TENDER SPECIFICATION
BHEL: PSSR: SCT: 1828
FOR

Handling at site stores / storage yard, transporting to site, erection, testing & commissioning including supply and application of final painting of Control and Instrumentation works

at

1 x 800 MW North Chennai TPS Stage III, Ponneri Taluk, Thiruvallur District, Tamil Nadu

VOLUME – I BOOK - I

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

Book- I Consists of

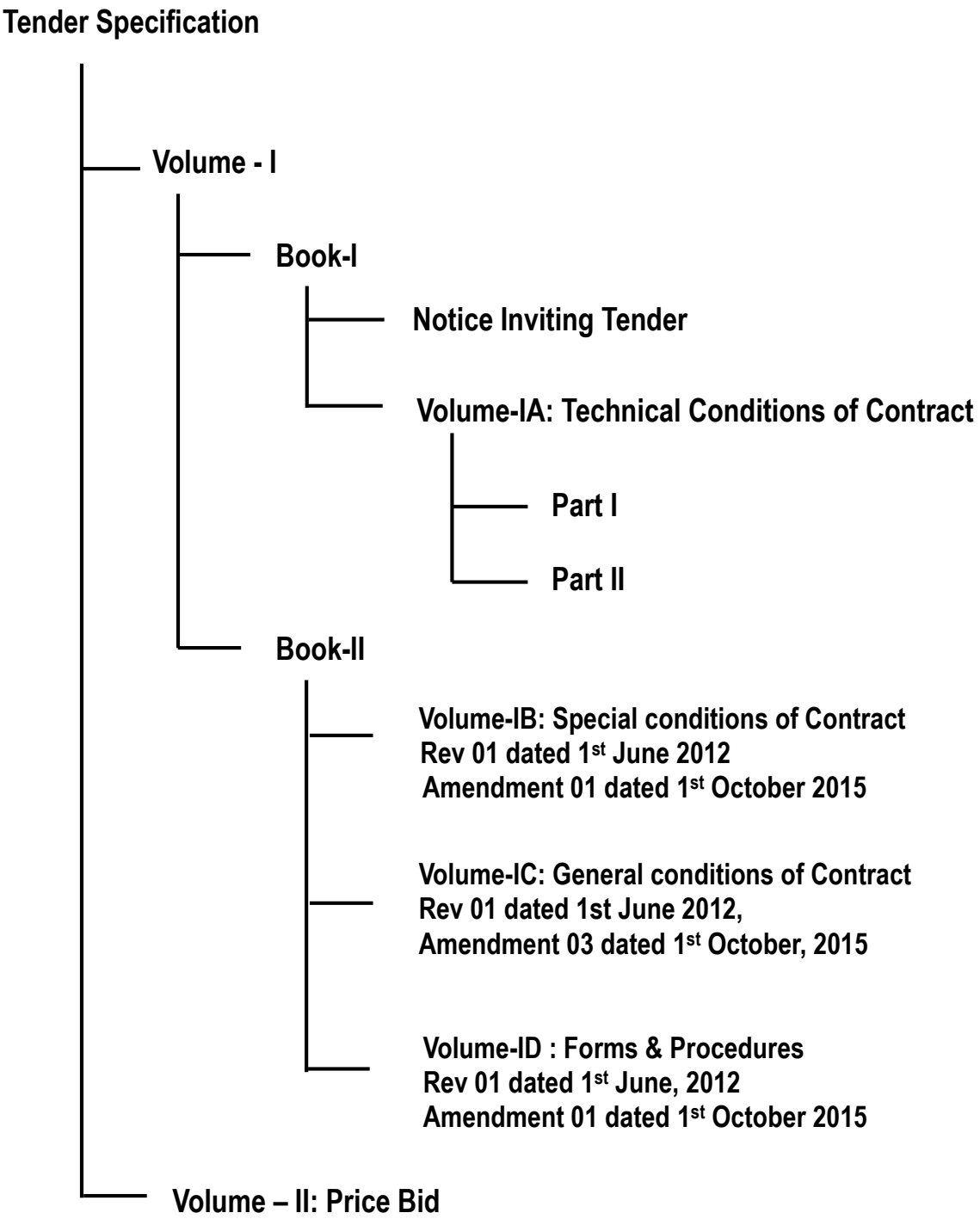
- **Notice Inviting Tender**
- **Volume-IA: Technical Conditions of Contract**

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 Amendment 01 dt 1st October, 2015**

BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)
Power Sector – Southern Region
690, Anna Salai, Nandanam, Chennai – 600 035

TENDER SPECIFICATION CONSISTS OF



NOTICE INVITING TENDER

Bharat Heavy Electricals Limited

Ref: BHEL: PSSR: SCT: 1828 **Date: 14.05.2019**

NOTICE INVITING TENDER (NIT)

Submission only through E-Procurement Portal
https://bhel.abcprocure.com

Note: However, Bidder may download Tender Documents from web sites

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To,

Dear Sir/Madam

Sub: NOTICE INVITING TENDER

Online Sealed offers in two part bid system are invited from reputed & experienced bidders (meeting PRE QUALIFICATION CRITERIA as mentioned in Annexure-I) **through E-Procurement Portal https://bhel.abcprocure.com** only, 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: 1828**	
ii)	**Broad Scope of job**	Handling at site stores / storage yard, transporting to site, erection, testing & commissioning including supply and application of final painting of Control and Instrumentation works for 1x800 MW at North Chennai TPS Stage III, Ponneri Taluk, Thiruvallur District, Tamil Nadu	
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 dated 1st June 2012, Amendment 01 dated October 01, 2015	Applicable
C	Volume-IC	General conditions of Contract Rev 01 dated 1st June 2012, Amendment 03 dated October 01, 2015	Applicable
D	Volume-ID	Forms & Procedures Rev 01 dated 1st June 2012 Amendment 01 dated October 01,2015	Applicable
E	Volume-II	Price Schedule (Absolute value).	Applicable

iv)	Issue of Tender Documents	**1.** This is an E-tender floated online through our E-Procurement Portal https://bhel.abcprocure.com **2. Sale Start: 15.05.19** Closes: Tender documents can be downloaded till due date of submission. **3.** From BHEL website (www.bhel.com -> Tender Notifications): Tender documents for bidder's reference can be downloaded from this website till due date of submission**.**	Applicable
v)	Due Date & Time of Offer Submission	**Date : 04.06.2019, Time :15.00 Hrs** Place: The bidder should submit their offer online in e-Procurement portal at https://bhel.abcprocure.com only. Offers are invited in two-parts only. Bidders are requested to upload their offer well in advance in order to avoid last minute congestion at this website. Hard copy bid or bids through email/ fax shall not be accepted.	Applicable
vi)	Opening of Tender	**Date: 04.06.19, 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 record their presence online, during tender opening. However this being an e-tender it shall be opened online	Applicable
vii)	EMD Amount	- Rs. 7,30,000 /- (Rs. Seven Lakhs & Thirty Thousand only). - Refer Volume-I A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I, Book-I) for mode of payment of Earnest Money Deposit (EMD). - It is to be noted that proof of remittance for EMD shall be made available at BHEL PSSR Office prior to tender opening. - EMD Exemption for MSMEs is not applicable for this tender. - One time EMD is not applicable.	Applicable

viii)	Cost of Tender	Rs. 2,000/- (Rupees Two Thousand Only) - Vol-1A Part-II Chapter-1 for mode of payment of EMD is also applicable for Cost of Tender.	Applicable
ix)	Last Date For Seeking Clarification	**Bidders may submit their queries in https://bhel.abcprocure.com 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 above.**	Applicable
x)	Schedule of Pre Bid Discussion (PBD)	**Date: 24th May, 2019** Time: **11.30AM** at BHEL PSSR - No. 690, EVR Periyar Building, Anna Salai, Nandanam,Chennai-35	Applicable
xi)	Integrity Pact & Details of Independent External Monitor (IEM)	IP is a tool to ensure that activities and transactions between the company and its Bidders / Contractors are handled in a fair, transparent and corruption free manner. A panel of Independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL. The IP as per format given at Volume 1D Formats (refer Volume I Book II) of this tender is to be submitted (duly signed and stamped by the authorized signatory who signs in the offer) along with Techno Commercial Bid. Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this pact would be a preliminary qualification. The Details of IEM for this tender is furnished below:- b) Please refer section- 8 of the IP (refer the format given at Volume 1D Formats of this tender) for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender. **Note:** No routine correspondence shall be addressed to the IEM (Phone / Post / E mail) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification / issues shall be posted in **https://www.bhel.abcprocure.com.** Any other queries may be addressed directly to the	Not Applicable

		tender issuing (Procurement) department as mentioned below: <table><tr><td>Shri. Vinod Jaseja DGM/SCT</td><td>Shri.Sandipan Biswas AGM/SCT & Purchase</td></tr><tr><td>Sub Contracts</td><td>Sub Contracts</td></tr><tr><td>91 44 28286748</td><td>91 44 28286757</td></tr><tr><td>jaseja@bhel.in</td><td>bsandipan@bhel.in</td></tr></table>	
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 (http://www.bhel.com→Tender Notifications), CPP Portal (https://eprocure.gov.in) & portal https : // bhel .abcprocure.com. 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 form in e-Procurement website, shall not be entertained.

3.0 Unless specifically stated otherwise, bidder shall remit cost of tender in line with mode of payment applicable to EMD as per Volume-1A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I Book-I) under the heading 'Modes of deposit of EMD'.

4.0 Unless specifically stated otherwise, bidder shall deposit Earnest Money Deposit (EMD) as mentioned in Volume IA, Part-II, Chapter-1 of Technical Conditions of Contract (Volume-I Book-I). Please note that 'One Time EMD' shall not be considered. For mode of payment of EMD, bidder shall refer Vol- 1A Part- II Chapter- 1 of Technical Conditions of Contract (Volume- I Book- I). **It is to be noted that proof of remittance for EMD shall be made available at BHEL PSSR Office prior to tender opening.**

5.0 **Procedure for Submission of Tenders**: This is an E-tender floated online through our E-Procurement portal https://bhel.abcprocure.com. The bidder should respond by submitting their offer online only in our e-Procurement portal at https://bhel.abcprocure.com. Hard copy bid or bids through email/ fax shall not be accepted.

I. Pre-requisite for Offer Submission:-

Digital Certificate: To access an e-Tender, you need to have a Class-III Digital Signature Certificate (DSC) for Signing & Encryption (Required both digital signature certificate: Signing & Encryption) of bids issued by any of the valid Certifying Authorities (approved by Controller of Certifying Authorities) in India. Valid Digital Signature Certificate (DSC) must be installed in a computer system from where you want to access the website.

MINIMUM REQUIREMENT: (Mandatory)

- Computer with good Internet Connection.
- Operating System should be Windows Vista / Windows 7 and above.
- Web Browsers: Internet Explorer 9.0 (32-bit Browser only) & above.

