the entire width up to 300 wide tray and part of the tray for more than 300 wide trays. Strip shall have two right angle bends for fixing on the rung with two bolts.

c. Clamps shall be of different lengths for different sizes of tray width. The

maximum size of clamp width shall be 300 mm and for cable trays of greater width, two clamps shall be used.

2.4.24.2 Self Locking Clamps

d. Clamps shall be of nylon material / fibre glass.

e. Clamps shall have self-locking feature when the cord is looped.

f. Clamps shall be provided with manual lock release.

g. Clamp cord shall not move in the backward position once it has been locked, unless the lock release is applied.

h. Type test certificates to ascertain the strength of clamps shall be submitted for purchaser's approval.

i. Nylon self locking clamps shall be of BHEL approved make only.

2.4.24.3 Ferrules

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

b. Ferrules shall be of plastic material.

c. Numbering on the ferrules shall be engraved type with contrast colour to the base. Engrave colouring shall be of durable quality to match the entire life of the plant. Engraving shall be legible from a distance of 600 mm.

d. Ferrules shall be interlocking type in such a way that the interlocked ferrules take the shape of tube with complete ferrule number appearing in a straight line.

2.4.24.4 Tags

a. Cables shall be provided with cable number tags for identification.

b. Cable tags shall be of durable fibre, aluminium, stainless steel sheets or lead of suitable thickness

c. Cable number shall be engraved type in case of aluminium or stainless steel tags, and printed type in case of fibre sheet.

d. Tags shall be durable quality of size 60mm x 12mm with holes at both ends.

e. Samples of tags shall be approved by BHEL Engineer before delivery.

f. Tags shall be provided with non-corrosive wire of sufficient strength for taggings.

2.4.25 GUIDELINES FOR EARTHING INSTALLATION

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

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

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

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

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

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

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

2.4.25.8 Conduits shall be bonded together and grounded at all switchgear and control centres.

2.4.25.9 M.S.Earthing conductors shall be coated with one coat of bituminous paint, wrapped with a layer of bitumen tape and finally coated with bitumen paint. For site welded GI strips / wires required coat of aluminium paint should be given.

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

2.4.26 Guidelines for Erection of Control Panels and Distribution Boards

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

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

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

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

2.4.27 The following points shall be checked up during erection

a) Layout of foundation channels.

b) Floor level covered by the panel with respect to main floor level.

c) Location and serial no. panels.

d) Positioning of panels.

e) Verticality of panels and breaker truck to station earth.

f) Earthing of panels and breaker truck to station earth.

g) Lugs for termination of HT and LT cables.

h) Mounting and fixing arrangements all modules.

i) Check the operation of:

01. Remote control

02. Various required - closing / tripping / alarm / indications / interlocks Installation position of instruments and relays Operation of relays and instruments.

j) AC / DC supplies for panel.

k) Tightness of terminal connections for HT & LT connections.

l) Working of ammeters and voltmeters for their entire range and other panel mounted instruments like recorder, indicator etc.

2.4.28 415 V switchgear and Electrical panels tests (as applicable)

a. IR Test on each pole of breaker

b. IR test on control circuit

c. Measurement of contact resistance for all three phases of breaker

d. Measurement of resistance of the closing and tripping coil of breaker

e. Checking the close trip operation at 70% and 100% of the rated auxiliary D.C. Voltage.

f. Checking of interlocks provided and tripping of breaker through relays

g. Space heater operation check

h. Opening and closing time check

i. Control and metering circuit checks.

j. Primary and secondary injection tests.

k. Thermal overload relay testing and checking

l. Calibration of all instruments and meters

m. Phase rotation checks

n. High voltage test on 7C.1.3 kV switchboard

2.4.29 Cutting & Wastage Allowance

The following scrap allowances are permissible:

	Description	Non-salvageable	unaccountable
1.	Length below 0.5 m steel pipes, Stainless / Copper tubes, Single pair cables	2%	0.5%
2.	Length below 20m multi cable, multitubes	2%	0.5%

2.4.30 Gudelines for handling of solid state modules:

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

2.4.31 Guidelines for landing and storage of Electronic Cubicles / sub-assemblies / loose items.

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

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

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

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

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