Bidder to also refer, the following documents available at E-Procurement portal https://bhel.abcprocure.com:

- Minimum System Requirements & Settings document for BHEL Users and Bidders.
- Bidder Manual for BHEL Bidders

At first time login, to verity and approve your login profile & DSC, you are requested to contact e-Procurement Service Provider. Digital Signing of e-Tender

II. Digital Signing of e-Tender

Tenders shall be uploaded with all relevant documents in PDF/zip format. The relevant tender documents should be uploaded by an authorized person having Class-III Digital Signature Certificate (DSC) for Signing & Encryption.

i) The Requirement:

a.PC with Internet connectivity &
b. DSC (Digital Signature Certificate) Class-II/III Digital Signature Certificate (DSC) for Signing & Encryption).

III. E-procurement service Provider-:

Address:

e-Procurement Technologies Limited (abcProcure),
Head Office:B-704/705, Wall Street - II, Opp. Orient Club,
Nr. Gujarat College, Ellis Bridge, Ahmedabad - 380 006, Gujarat (India)

Timing:
Indian Standard Time (+5:30 GMT): 10:00 AM - 07:00 PM (Monday to Friday)
Indian Standard Time (+5:30 GMT): 10:00 AM - 04:00 PM (Saturday)

The contact details of the service provider are given below:
Contact: +91-79-40270549/560/590
E-Mail: bhel.support@abcprocure.com

Further contact details can be obtained by visiting the following webpage:
https://bhel.abcprocure.com/EPROC/contactus

IV. Documents Comprising the e-Tender

The tender shall be submitted online - ONLY EXCEPT TENDER FEE & EMD (in physical form) as mentioned below:

i) Technical Tender (UN- priced Tender)

Bidders shall furnish the following information along with technical tender (preferably in pdf format):

i). Tender Cost and Earnest Money Deposit (EMD) furnished in accordance with **NIT Clause 3.0 & 4.0.**

ii). All Technical details (eg. Eligibility Criteria requested, Technical Conditions of Contract) should be attached in e-tendering module (As detailed in Clause 6.0 below), failing which the tender stands invalid & may be REJECTED.

ii) Price Bid:

a. Prices are to be quoted as per the Price Bid format attached online on e-tender portal.
b. The price should be quoted for the accounting unit indicated in the e-tender document.
c. The item description, Quantity and Unit of measurement, as mentioned in Price bid uploaded by BHEL and subsequent revisions issued by BHEL, shall be binding on the bidder.

Note:

i). It is the responsibility of tenderer to go through the Tender document to ensure furnishing all required documents in addition to above, if any. Any deviation would result in REJECTION of tender and would not be considered at a later stage at any cost by BHEL.

ii). A person signing (manually or digitally) the tender form or any documents forming part of the contract on behalf of another shall be deemed to warrantee that he has authority to bind such other persons and if, on enquiry, it appears that the persons so signing had no authority to do so, the purchaser may, without prejudice to other civil and criminal remedies, cancel the contract and hold the signatory liable for all cost and damages.

iii). A tender, which does not fulfil any of the above requirements and/or gives evasive information/reply against any such requirement, shall be liable to be ignored and rejected.

iv). In case offer is sent through hard copy/fax/telex/cable/electronically in place of e-tender, same shall not be considered.

i). Vendors are also requested to go through bidder manual available on https://bhel.abcprocure.com

V. DO NOT'S (Don't's)

Bidders are requested NOT to submit the hard copy of the Bid. In case offer is sent through hard copy/ fax/ telex/ cable/ electronically in place of e-tender, the same shall not be considered.

6.0 DOCUMENTS TO BE UPLOADED & MODALITY OF UPLOADING in E-PROCUREMENT PORTAL https://bhel.abcprocure.com SHALL BE AS DETAILED BELOW:

Sl No	Description	Remarks
	Techno-Commercial Bid CONTAINING THE FOLLOWING:-	
i.	Covering letter / Offer forwarding letter of Tenderer.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
ii.	Duly filled-in `No Deviation Certificate' as per prescribed format to be placed after document under sl no (i) above. **Note:** 1 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 attached along with document under sl no (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com

	2 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. (Technical & Financial) As detailed in Clause No. 25 of NIT, 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.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
iv.	All Amendments / Correspondences / Corrigenda / Clarifications / Changes / Errata etc pertinent to this NIT.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
v.	Integrity Pact Agreement (Duly signed by the authorized signatory) **(not applicable for this tender)**	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification / NIT	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
vii.	Notice inviting Tender (NIT)	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
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)	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	

		for BHEL Bidders" available on https://bhel.abcprocure.com
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
xiii.	Any other details preferred by bidder with proper indexing.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com
Caution to Bidders: - The duly signed & stamped copies of Volume – I Book I & Volume I Book II are to be attached in their respective sections. Also, for any further queries, refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com		

	PRICE BID consisting of the following shall be attached as mentioned below	
i	Price/ Total Amount corresponding to the total works as specified in "Part C: Bill of Quantities" available in "Volume II – PRICE BID (latest Revision) shall be quoted in the Price Bid Form available in e-Procurement portal. Bidders to note that documents uploaded under the Price Bid Form shall be considered for commercial evaluation of offer.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available on https://bhel.abcprocure.com

SPECIAL NOTE:

i. All documents / annexures submitted with the **offer shall be properly attached / entered / uploaded in the respective sections**. BHEL shall not be responsible for any missing documents.

ii. **Your offer & documents submitted along with offer shall be signed & stamped in each page by your authorized representative.**

iii. No overwriting/ correction in tender documents by bidders shall be allowed. However, if correction is unavoidable, the same may be signed by authorized signatory.

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 cut off month for reckoning 'Load' shall be the 3rd Month preceding the month corresponding to the 'latest date of bid submission', in the following manner -
(**Note:** For example, if latest bid submission is in Jan 2017, then the 'load' shall be calculated up to and inclusive of Oct 2016)

Total number of Packages in hand = Load (P)

Where 'P' is the sum of all unit wise identified packages (refer table-1) under execution with BHEL Regions as on the cut off month defined above, including packages yet to be commenced, excepting packages which are on Long Hold.

II. **PERFORMANCE**: Here 'Monthly Performance' of the bidder for all the packages (under execution/ executed during the 'Period of Assessment' in all 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 and including the cut off month. The cut off month for reckoning 'Period of Assessment' shall be the 3rd Month preceding the month corresponding to 'latest date of bid submission', in the following manner:

(**Note**: For example, if 'latest date of bid submission' is in Jan 2017, then the 'performance' shall be assessed for a 6 months' period up to and inclusive of Oct 2016 (i.e. from May 2016 to Oct 2016), 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 of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions = $\mathbf{P_T}$ (i.e. $P_T = P_1 + P_2 + P_3 + P_4 + \ldots P_N$)

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 ($S_{1\text{-}1}$, $S_{1\text{-}2}$, $S_{1\text{-}3}$, $S_{1\text{-}4}$, $S_{1\text{-}5}$…. $S_{1\text{-}T1}$) for similar package P_1, for the 'period of assessment' 'T_1' (i.e. $S_1 = S_{1\text{-}1} + S_{1\text{-}2} + S_{1\text{-}3} + S_{1\text{-}4} + S_{1\text{-}5} + \ldots S_{1\text{-}T1}$). 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

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

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

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 = $\mathbf{P_T}$ i.e. 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 Packages (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). <u>Calculation of Overall 'Performance Rating' ($\mathbf{R_{BHEL}}$) in case at least 6 evaluation scores for 'similar Package/Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment'</u>:

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

a) 'Period of Assessment' i.e. 6 months preceding and including the cut-off month
b) 12 months preceding and including the cut-off month

c) 24 months preceding and including 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 ≤ P_{Max}
(Where P is calculated as per clause 'I' above)

Note: For the transition period of 1 year (i.e. for all the NITs floated between 11th May 2019 to 10th May 2020), in addition to above, 'Assessment of Capacity of Bidder' shall also be calculated considering 'performance scores' till 36 months as per Sl. no II ii).

Higher of the results obtained out of both shall be considered for 'Assessment of Capacity of Bidder'.

IV. **Explanatory note**:

i). Similar package means Boiler or ESP or Piping or Turbine or Civil or Structure or Electrical or C&I 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, C&I, 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 (i.e. Boiler, ESP and Power Cycle Piping) and finally the Bidder's capacity to execute the tendered scope is assessed in line with III above.

ii). Identified Packages (Unit wise)

Table-1

Civil	Electrical and C&I	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). C&I iii). Others (Elect. and C&I)	i). Boiler & Aux (All types including CW Piping if applicable) ii). Power Cycle Piping/Critical Piping iii). ESP iv). LP Piping 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 Management x). Others (Mechanical)

iii). Bidders who have not been evaluated for at least six package months in the last 24 months preceding and including the Cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions, 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 completion of all the contracts against which vendor has been tagged as First Timer or availability of 6 evaluation scores within last 24 months preceding and including the Cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions.

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 'Assessment of Capacity of Bidders'.

iv). Consequent upon applying the criteria of 'Assessment of Capacity of Bidders' detailed above on all the bidders qualified against Technical and Financial Qualification criteria, if the number of qualified bidders reduces to less than four, then for further processing of the Tender, BHEL at its discretion reserves the right to also consider the bidders who are "not qualified" as per criteria of 'Assessment of Capacity of Bidders' and for this, procedure described in following three options shall be followed:

a) All the bidders having Overall Performance Rating ('R_{BHEL}') ≥60 shall be considered qualified against criteria of 'Assessment of Capacity of Bidders'.

b) If even after using option "a", the number of qualified bidders remains less than four, then in addition to bidders considered as per option "a", "First timer" bidders having average of available performance scores ≥60 upto and including the Cut Off month shall also be considered qualified against criteria of 'Assessment of Capacity of Bidders'.

c) If even after using option "a" and "b", the number of qualified bidders remains less than four, then in addition to bidders considered as per option "a" and "b", "First timer" bidders for whom no performance score is available in the system upto and including the Cut Off month, shall also be considered qualified against criteria of 'Assessment of Capacity of Bidders'.

Note:- In case, the number of bidders qualified against Technical and Financial Qualification criteria itself is less than four, then all bidders (a)- having Overall Performance Rating ('R_{BHEL}') ≥60, (b)- First timer" bidders having average of available performance scores ≥60 upto and including the Cut Off month, (c)- "First timer" bidders for whom no performance score is available in the system upto and including the Cut Off month, shall be considered qualified against criteria of 'Assessment of Capacity of Bidders' for further processing of tender.

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

a. Up to execution of 90% of anticipated Contract Value in case of Civil, MM, Structural and Turbo Blower Packages

b. Up to Steam Blowing in case of Boiler/ESP/Piping Packages

c. Up to Synchronization in all Balance Packages

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

vi). Contractor shall provide the latest contact details i.e. mail-ID and Correspondence Address to SCT Department, so that same can be entered in the Contractor Performance Evaluation System, and in case of any change/discrepancy same shall be informed immediately. Login Details for viewing scores in Contractor Performance Evaluation System shall be provided to the Contractor by SCT Department.

vii). Performance Evaluation for Activity Month shall be completed in Evaluation Month (i.e. month next to Activity Month) or in rare cases in Post Evaluation Month (i.e. month next to Evaluation Month) after approval from Competent Authority. In case scores are not acceptable, Contractor can submit Review Request to GM Site/ GM Project latest by 25th of Evaluation Month or 3 days after approval of score, whichever is later. However, acceptance/rejection of 'Review Request' solely depends on the discretion of GM Site/GM Project. After acceptance of Review Request, evaluation score shall be reviewed at site and the score after completion of review process shall be acceptable and binding on the contractor.

viii). Project on Hold due to reasons not attributable to bidder -

a. **Short hold:** Evaluation shall not be applicable for this period, however Loading will be considered.

b. **Long hold:** Short hold for continuous six months and beyond or hold on account of Force Majeure shall be considered as Long Hold. Evaluation as well as Loading shall not be considered for this period.

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

11.0 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.

12.0 For any clarification on the tender document, the bidder may seek the same in clarification provision available in procurement portal https://bhel.abcprocure.com, 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.

13.0 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.

14.0 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.

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

16.0 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 Integrity pact is to be submitted by Prime Bidder & Consortium / Technical Tie up partner jointly in case Consortium bidding is permitted, otherwise by the sole bidder. The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (1) above.

17.0 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.

18.0 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 authorized 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.

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

20.0 BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'Process compliance form' (to the designated service provider) as well as 'Online sealed bid' in the Reverse Auction. Non-submission of 'Process compliance form' or 'Online sealed bid' by the agreed bidder(s) will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers / contractors (as available on www.bhel.com).

The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. **The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.**

If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

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

22.0 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.

23.0 Void

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

25.0 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.

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

27.0 The offers of the bidders who are under suspension 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".

28.0 It may be noted that guidelines / rules in respect of 'Suspension of Business dealings' available on BHEL website "www.bhel.com→ Supplier Registration", "Vendor evaluation format", etc may undergo change from time to time and the latest one shall be followed.

29.0 Void

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

31.0 Integrity commitment, performance of the contract and punitive action thereof:

31.1 Commitment by BHEL:

BHEL commits to take all measures necessary to prevent corruption in connection with the tender process and execution of the contract. BHEL will during the tender process treat all Bidder(s) in a transparent and fair manner, and with equity.

31.2 Commitment by Bidder / Supplier / Contractor:

31.2.1 The bidder / supplier / contractor commit to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.

31.2.2 The bidder / supplier / contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.

31.2.3 The bidder / supplier / contractor will perform / execute the contract as per the contract terms & conditions and will not default without any reasonable cause, which causes loss of business / money / reputation, to BHEL.

31.3 If any bidder / supplier / contractor during pre-tendering / tendering / post tendering / award / execution / post-execution stage indulges in mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, then, action may be taken against such bidder / supplier / contractor as per extant guidelines of the company available on www.bhel.com and / or under applicable legal provisions.

32.0 Bid should be free from correction, overwriting, using corrective fluid etc. Any interlineation, cutiing, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for rejection.
All overwriting/ cutting, etc. will be numbered by bid opening officials and announced during bid opening.

33.0 For this procurement, Public Procurement (Preference to Make in India), Order 2017 dated 15.06.2017 & 28.05.2018 and subsequent Orders issued by the respective Nodal Ministry shall be applicable even if issued after issue of this NIT but before finalization of contract/ PO/ WO against this NIT.

34.0 In the event of any Nodal Ministry prescribing higher or lower percentage of purchase preference and/ or local content in respect of this procurement, same shall be applicable.

35.0 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; Amendment: 01 Dt. 1st October 2015
f. General Conditions of Contract (GCC) —Volume-1C
   Rev. 01 Dt. 01 Jun 2012; Amendment: 03 Dt. 1st October 2015
g. Forms and Procedures —Volume-1D
   Rev. 01 Dt. 01 Jun 2012; Amendment: 01 Dt. 1st October 2015

For and on behalf of BHARAT HEAVY ELECTRICALS LTD

Additional General Manager / SCT & Purchase

Enclosure

1. Annexure-1 : Pre Qualifying criteria.
2. Annexure-2 : Check List.
3. Annexure-3 : Technical Pre-Qualification Criteria.
4. Annexure-4 : Annexure to Pre-Qualifying Criteria.
5. Annexure-5 : Tender Schedule.
6. Annexure-6 : Declaration for Reverse auction.
7. Other documents as per this NIT.

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	Handling at site stores / storage yard, transporting to site, erection, testing & commissioning including supply and application of final painting of Control and Instrumentation works for 1 x 800 MW at North Chennai TPS Stage III, Ponneri Taluk, Thiruvallur District, Tamil Nadu
TENDER No.	**BHEL: PSSR: SCT: 1828**

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 for details	Applicable	To be filled in Annexure-4
C: C-1	**FINANCIAL** **Turnover** Bidders must have achieved an average annual financial turnover (Audited) of Rs.1,10,00,000 /- (Rs. One Crore & Ten Lakhs only) or more over last three Financial Years (FY) i.e. 2015-16,2016-17& 2017-18	Applicable	To be filled in Annexure-4
C-2	**Networth** (only in case of Companies) Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive	Applicable	To be filled in Annexure-4

C-3	**Profit** Bidder must have earned profit in any one of the three Financial Years as applicable in the last three Financial Years defined in 'C-1 above based on latest Audited Accounts.	Applicable	To be filled in Annexure-4
C-4	Bidder must not be under Bankruptcy Code Proceedings (IBC) by NCLT or under liquidation / BIFR, which will render him illegible for participation in this tender, and shall submit undertaking to this effect.	Applicable	Undertaking to be enclosed with the offer
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. If Financial Statements are not required to be audited statutorily, then instead of audited financial statements, financial statements are required to be certified by Chartered Accountant.
4. C-2:- NETWORTH: Shall be calculated based on the latest Audited Accounts as furnished for C-1 above. Net worth =Paid up share capital* + reserves (* Share capital OR Partnership Capital OR Proprietor Capital as the case may be) (Net worth is required to be evaluated in case of companies).
5. C-3:- PROFIT : shall be PBT earned during any one year of the three financial years as in C-1 above

	6. For Evaluation of PQR, the credential of the Bidder alone, and not that of the Group Company shall be considered. 7. Time period for achievement of the 'Technical' criteria of PQR (as in 'B' above) will be the last 7 years ending on the 'latest date' of Bid submission 8. Boiler means HRSG or WHRB or any other types of Steam Generator 9. Power Cycle piping means Main Steam, Hot Reheat, Cold Reheat, HP Bypass, LP Bypass lines 10. For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5TPH where ever rating of HRSG/BOILER is mentioned in MW. Similarly, where ever rating of Gas Turbine is mentioned in terms of Frame size, ISO rating in terms of MW shall be considered for evaluation. 11. In case the experience/PO/WO certificate enclosed by bidders do not have separate break up prices for the E&C portion of Electrical and CI Works, (i.e. the certificates enclosed are for composite order for supply and erection of Electrical & CI and other works if any), then value of Erection and Commissioning for the Electrical & CI portion shall be considered as 15% of the supply & erection of Electrical & CI. 12. Scope for capital overhaul of STG shall cover Bearing Inspection work and overhauling of all cylinders of the Turbine unless otherwise specifically indicated in the PQR.. 13. In case the tendered scope is not a Pulverised Fuel Boiler, experience of Oil/ Gas Fired Boilers also can be considered unless otherwise specifically indicated in the PQR.

Note:

(i) 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.

(ii) Authenticity of Credentials submitted by the Bidder against 'Pre-Qualifying Criteria' shall be verified from the Issuing Authority, by BHEL. In case, any credential(s) is/are found to be unauthentic, offer of the bidder is liable to be rejected. BHEL reserves the Right to Initiate any further action as per the "Guidelines for Suspension of Business Dealings with Suppliers/Contractors" (Published in http://www.bhel.com/vender_registration/vender.php) and "Fraud Prevention Policy" (Published in http://www.bhel.com/home.php) as applicable.

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 (Remittance of EMD should be in line with Mode of Deposit as detailed in Volume-1A, Part 2, Chapter 1 of Technical Conitions of Contract (Volume-I Book-I)	Mode of Remittance: Ref No: Date : Amount:		
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-IV**) is understood and filled with proper supporting documents referenced in the specified format		Applicable	YES / NO
7	Submission of Copy Audited Balance Sheet and Profit and Loss Account for the last three years (Refer "Explanatory Note for the PQR" in Annexure 1 of NIT)		Applicable	YES / NO
8	Submission of Copy of PAN Card		Applicable	YES / NO

9	Whether all pages of the offer documents are signed by the person authorized to sign this offer.	Applicable	YES / NO
10	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable	YES / NO
11	Submission of Integrity Pact	Not Applicable	YES / NO
12	Submission of Declaration by Authorised Signatory	Applicable	YES / NO
13	Submission of No Deviation Certificate	Applicable	YES / NO
14	Submission of Declaration confirming knowledge about Site Conditions	Applicable	YES / NO
15	Submission of Declaration for relation in BHEL	Applicable	YES / NO
16	Submission of Non Disclosure Certificate	Applicable	YES / NO
17	Submission of Copy Bank Account Details for E-Payment	Applicable	YES / NO
18	Submission of Capacity Evaluation of Bidder for current Tender	Applicable	YES / NO
19	Submission of Tie Ups/Consortium Agreement are submitted as per format Form F22 of Book-II Vol-1D	Not Applicable	YES / NO
20	Submission of Power of Attorney for Submission of Tender / Signing Contract Agreement	Applicable	YES / NO
21	Submission of Analysis of Unit rates	Applicable	YES / NO
22	Submission of Unquoted Price Bid	Applicable	YES / NO
23	Tabular column showing Category- wise, month wise, man power deployment sub package wise planned for the execution of the scope of works.	Applicable	YES / NO
24	Declaration by bidder for price opening through reverse auction (Refer Annexure-7 of Notice Inviting Tender)	Applicable	YES / NO
25	Copy of Organization Chart	Applicable	YES / NO
26	Copy of Registration / Incorporation certificate, Partnership Deed (Certified by Notary Public) as applicable for firm.	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. 11 to 21 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. Technical Pre Qualification Criteria - Technical

Bidder should satisfy both the clauses B.1 and B.2 mentioned below:

B.1) Bidder should have executed* the following (B.1.1 to B.1.3) in the last seven years reckoned from the latest due date of Bid Submission.

B.1.1 One (1) C&I / Electrical and C&I work of value not less than **Rs 2.90 Crores.**

(OR)

B.1.2 Two (2) C&I / Electrical and C&I works each of value not less than **Rs 1.80 Crores.**

(OR)

B.1.3 Three (3) C&I / Electrical and C&I works each of value not less than **Rs 1.45 Crores.**

Note: The term executed* above means the Bidder should have achieved the criteria specified in the

(AND)

B.2) Bidder should have executed# Erection, Testing and Commissioning of C&I works for BTG/ GT or C&I works consisting of DCS/ DDC/ Station C&I in one **unit** of 400 MW or above in the last seven years reckoned from the latest date of Bid Submission.

Note: The term executed# above means "Synchronization" of the Unit.

(OR)

Bidder should have executed** at least one contract of Erection, Testing and Commissioning of C&I works consisting of DCS/ DDC/ Station C&I in any Industry with its executed value of Rs 2.80 Crores (Rs. Two Crores and Eighty Lakhs only) or more in the last seven years reckoned from the latest date of Bid Submission.

Note: The term executed** above means "Work completion of the value as defined in PQR above".

Note to Technical PQR:

1) **The value of work executed* in B.1 of PQR will be updated as per PVC formula of GCC with indices for "All India average consumer price index for Industrial workers" and "Monthly Whole Sale Price Index for All Commodities" with base month as per last month of work execution and indexed up to three (3) months prior to the month of latest due date of bid submission as per the following formula –**

$$P = R + \left\{ 0.425 \times R \times \frac{(X_N - X_0)}{X_0} \right\} + \left\{ 0.425 \times R \times \frac{(Y_N - Y_0)}{Y_0} \right\}$$

Example Calculation for value updation:

Value of work is to be updated with indices for "All India Avg. Consumer Price index for industrial workers" and "Monthly Whole Sale Price Index for All Commodities" with base month as per last month of work execution and indexed up to three (3) months prior to the month of latest due date of bid submission as per following formula : -

$$P = R + \left\{ 0.425 \times R \times \frac{(X_N - X_0)}{X_0} \right\} + \left\{ 0.425 \times R \times \frac{(Y_N - Y_0)}{Y_0} \right\}$$

Where

P = Updated value of work
R = Value of executed work
X_N = All India Avg. Consumer Price index for industrial workers for the month, three months prior to the month of latest due date of bid submission (e.g. If latest bid submission date is 03-Apr-17, then bid submission month shall be reckoned as April'17 and index for Jan'17 shall be considered).
X_0 = All India Avg. Consumer Price index for industrial workers for last month of work execution
Y_N = Monthly Whole Sale Price Index for All Commodities for the month, three months prior to the month of latest due date of bid submission (e.g. If latest bid submission date is 03-Apr-17, then bid submission month shall be reckoned as April'17 and index for Jan'17 shall be considered).
Y_0 = Monthly Whole Sale Price Index for All Commodities for last month of work execution.

2) No consortium bid is allowed for this Tender. However, for the purpose of qualification, after successful execution of two similar works in consortium with the same consortium partner(s) under direct orders from BHEL, the prime bidder in such contracts shall be eligible for becoming a standalone bidder for this tender work, subject to certification from end user / purchaser about the active involvement of the prime bidder for satisfactory execution of works in such contracts.

Annexure-4

Additional Format to be submitted by Bidders in an additional separate cover superscribed "Annexure to Pre-Qualifying Criteria".

Non submission of this additional format will make the bid liable for rejection

Name of the Bidder: M/s……

Sl. No.	PQR Ref	PQR (Reproduced from Annexure – 3)	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, Quantity/ rating & Period	Remarks
1A	**Technical B**	B Technical PQR B.1) Bidder should have executed* the following (B.1.1 to B.1.3) in the last seven years reckoned from the latest due date of Bid Submission. B.1.1 One (1) C&I / Electrical and C&I work of value not less than Rs 2.90 Crores. **(OR)** B.1.2 Two (2) C&I / Electrical and C&I works each of value not less than Rs 1.80 Crores. **(OR)**					

		B.1.3 Three (3) C&I / Electrical and C&I works each of value not less than Rs 1.45 Crores. Note: The term executed* above means the Bidder should have achieved the criteria specified in the **(AND)** B.2) Bidder should have executed# Erection, Testing and Commissioning of C&I orks for BTG/ GT or C&I works consisting of DCS/ DDC/ Station C&I in one **unit** of 400 MW or above in the last seven years reckoned from the latest date of Bid Submission. Note: The term executed# above means "Synchronization" of the Unit. **(OR)** Bidder should have executed** at least one contract of Erection, Testing and Commissioning of C&I works consisting of DCS/ DDC/ Station C&I in any Industry with its executed value of Rs 2.80 Crores (Rupees Two Hundred and eighty Lakhs) or more in the last seven years reckoned from the latest date of Bid Submission.					

		Note: The term executed** above means "Work completion of the value as defined in PQR above".					
2	**Financial** **C1**	TURNOVER Bidders must have achieved an average annual financial turnover (Audited) of **Rs. 1,10,00,000 /- (Rs. One Crores & Ten Lakhs only)** or more over last three Financial Years (FY) i.e., 2015-16, 2016-17and 2017-18.					
3	**Financial** **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					
4	**Financial** **C3**	PROFIT Bidder must have earned 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.					
	Financial **C4**	Bidder must not be under Bankruptcy Code Proceedings (IBC) by NCLT or under liquidation / BIFR, which will render him illegible for participation in this tender, and shall submit undertaking to this effect.					

Non submission of this additional format will make the bid liable for rejection.

Note: Indicate the page nos in the respective columns for the enclosed PQR supporting documents in the offer

Annexure-5

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 fourth day of Tender opening date	
Last date for Bidders to submit the clarifications / documents required	On or before fifth 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	Twelth 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-6

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

1.1	Project Title	:	1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III.
1.2	Plant capacity	:	800 MW
1.3	Type of project	:	Brown field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	In the premises of North Chennai Thermal Power Station (NCTPS)
1.6	Location co-ordinates	:	80° 19' E to 80° 20' E Longitude 13° 13' N to 13° 18' N Latitude
1.7	Nearest Village	:	Ennore & Puzhudhivakkam Village
1.8	Nearest Town & City	:	Chennai (35 Km)
1.9	State Capital	:	Chennai (35 Km)
1.10	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai – Vijayawada Line
1.11	Nearest Airport	:	Chennai (~ 60 Km)
1.12	Nearest Seaport	:	Ennore (~ 3 Km)
1.13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri highway
2.0	**Meteorological Condition**		
2.1	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
2.2	Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	45 ºC
b.	Annual Minimum Mean Temperature	:	15 ºC
c.	Design ambient temperature	:	30 ºC
2.4	Relative Humidity		
a.	Maximum	:	90 %
b.	Minimum	:	36 %
c.	Design	:	75 %

2.5	Annual Rainfall		
	Maximum	:	2540 mm
	Average	:	1600 mm
	Minimum	:	1175 mm
2.6	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)
2.7	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
2.7	Seismic zone	:	Zone: III as defined in IS:1893-2002
2.8	Design ambient temperature for Electrical equipment	:	50 °C

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:

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 Vibration Monitoring System, SWAS, Flue Gas analyser, Master clock system, Coal Bunker level monitor, LVS System, Hart Management System, Furnace Flame Viewing system EPABX, CCTV, UPS, Wireless communication, Station LAN, OPC connectivity to all PLC, C&I lab 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 Vibration Monitoring System, SWAS, Flue Gas analyser, Master clock system, Coal Bunker level monitor, LVS System, Hart Management System, LVS system, Furnace Flame Viewing system EPBAX, CCTV, C&I lab, Wireless communication, Station LAN, OPC connectivity to all PLC 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

d. Seal welding on temperature stub on piping before hydra test.

e. Removal of seal welding on temperature stub on piping after successful completion of hydra test. Height of the temp stub to be maintained as per piping drawing.

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
		BHEL	Bidder	
1.3.1	**PART I**			
1.3.1.1	**ESTABLISHMENT**			
1.3.1.1.1	**FOR CONSTRUCTION PURPOSE:**			
1.3.1.1.1.1	Open space for office	Yes		
1.3.1.1.1.2	Open space for storage	Yes		
1.3.1.1.1.3	Construction of bidder‘s office, canteen and storage building including supply of materials and other services		Yes	
1.3.1.1.1.4	Bidder‘s all office equipments, office / store / canteen consumables		Yes	
1.3.1.1.1.5	Canteen facilities for the bidder‘s staff, supervisors and engineers etc		Yes	
1.3.1.1.1.6	Fire fighting equipments like buckets, extinguishers etc		Yes	
1.3.1.1.1.7	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.3.1.1.2	**FOR LIVING PURPOSES OF THE BIDDER**			
1.3.1.1.2.1	Open space		Yes	
1.3.1.1.2.2	Living accommodation		Yes	
1.3.1.2	**ELECTRICITY**			**Chargeable Basis**
1.3.1.2.1	Electricity For construction purposes (to be specified whether chargeable or free)			Prevailing rate of TANGEDCO
1.3.1.2.1.1	Single point source	Yes		
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	
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	Calibration certificate to be provided
1.3.1.2.2.3	Duties and deposits including statutory clearances		Yes	

Sl.No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.4	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	**WATER SUPPLY**			**Chargeable Basis**
1.3.1.3.1	For construction purposes:			Prevailing rate of TANGEDCO
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	**LIGHTING**			
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	**COMMUNICATION FACILITIES for site operations of the bidder**	-		
1.3.1.5.1	Telephone, Fax, internet, internet, email etc (min 2 Nos of PC & Printer) – 2 Data entry operator with computer knowledge		Yes	
1.3.1.6	**COMPRESSED AIR SUPPLY**			
1.3.1.6.1	Supply of Compressor and all other equipments	-	YES	
1.3.1.6.2	Installation of above system and operation &	-	YES	
1.3.1.6.3	Supply of the all the consumables for the above		YES	

Sl.No	Description	Scope to be taken		Remarks
1.3.2	**PART II**	**BHEL**	**Bidder**	
1.3.2.1	**ERECTION FACILITIES**			
1.3.2.1.0	Engineering works for construction			In consultation with BHEL
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	
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	
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes	Yes	In consultation with BHEL
1.3.2.1.5	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
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	
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 **LAND FOR SITE OFFICE AND LABOUR COLONY**

1.3.3.1 Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, fabrication yard and storage area at the job site, contractor's stores shed(s).

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. Contractor has to make his own arrangements for labour colony.

1.3.3.3 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 at one points within plant area by BHEL on chargeable basis at the applicable rate of TANGEDCO under LT tariff VI at the nearest substation. The present LT tariff VI rate of TANGEDCO is

a) Consumption charges at Rs.12.00 per unit
b) Fixed charges as applicable per month
c) Electricity Tax on total amount

The TANGEDCO tariff and tax may vary from time to time. The required Energy meter for measuring the consumption shall be provided and installed by the contractor. Any dispute regarding consumption, the BHEL engineer's decision is final. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc.

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

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1.3.4.3 Provision of distribution of electrical power from the given points 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.

1.3.4.4 The required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the 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 Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.85-0.9 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.

1.3.4.7 Contractor has to make his own arrangements for his electricity requirement for his labour colony at his cost.

1.3.4.8 As there are bound to be interruptions in regular power supply, power cut/load shedding in any construction sites, contractor should 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 CONSTRUCTION WATER

1.3.5.1 Water (Raw water) required for construction purposes will be provided at one single point within the plant area on chargeable basis from the nearest storage tank located inside the plant area at the prevailing rates of TANGEDCO / Metro water. The required water meter for measuring the consumption shall be provided and installed by the contractor. The required pumps & accessories, pipes for drawing water from the storage tank and further distribution will be arranged by the contractor at their cost.

1.3.5.2 The water charges may vary from time to time as per TANGEDCO / Metro water conditions, however the prevailing water charge is Rs 66.00 per 1000 litres. Any dispute regarding consumption, the BHEL engineer decision will be final. In case of non-availability of water, the contractor shall make his own arrangements of water suitable for construction to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Calibrated water meter shall be arranged by the vendor. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

1.3.5.3 Incase non-availability of water, the contractor shall make his own arrangements of **water suitable for construction purpose** to have 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 DRINKING WATER:

1.3.6.1 Bidder shall provide drinking water at the work spot at their cost.

1.3.7 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:

1.3.7.1 **Contractor has to provide at BHEL office, minimum 2 computers (along with one operator per PC) for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate. Computers shall have minimum configuration of minimum Windows 7 OS, 4GB RAM and Internet Explorer 8 or above**.

1.3.8 POSSESSION OF GENERATORS

1.3.8.1 As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the tenderer / contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have at least 2 diesel operated welding generator sets to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting.

1.3.9 LIGHTING FACILITY:

1.3.9.1 Adequate lighting facilities such as flood lamps, 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.

1.3.10 GASES:

1.3.10.1 All the required gases like Oxygen / Acetylene / argon /Nitrogen required for work shall be supplied by the Contractor at his cost. It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of these gases. Non availability of gases cannot be considered as reason for not attaining the required progress.

1.3.10.2 BHEL reserves the right to reject the use of any gas in case required purity is not maintained.

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

1.3.10.4 The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.

1.3.11 ELECTRODES SUPPLY AND STORAGE

1.3.11.1 The bidder shall use the BHEL / Customer approved quality welding electrodes only.

1.3.11.2 It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.

1.3.11.3 Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate.

1.3.11.4 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.

1.3.11.5 All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at his cost.

1.3.11.6 In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's first subsequent bills at market value plus departmental charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.

1.3.11.7 BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at his cost without loss of time.

1.3.12 **OTHER FACILITIES**

1.3.12.1 Adequate water less urinals [at least 2 nos per level] shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, with proper disposal arrangement.

1.3.13 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

1.3.14 TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS

1.3.14.1 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

1.3.14.2 FERRULES:

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

1.3.14.3 TAGS:

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

VOLUME-IA PART – I CHAPTER – IV

T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR

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.

A) 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.
09	Manometer 0 to 1000 mm WC with hand bulb	03 Nos.
10	Vacuum pump with standard vacuum gauge	01 No.

Sl. No	DESCRIPTION	QUANTITY
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

B) List of Recommended Tools & Plants

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

Note:

a) T & Ps and their quantity as mentioned in above list are the suggestive requirement considering parallel working. However, its mobilization, quantity and period of T&Ps deployment will be mutually agreed at site as per actual requirement.

b) Numbers / time of requirement will be reviewed from time to time at site and contractor will provide required T&Ps / equipment to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL.

c) Vendor will give advance intimation prior to its dispatch. Also on completion of the respective activity, demobilization of T&Ps in total or in part can be done with the due approval of engineer in charge. Retaining of the T&Ps during the contract period will be mutually agreed in line with construction requirement.

1.4.2 ACCURACY REQUIREMENT OF 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	
		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”

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
		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 kg/cm^2	10”
		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”

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
		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	
		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	

Sl. No	INSTRUMENT / TOOL	RANGE	ACCURACY	Dial size
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%	

Note for Contractors' Instruments

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

b. Any other tools and plants instruments and equipment required in addition to the above for the successful completion of this job will have to be arranged by the contractor at his cost.

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

d. The above instruments / equipment will be sent for testing and calibration wherever from time to time and maintained by contractor as required by BHEL.

e. All testing instruments shall have calibration certificate issued by recognized / accredited agencies.

f. List of such agencies and periodicity of calibration required for different instruments will be furnished by BHEL at site.

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

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

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

1.4.3 PROTECTION / HANDLING OF TOOLS AND PLANT ARRANGED BY THE CONTRACTOR

1.4.3.1 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.

1.4.3.2 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.

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

1.4.3.4 BHEL shall not be responsible for the safety and protection of the materials of the contractor and the contractor shall make his arrangements for proper watch and ward for his materials.

1.4.3.5 Until such time the work is taken over by BHEL, the contractor shall be responsible for proper protection including proper fencing, guarding, lighting, flagging, 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.

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

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 without operator	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 of the package as detailed in the Tender Specification shall be completed within **13 (Thirteen) 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:-

Milestone	Completion Month
Tentative Start of Work	Jun - 19
Boiler Light Up	5th Month
Synchronization	7th Month
Trial Operation	9th Month
Completion of Contractual Obligation	13th Month

Intermediate Milestones:

Sl No.	Milestone Description	Scheduled Completion (from date of commencement	Intermediate Milestone
1	Readiness for Synchronisation	7th Month	M1
2	Readiness for Trial Operation	9th Month	M2

Note: Please refer Sl No. 7 Part II Chapter-1 of Technical Conditions of Contract (Volume 1A of Volume I Book I) for Penalty for Intermediate Milestones

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 for the package under scope shall be 13 (Thirteenth) months from the "COMMENCEMENT 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 synchronization 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 the package (unit) Pro rata as per Clause no 1.7.1.1.1 to 1.7.1.12.1 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 , Devices , Sensors , Cells , Probes etc.,**	
1.7.1.1.1	Calibration / Testing and pre erection checks	30%
1.7.1.1.2	Erection / Placement of the item and fixing its loose accessories	30%
1.7.1.1.3	Pre Commissioning Checks / Loop testing / Simulation testing as required	10%
1.7.1.1.4	Local and Remote commissioning	15%
	Total =	**85%**
1.7.1.2	**Cable Laying and Cable Termination (Power cables)**	
1.7.1.2.1	Laying	45%
1.7.1.2.2	Glanding, Termination and Tagging	15%
1.7.1.2.3	Dressing and clamping	10%
1.7.1.2.4	Testing and Charging of Cables	15%
	Total =	**85%**
1.7.1.3	**Cable Laying and Cable Termination (Control & Signal Cable)**	
1.7.1.3.1	Laying	45%
1.7.1.3.2	Glanding, Termination and Tagging	15%
1.7.1.3.3	Dressing and clamping	10%
1.7.1.3.4	Sheilding of cables	5%
1.7.1.3.5	Testing and Charging of Cables	10%
	Total =	**85%**
1.7.1.4	**DCS / FURNITURE DESK / RACK / ENCLOSURE / HMI / MIS system and all types of control panels**	
1.7.1.4.1	Erection and Alignment	50%
1.7.1.4.2	Fixing of Loose Items / Instruments wherever applicable	5%
1.7.1.4.3	Pre-commissioning tests, Charging of Panels and loop testing etc	15%
1.7.1.4.4	System Commissioning	15%
	Total =	**85%**

1.7.1.5	**Fabrication and Installation of Structural Steel Materials**	
1.7.1.5.1	Fabrication ,Erection, Alignment, welding/ bolting , Painting and if applicable chipping / grouting.	65%
1.7.1.5.2	Erection of associated items / Equipment / Systems as applicable	20%
	Total =	**85%**
1.7.1.6	**UPS / Battery Charger / Battery / ACDB**	
1.7.1.6.1	Erection and Alignment	50%
1.7.1.6.2	Fixing of Loose supplied items / Instruments wherever required	5%
1.7.1.6.3	Pre Commissioning Checks, Charging of panels Loop testing and pouring of Electrolytes	15%
1.7.1.6.4	System Commissioning	15%
	Total =	**85%**
1.7.1.7	**Cable Trays and Accessories**	
1.7.1.7.1	Fabrication and Fixing Bolting in position	60%
1.7.1.7.2	Earthing of Cable Trays	15%
1.7.1.7.3	Tagging of Cable Trays (Painting cable Tray numbers on sides)	5%
1.7.1.7.4	Covering of trays wherever envisaged	5%
	Total =	**85%**
1.7.1.8	**Impulse Pipes / Conduits / Tubes**	
1.7.1.8.1	Fabrication , laying and Erection	50%
1.7.1.8.2	Leak test / Hydraulic test (Wherever applicable , Otherwise clubbed with next activity)	20%
1.7.1.8.3	Dressing , ,Clamping , Tagging and Painting wherever applicable	8%
1.7.1.8.4	Testing & commissioning of associated Equipment/system	7%
	Total =	**85%**
1.7.1.9	**Junction Box / Push Button**	
1.7.1.9.1	Erection Including fixing of terminal blocks wherever applicable	75%
1.7.1.9.2	Labelling (both Inside and Outside) , Name Plate Fixing and Earthing & connection of connected equipments	10%
	Total=	**85%**
1.7.1.10	**POWER CYLINDER**	
1.7.1.10.1	Erection and Alignment	30%
1.7.1.10.2	Fixing of Loose supplied items	30%
1.7.1.10.3	Loop checking , calibration and Local Commissioning	20%
1.7.1.10.4	System / Remote Commissioning	5%
	Total =	**85%**
1.7.1.11	**Testing / Commissioning of Equipment Erected by other agencies**	

1.7.1.11.1	Removal & Refixing/ Fixing of loose supplied components of instruments of individual racks/skid. (incl tubing/ hose, regulator etc)	30%
1.7.1.11.2	Calibration/Local Testing- Commissioning readiness	30%
1.7.1.11.3	Local Commissioning and Loop Testing	10%
1.7.1.11.4	System / Remote Commissioning	15%
	Total =	**85%**
1.7.1.12	**Other Items (Items not covered under above heads) – EPBAX, Wireless Communication, C&I lab, Plant security system etc.**	
1.7.1.12.1	Erection	75%
1.7.1.12.2	Alignment	10%
1.7.1.12.3	Testing	15%
1.7.1.12.4	Completion of Commissioning of the respective item/equipment.	10%
	Total=	**85%**
1.7.1.13	**For Supply Items(if applicable)**	
1.7.1.13.1	On submission of running bill along with the Stores Receipt /Voucher/Stores endorsement issued by BHEL	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 in the package** 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/chemical /EDTA cleaning	1%
1.7.2.3	Safety valve floating (Electromatic Relief valves)	0.5%
1.7.2.4	Completion of fire fighting with all protocols	0.5%
1.7.2.5	Completion of EPABX, MRS, AC& Ventilation	0.5%
1.7.2.6	Plant security system	0.5%
1.7.2.7	Barring Gear	1%
1.7.2.8	Rolling and Synchronisation	1%
1.7.2.9	Full Load	1%
1.7.2.10	Trial Operation of Unit	2%
1.7.2.11	Area cleaning, temp structure cutting/removal and return of scrap	1%
1.7.2.12	Punch List points / pending points liquidation	1%
1.7.2.13	Submission of 'As Built Drawings'	1%
1.7.2.14	Completion of painting	1%
1.7.2.15	Monthly Material Reconciliation	1%
1.7.2.16	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.
    vii. MATERIAL RECONCILATION AND FINAL BILL FOR EACH UNIT CAN BE SUBMITTED SEPARATELY

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

1.8.1 Goods and service Tax (GST) & Cess

1.8.1.1 The successful bidder shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work.

1.8.1.2 Contractor's price/rates shall be exclusive of GST & Cess (if applicable) (herein after termed as GST). Contractor shall submit to BHEL the GST compliant tax invoice/debit note/revised tax invoice on the basis of which BHEL will claim the input tax credit in its return. Since this is a works contract, the applicable rate shall be @ 18% GST, as applicable presently.

1.8.1.3 Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules wherein the 'Bill To' details will as below:

BHEL GSTN - 33AAACB4146P2ZL
NAME - BHEL PSSR SITE OFFICE,
ADDRESS - 1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III, Ennore & Puzhudhivakkam Village

1.8.1.4 GST charged in the tax invoice/debit note/revised tax invoice by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return.

1.8.1.5 In case BHEL has to incur any liability (like interest / penalty etc.) due to denial/reversal / delay of input tax credit in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

1.8.1.6 Further, In case BHEL is deprived of the Input tax credit due to any reason attributable to contractor, the same shall not be paid or Recovered if already paid to the contractor.

1.8.1.7 Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.

1.8.1.8 TDS under GST (if/ as & when applicable) shall be deducted at prevailing rates on gross invoice value from the running bills.

1.8.1.9 E-way bills / Transit passes / Road Permits, if required for materials / T&P etc., bought into the project site is to be arranged by the Contractor only.

1.8.1.10BHEL shall not reimburse any amounts towards any interest / penalty etc., incurred by contractor. Any additional claim at a later date due to issues such as wrong rates / wrong classification by contractor shall not be paid by BHEL.

1.8.2 All taxes and duty other than GST & Cess

The contractor shall pay all (except the specific exclusion viz GST & Cess) taxes, fees, license charges, deposits, duties, tools, royalty, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract **and the same shall not be reimbursed by BHEL**. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

1.8.3 Statutory Variations

Statutory variations are applicable under the GST Acts, against production of proof. The changes implemented by the Central / State Government 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.

1.8.4 New Taxes/Levies –

In case Government imposes any new levy / tax after submission of bid 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 Direct Tax

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

VOLUME-IA PART – I CHAPTER - IX
BILL OF QUANTITY

SL.NO	DESCRIPTION	Unit	qty
A	**BHEL -Tiruchy**		
A.1	**Main Boiler**		
A.1.1	**FUEL OIL SYSTEM**		
A.1.1.1	PD type mass flow meter LFO, HFO, HFO return mounting with matching flanges, electronics amplifier box, inter cabling etc.	set*	3
A.1.1.2	Pressure gauge	Nos	112
A.1.1.3	Diff. Pres. Gauge	Nos	11
A.1.1.4	Temperature Gauges	Nos	22
A.1.1.5	Differential Pressure switch	Nos	49
A.1.1.6	Pressure switch	Nos	26
A.1.1.7	Level Swiches (RF type)	Nos	32
A.1.1.8	FSSS Local Oil Gun Maintenance Switch Box	Nos	22
A.1.1.9	H.E.A Exciter box 240V AC alongwith retractor assembly 240V AC solenoid , flexible spark rod 133 inch, spark tip, flexible cable assembly 3 mtr long, SS hose 6.35mm x 1000mm , Air filter regulator 1/4 inch etc.,	set*	20
A.1.1.10	Flame Scanner Head Assembly consisting fibre optic cable L130", lens barrel, flame processor module, Flame module, pigtail cable, pico fuse, card extender module, power supply module, 6 way JB etc.	set*	40
A.1.1.11	Microprocessor based flame scanner amplifier 10 Nos. of 19” Racks of size 482 x 263 x 134 (W x D x H) to be mounted in Flame Scanner Panel (CJF49/ CJF 50) supplied by EDN	set*	1
A.1.2	**Heat flex sensor for smart wall blower system**		
A.1.2.1	Smart Millivot transmitter (Temp. transmitter) to be installed in JB enclosure.	Nos	50
A.1.2.2	JB for Temp. transmitters (6 transmitters/JB)	Nos	8
A.1.3	**ACUSTIC STEAM LEAK DETECTOR**		
A.1.3.1	ASLD panel assembly and computer with monitor panel size 800mm x 2315mm x 750mm & aproximate weight 250 kg	set	1
A.1.3.2	ASLD sensor assembly 30 +sonic tube+ field amplifier box with module - 37 set,power supply JB qty 1, calibrator - 1 no, sensor pig tail cable - 450 mtr	set	1
A.1.3.3	4p x 0.5 sqmm	Mtrs	4500
A.1.3.4	8p x 0.5 sqmm	Mtrs	500
A.1.4	**FURNACE CCTV SYSTEM**		
A.1.4.1	High temperature furnace camera CCTV head assembly with advance retract mechanism and control junction box panels (800mm x 600mm x 250 mm) with inter connecting pipes, air filter regulators, ss hose mounted at Boiler 45 mtr elevation. Remote control box (800mm x 600mm x 400mm) with 24 inch monitor and accessories at CCR, 40 inch LED monitor,	set*	2
A.1.5	**PNEUMATIC POWER CYLINDERS (REGULATING TYPE) installation and commissioning**		
A.1.5.1	Power Cylinders for SADC (Weight 20 kg each)	Nos	140
A.1.5.2	PA , ID & FD Fans Blade Pitch Control Damper with HART Modam and soft ware (Approx.Weight 90 kg each)	Nos	6
A.1.5.3	Cold Air Regulating Dampers with smart positioner alongwith linkage rod (Approx. Weight 95 kg each)	Nos	9

SL.NO	DESCRIPTION	Unit	qty
A.1.5.4	Hot Air Regulating Damper with smart positioner along with linkage rod (Approx.Weight 175 kg each)	Nos	9
A.1.5.5	Dynavane Filter Bleed Air Damper regulating with smart positioner	Nos	2
A.1.6	**Gravimetric Feeder Panel**		
A.1.6.1	Gravimetric Feeder Remote Power Cabinet including Feeder coal flow monitor assembly ,Size 1400 x 2365 x 610 , weight 300 Kg	Nos	9
A.1.6.2	Feeder coal Flow monitor assembly Flange mounted	Nos	9
A.1.7	**BOILER CIRCULATING WATER PUMP INSTRUMENTS**		
A.1.7.1	K Type Duplex Thermocouple	Nos	15
A.1.7.2	Flow Indicators (checking only)	Nos	3
A.1.7.3	Temperature Indicators	Nos	3
A.1.7.4	Pressure Gauges	Nos	3
A.1.8	**K TYPE THERMOCOUPLE**		
A.1.8.1	MTM T/Cs of route length 10 Mtrs (8 mm OD)	Nos	24
A.1.8.2	MTM T/Cs of route length 12 Mtrs (8 mm OD)	Nos	43
A.1.8.3	MTM T/Cs of route length 14 Mtrs (8 mm OD)	Nos	57
A.1.8.4	MTM T/Cs of route length 16 Mtrs (8 mm OD)	Nos	50
A.1.8.5	MTM T/Cs of route length 18 Mtrs (8 mm OD)	Nos	136
A.1.8.6	MTM T/Cs of route length 20 Mtrs (8mm OD)	Nos	88
A.1.8.7	MTM T/Cs of route length 22 Mtrs (8mm OD)	Nos	119
A.1.8.8	MTM T/Cs of route length 24 Mtrs (8mm OD)	Nos	70
A.1.8.9	MTM T/Cs of route length 26 Mtrs (8mm OD)	Nos	41
A.1.8.10	MTM T/Cs of route length 28 Mtrs (8mm OD)	Nos	18
A.1.8.11	MTM T/Cs of route length 22 Mtrs (3 mm OD)	Nos	4
A.1.8.12	MTM T/Cs of route length 24 Mtrs (3 mm OD)	Nos	8
A.1.8.13	MTM T/Cs of route length 26 Mtrs (3 mm OD)	Nos	15
A.1.8.14	MTM T/Cs of route length 28 Mtrs (3 mm OD)	Nos	10
A.1.8.15	MTM T/Cs of route length 30 Mtrs (3 mm OD)	Nos	18
A.1.8.16	MTM T/Cs of route length 32 Mtrs (3 mm OD)	Nos	7
A.1.8.17	MTM T/Cs of route length 34 Mtrs (3 mm OD)	Nos	15
A.1.8.18	MTM T/Cs of route length 36 Mtrs (3 mm OD)	Nos	2
A.1.8.19	MTM T/Cs of route length 38 Mtrs (3 mm OD)	Nos	7
A.1.8.20	ERV Controller with Pressure Switch Dimension: 305 x 305 x 203mm; weight: 10 kg each	set*	4
A.1.9	**SADC system HARDWARE LIST**		
A.1.9.1	1/4" Air Filter Regulators (for mill system)	Nos	9
A.1.9.2	1" Air Filter Regulators (for SADC system)	Nos	9
A.1.9.3	Purge Meter cum DP regulator	Mtrs	18
A.1.9.4	1 inch OD copper tube	Mtrs	45
A.1.9.5	1/2 inch OD copper tube	Mtrs	25
A.1.9.6	3/4 inch OD copper tube	Mtrs	20
A.1.9.7	1/4 inch copper SS tube	Mtrs	4850
A.1.9.8	3/8 inch OD copper tube	Mtrs	120
A.1.9.9	1 inch teflon hose 3 mtr long	Nos	5
A.1.9.10	1/4 inch teflon hose 2 mtr long	Nos	145
A.1.9.11	1/2 inche teflon hose 1 mtr long	Nos	30
A.1.10	**CABLES (PVC, FRLS, Armoured cables for Scanner, Mill feeder, AC Control, and Instruments)**		
A.1.10.1	Flame Scanner Cable (2P x 1.31 sq.mm triple screened, unarmoured cable)	Mtrs	9500

SL.NO	DESCRIPTION	Unit	qty
A.1.10.2	2P X 0.5 sqmm, overall shielded cable.	Mtrs	3500
A.1.10.3	4P X 0.5 sqmm, overall shielded cable.	Mtrs	6000
A.1.10.4	8P X 0.5 sqmm, overall shielded cable.	Mtrs	84500
A.1.10.5	12P X 0.5 sq. mm, overall shielded cable.	Mtrs	12200
A.1.10.6	2P x 1.5 sqmm, MSCICS P/O armoured cable	Mtrs	10500
A.1.10.7	4p x 0.5 sqmm PTFE inst cable -G	Mtrs	2700
A.1.10.8	8p x 0.5 sqmm PTFE inst cable -G	Mtrs	500
A.1.10.9	5c x 2.5 sqmm PTFE inst cable	Mtrs	5000
A.1.10.10	3c x 2.5 sqmm PTFE inst cable	Mtrs	1500
A.1.10.11	4p x 0.5 sqmm PTFE inst cable -F	Mtrs	500
A.1.10.12	2P x 1.5 sqmm, P/O Fire surv. Inst cable	Mtrs	1000
A.1.10.13	4p x 0.5 sqmm Fire surv. inst cable	Mtrs	5000
A.1.10.14	8p x 0.5 sqmm Fire surv. inst cable	Mtrs	2500
A.1.10.15	2 Pair x 1.3 sqmm, K type, compensating cable	Mtrs	3200
A.1.10.16	12 Pair x 1.3 sqmm, K type, compensating cable	Mtrs	2500
A.1.10.17	2P x 0.5 sqmm, P/O armoured cable	Mtrs	1500
A.1.10.18	4P x 0.5 sqmm,P/O armoured cable	Mtrs	4000
A.1.10.19	8P x 0.5 sqmm, P/O armoured cable	Mtrs	11500
A.1.10.20	12P x 0.5 sqmm, P/O armoured cable	Mtrs	3500
A.1.10.21	3C x 2.5 sq mm control cable	Mtrs	3000
A.1.10.22	5C x 2.5 sq mm control cable	Mtrs	5000
A.1.10.23	7C x 2.5 sq mm control cable	Mtrs	1500
A.1.10.24	10C x 2.5 sq mm control cable	Mtrs	27500
A.1.10.25	12C x2.5 sq mm control cable	Mtrs	10000
A.1.10.26	2C x2.5 sq mm power cable	Mtrs	5200
A.1.10.27	3C x2.5 sq mm power cable	Mtrs	80500
A.1.10.28	3C x 10 sq mm power cable	Mtrs	500
A.1.10.29	3C x16 sq mm power cable	Mtrs	2700
A.1.10.30	Heat flex sensor cable (SWBS)	Mtrs	1500
A.1.11	**CABLE TRAY**		
A.1.11.1	GI cable tray 50MM wide	Mtrs	2050
A.1.11.2	GI cable tray100MM wide	Mtrs	6250
A.1.11.3	GI cable tray 150MM wide	Mtrs	3500
A.1.12	**JUNCTION BOXES**		
A.1.12.1	JUNCTION BOX-24 WAY Approx. weigh :8.5 Kg each	Nos	112
A.1.12.2	JUNCTION BOX-48 WAY Approx. weigh : 10 Kg each	Nos	69
A.1.12.3	JUNCTION BOX-72 WAY Approx. weigh : 14 Kg each	Nos	46
A.1.13	**CHANNELS, PIPES, TUBES ETC.**		
A.1.13.1	Structural Steel for fabrication of supports consisting of angles, channels (ISA ISMC 100x50x6 wt 1250 kg , ISA 50X50X6 WT 800 kg etc.)	MT	2
A.1.13.2	Flat 50 x 6 mm	Mtrs	450
A.1.13.3	GI Wire dia 1.219 mm	Mtrs	1900
A.1.13.4	1/2 inch GI pipe	Mtrs	1220
A.1.14	**IMPULSE PIPES**		
A.1.14.1	PIPE OD 21.3 X 4.78 SA 106 GR B- IMPULSE	Mtrs	180
A.1.14.2	PIPE OD 26.7 X 3.91 SA 106 GR B- IMPULSE	Mtrs	1150
A.1.14.3	PIPE OD 33.4 X 4.55 SA 106 GR B- IMPULSE	Mtrs	1410
A.1.14.4	PIPE OD 26.7 X 3.91 SA 335 P22- IMPULSE	Mtrs	410

SL.NO	DESCRIPTION	Unit	qty
A.1.14.5	TUBE OD 21.3 X 7.47 SA335P91	Mtrs	120
A.1.15	**INSTRUMENT RACKS**		
A.1.15.1	Local Instrument rack with Junction Boxes , Size of the rack : 1800 (W)x 630 (D)x 2150 (H),approximate weight :575 Kgs	Nos	3
A.1.15.2	Local Enclosure with Junction Boxes , Size of the rack : 1800 (W)x 630 (D)x 2150 (H),approximate weight :575 Kgs	Nos	15
A.1.15.3	SOFA automatic flow meter with accessories like installation of pitot tube	set	8
A.1.15.4	HWL & MEFCV Junction box	Nos	3
A.1.16	**COMMISSIONING OF THE FOLLOWING erected by mechanical agency**		
A.1.16.1	Limit Switches (checking only).burner trip valve isolation HSD one elev qty 8, HFO five elev qty 50	Nos$	48
A.1.16.2	Pneumatic Valves: corner station Trip Valves includes Feedbacl LS, AFR and Solenoids, 8mm Copper tubing HSD qty 8 nos, HFO five elevation qty 40, scvange five elev qty 20	Nos$	68
A.1.16.3	speed regulator (each corner 1 no for 5 elevation) 1 x 4 x 5 = 20 nos	Nos$	20
A.1.16.4	Pneumatic control valves for HFO & LFO system - Regulating Valves consisting of air filter regulator, air lock valve, smart positioner, feedback limit switches, copper tubing etc	Nos$	18
A.1.16.5	Burner Tilt Shear Pin Failure Indication Junction Box Approx. Dimension: 280(H) x 600(L) x 200(D) mm; weight 12 kg each	Nos$	16
A.1.16.6	Heavy Duty Limit Switch (for Burner Tilt Shear Pin Failure Indication Purpose)	Nos$	32
A.1.16.7	Scanner Air Emergency open/close Damper	Nos$	1
A.1.17	**Pneumatic Power Cylinder (Regulating type)**		
A.1.17.1	SOFA tilt power cylinders (BTPS) (Regulating Type)	Nos	4
A.1.18	**Pneumatic Actuators (On/Off Type) with solenoids, AFR, feedback limit switch etc**		
A.1.18.1	Cold Primary Air Gate open/ close power cylinder	Nos$	9
A.1.18.2	Hot Primary Air Gate open/ close power cylinder	Nos$	9
A.1.18.3	Feeder Outlet Gate	Nos$	9
A.1.18.4	Seal Air to Mill qty 9 nos & Coal Pipies qty 9 nos seal air to feeder qty 9, seal air outlet damper qty 2 nos	Nos$	29
A.1.18.5	APH-A&B Sec. Air & Pri.Air O/L Damper Seal Air Knif Edge Gate qty 6 nos, ID fan O/L blr knife edge gate qty 2 nos	Nos$	8
A.1.19	**Electrical Bi directional actuators MOV commissioning**		
A.1.19.1	MOV actuator water (steam and water circuit)	Nos$	45
A.1.19.2	Calibration/ Commissioning of Gravimetric Feeder comprising of Feeder Mounted C&I Equipment like motion monitor sensor, micro switches, etc. along with Feeder Integral Cabine of size 600 x 750 x 350 , LT Motors etc.	set*$	9
A.1.19.3	Bunker outlet Gate / Feeder inlet gate Limit Switches (Only checking)	Nos$	36
A.1.19.4	Heat flex sensor for smart wall blower system Assembled Thermocouple installed by Mech agency Thermocouple healthiness checking	Nos$	50
A.1.19.5	HWL & MEFCV motor starter panel local mounted weight 100 Kg	set$	1
B	**BHEL- RANIPET SCOPE**		
B.1.1	Pressure Gauges	Nos	14
B.1.2	Flow switch	Nos	4
B.1.3	GO no GO switch	Nos	2

SL.NO	DESCRIPTION	Unit	qty
B.1.4	RTDs with Thermowell	Nos	8
B.1.5	Pressure switch	Nos	4
B.1.6	Thermocouple with thermowell	Nos	58
B.1.7	Thermocouple Assembly consisting of 14 Nos. Cr-Al M. thermocouples along with integral terminal box	set*	4
B.1.8	ON/OFF Switch Box including light assembly and interconnecting heat resistance cable	set	2
B.1.9	Fan Bearing RTDs	Nos	28
B.1.10	Fan Bearing Temperature Indicators	Nos	22
B.2	**OPACITY MONITOR Installation and commissioning**		
B.2.1	Opacity monitoring system consisting of 1 no measuring head, 1 no local control unit, 1 no reflector, 1 no air blower with hoses, Fail safe shutters, Field terminal box, Power termininal box, interconnecting cable, mounting accessories etc	set	6
B.2.2	3D Acoustic level Transmitter sensor, amplifier unit vendor supplied inter connecting cable etc (For First field of ESP Hopper)	set	12
B.3	**Automatic Leakage Control System - Air Preheater**		
B.3.1	ALCS DCS Panel 750x750x2067 mm	No.	1
B.3.2	ALCS Drive Control Panel 680x400x1053 mm	Nos	6
B.3.3	ALCS Controller with panel 370x210x520 mm	Nos	6
B.3.4	Sensor Electronic With Enclosure 140x100x70 mm	Nos	6
B.3.5	Interfacing Box 140x100x70 mm	Nos	6
B.4	**COMMISSIONING OF FOLLOWING**		
B.4.1	Solenoid Valves	Nos$	2
B.4.2	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.	set*$	4
B.4.3	Fan Motor Bearing Temperature Indicators. (Removal, calibration and refixing only)	Nos$	12
B.4.4	Fan Motor Bearing/ Winding RTDs (checking of healthines only)	Nos$	84
B.4.5	Lub oil skids for FD Fans The scope of work includes removal of instruments calibration, refixing, checking cable connection from JB to instruments etc. The approximate total quantity of instruments for the skid put together is given below: Tank instrumentation Level transmitters(contact type guided wave) qty 2 nos, RTD qty 2 nos, Temp gauge qty 2 nos, DPTransmitter qty 1 no, DP indicator qty 1 no, Pr.gauge qty 3 nos, Pr.transmitters 2 nos, Flow indicator with flow transmitter - 01 Nos.	set*$	2
B.4.6	Lub oil skids for ID Fans The scope of work includes removal of instruments calibration, refixing, checking cable connection from JB to instruments etc. The approximate total quantity of instruments for the skid put together is given below: Tank instrumentation Level transmitters(contact type guided wave) qty 2 nos, RTD qty 2 nos, Temp gauge qty 2 nos, DPTransmitter qty 1 no, DP indicator qty 1 no, Pr.gauge qty 5 nos, Pr.transmitters 2 nos, Flow indicator with flow transmitter - 03 Nos.	set*$	2
B.4.7	Lub oil skids for PA Fans The scope of work includes removal of instruments calibration, refixing, checking cable connection from JB to instruments etc. The approximate total quantity of instruments for the skid put together is given below: Tank instrumentation Level transmitters(contact type guided wave) qty 2 nos, RTD qty 2 nos, Temp gauge qty 2 nos, DPTransmitter qty 1 no, DP indicator qty 1 no,	set*$	2

SL.NO	DESCRIPTION	Unit	qty
	Pr.gauge qty 5 nos, Pr.transmitters 2 nos, Flow indicator with flow transmitter - 03 Nos.		
B.5	**COMMISSIONING OF BIDIRECTIONAL DRIVES**		
B.5.1	Gates and dampers - ID, scaph FD fan,AH qty 12, FD fan, ESP qty 44, bunker outlet gate qty 9 nos including loop checking	Nos$	88
C	**BHEL - PIPING CENTRE SCOPE**		
C.1	**S.G. PACKAGE**		
C.1.1	**LOCAL/FIELD INSTRUMENTS**		
C.1.1.1	Pressure Gauges	Nos	149
C.1.1.2	Temperature Gauges	Nos	138
C.1.1.3	Thermowells (screwed & Welded)	Nos	205
C.1.1.4	Level gauges	Nos	10
C.1.1.5	Sight flow Glases	Nos	58
C.1.1.6	Anu bar flow meter consist of pitot tube, transmitter and accessories - installed CW piping OD 324mm x 10mm	set	2
C.1.2	**Impulse pipes**		
C.1.2.1	Pipe OD 21.3 X 7.47 SA335 P22	Mtrs	40
C.1.2.2	Pipe OD 21.3 X 7.47 SA335 P91	Mtrs	50
C.1.2.3	Carbon Steel SA 106 Gr B Dia 21.3 x 3.73 Thk	Mtrs	250
C.1.2.4	Carbon Steel SA106 Gr C Dia 21.3 x 3.73 Thk	Mtrs	400
C.1.3	**Instrument air**		
C.1.3.1	Galvanised pipe IS 1239 NB 25 x 4.0	Mtrs	1914
C.1.3.2	Galvanised pipe IS 1239 NB 15 x 3.2	Mtrs	4786
C.1.4	**Electrical heat tracer**		
C.1.4.1	self regulator Heat tracer HTSX 12-2 QJ, Addhessive tapes 340 rolls, 1 way/2 way power connector 68 nos, end connector, splice connector qty 9 nos ,RTD 2 nos, Thermostat 14 nos. adhesive tapes for heat tracing, pipe straps, caution lable etc.	Mtrs	1815
C.1.4.2	Junction boxes for heat tracer cables	Nos	88
C.1.4.3	Cable : 1 triod x 1.5 sqmm copper	Mtrs	110
C.1.5	**Power cables**		
C.1.5.1	3c x 2.5 sqmm	Mtrs	4685
C.1.5.2	3c x 6 sqmm	Mtrs	190
C.1.5.3	3c x 25 sqmm	Mtrs	310
C.1.5.4	3c x 35 sqmm	Mtrs	655
C.1.5.5	3c x 50 sqmm	Mtrs	490
C.1.5.6	3c x 70 sqmm	Mtrs	760
C.1.5.7	3c x 95 sqmm	Mtrs	1025
C.1.5.8	3c x 120 sqmm	Mtrs	1295
C.1.5.9	LT Power distribution board 80 KW rating, floor mounted non drawout overall size 4000mm(L) x 1000mm(W) x 2300mm(H)	set	1
C.1.6	**COMMISSIONING OF THE FOLLOWING**		
C.1.6.1	Control Valves - AFR, Positioner, tesitng upto DCS	Nos$	7
C.1.6.2	MOV actuator for SCAPH, CW,Aux steam,APH water wash etc	Nos$	27
C.1.6.3	LT drives - cond pump, emergency pump, dosing system drives	Nos$	6
E	**EDN SCOPE**		
E.1	**SG PACKAGE**		
E.1.1	PANELS		

SL.NO	DESCRIPTION	Unit	qty
E.1.1.1	Suit of two Cubicles Size: 1500 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 800 kg. CJF81 & 82(FOPH room), CJF49 & 50 (Flame scanner)	Nos	2
E.1.1.2	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CJF06-07&08(SADC) , CJF 97,98 & 99(HPBP & PRDS), CJF 91,92 & 93(Aux Boiler)	Nos	3
E.1.1.3	Suit of Four Cubicles Size: 3000 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1600 kg. CJF11 to 14, CJF 16 to 19, CJF 21 to 24, CJF 26 to 29, CJF 31 to 34 (FSSS-OIL)	Nos	5
E.1.1.4	Suit of Five Cubicles Size: 3750 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 2000 kg. CJF01 to 05 (FSSS), CJF61 to 65(SBC), CJF66 to 70(SBC)	Nos	3
E.2	**TG PACKAGE**		
E.2.1	PANELS		
E.2.1.1	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 400 kg. CCA 91(for Siemens signal), CJJ08 (auto syn), CWW01 (TSI-BFPDT), CCA20(HMI), CJj 41 (TSI-Turbine)	Nos	5
E.2.1.2	Suit of two Cubicles Size: 1500 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 800 kg. CCA10-11(GAMP)	Nos	1
E.2.1.3	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CCA 01,02&03 (ATRS-SGC), CCA 04,05&06 (ATRS - SGC), CJJ03,04&05 (LPBP)	Nos	3
E.2.1.4	Suit of Four Cubicles Size: 3000 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1600 kg. CJJ20,21,22&23(ATRS-BFPDT), CJJ30,31,32&33 (ATRS-BFPDT)	Nos	2
E.3	**BOP PACKAGE**		
E.3.1	PANELS		
E.3.1.1	Suit of two Cubicles Size: 1500 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 800 kg. CRE31 & 32 (Hot well), CRE 36 &37(MDBFP), CRE 44 & 45(CEP), CRE 46&47(COLTS), CRE 81&82 (CWP), CRE 83 &84(CWP), CRE 85 & 86(CWP)	Nos	7
E.3.1.2	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CRE17,18&19 (Mill), CRE 28,29&30 (Dearator), CRE 33, 34&35(Dosing sys), CRE 38, 39&40 (CEP), CRE 41, 42&43(CEP), CTE 01,02 & 03(interpose relay)	Nos	6
E.3.1.3	Suit of Four Cubicles Size: 3000 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1600 kg.CRE 01 to 04, CRE 05 to 08, CRE 09 to 12, CRE 13 to 16,(All HT drives), CRE 20 to 23, CRE 24 to 27,(SH,RH,FW), CRE 61 to 64, CRE 65 to 68, CRE 69 to 72, CRE 73 to 76 (Electrical)	Nos	10
E.3.1.4	UNIT CONTROL PANEL CWD 01 - Size 1976 mm(w) x 1000 mm(d) x 2355 mm(h) ; Approximate weight- 1600 kg Location CCR	Nos	1
E.3.1.5	ELECTRICAL CONTROL PANEL CWB 01 - Size 3080 mm(w) x 1000 mm(d) x 2355 mm(h) ; Approximate weight- 2000 kg Location CCR	Nos	1
E.4	**ACN - T&AVT PACKAGE**		
E.4.1	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. CFA01	Nos	1
E.4.2	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. ACN01	Nos	1
E.4.3	Commissioning of Transducers -Removal and reclibration of Power, voltage, current, frequency output 4-20 mA	Nos	28

SL.NO	DESCRIPTION	Unit	qty
E.5	**HMI PANELS**		
E.5.1	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. CNP33(Powr dist),CNP11(DCS1),CNP12(DCS2),(Station lan- 2 panels)	Nos	5
E.6	**HMI PACKAGE for Unit & Common**		
E.6.1	**Operation work station installed at CCR and common including network components, Common means location other than CCR**		
E.6.1.1	Ops work station at CCR 22 nos, alarm/SOE 1 no, EAS qty 3 nos, EAC qty 2,Historian qty 4, Buffer stn qty 4 nos, Backup stn qty 4,OPC server qty 4 nos, Common - Local operating stations - 10 nos	set	54
E.6.1.2	A4 black & white laser printers at CCR qty 4 nos, common qty 5 nos	set	9
E.6.1.3	A4 color laser printers at CCR qty 7 nos, common qty 4 nos	set	11
E.6.1.4	A3 color laser printer & multi function A3 printer CCR qty 4 nos	set	4
E.6.1.5	Heavy duty dot matrix printer for SOE & Historian at CCR	set	4
E.6.1.6	UTP cables	Mtrs	15000
E.6.1.7	Power cable for power distribution to PCs, servers and printers (4Cx1 Sqmm PVC)	Mtrs	1500
E.6.1.8	OFC Cable for Main and Offsite connectivity (6 Core Single mode)	Mtrs	16000
E.6.1.9	VOID		
E.6.1.10	HDPE pipes for OFC	Mtrs	5000
E.7	**Electrical interface panel**		
E.7.1	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. EDMS(CYJ01), IEMS(CYJ02)	Nos	2
E.7.2	Untwisted pair cable (UTP) between Data concentractor panels (MV/LV swgears), GRP, Multi function meters (MV/LV/GRP) and CYJ01 & CYJ02 panels	Mtrs	500
E.8	**HMI package - EDMS & IEMS - Interfacing panels of CYJ01 & CYJ02 to data concentrators of MV swgr, LV swgr, BOP swgr, GRP and Sub Station automation**		
E.8.1	OWS and OWS cum EWS system with 24 inch monitor alongwith original softwares	set	5
E.8.2	Server Info station with 24 inch monitor alongwith original softwares	set	4
E.8.3	A4 color laser printer	Nos	2
E.8.4	multi function A3 printer	Nos	1
E.8.5	UTP cables	Mtrs	1200
E.9	**BOP - AC & VENTILATION SYSTEM - SERVICE BLDG, TG , ESP**		
E.9.1	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CRA 01,02&03, CRA 04,05&06 (Service bldg)	Nos	2
E.9.2	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. CTE21 & 22 (Service bldg)	Nos	2
E.9.3	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CRA 07,08 & 09, CRA 10,11 & 12 (Main plant bldg)	Nos	2
E.9.4	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. CTE23 (Main plant bldg)	Nos	1
E.9.5	Suit of Four Cubicles Size: 3000 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1600 kg.CRA 13, 14, 15 & 16 (ESP Building).	Nos	1

SL.NO	DESCRIPTION	Unit	qty
E.10	**HMI for AC & Ventilation**		
E.10.1	OPS and EAS server station with 24 inch monitor alongwith original softwares	set	2
E.10.2	Black white laser printer A4	No.	1
E.10.3	Network Enclosure mounted with Ethernet switches	Nos	3
E.10.4	UTP cable	Mtrs	300
E.10.5	Furniture - Operator desk 1 no, Printer table - 1 no, Chairs - 2 nos.	set	1
E.11	**BOP - Mill reject system**		
E.11.1	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CRE 51,52&53 FOR Mills A , C, E,G,J , Compressor 1	Nos	1
E.11.2	Suit of two Cubicles Size: 1500 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 800 kg. CRE54 & 55 For Mills B , D, F,H , Compressor 2	Nos	1
E.11.3	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. CTE11 & 12	Nos	2
E.12	**HMI for Mill reject system**		
E.12.1	OPS and EAS server station with 24 inch monitor alongwith original softwares	set	2
E.12.2	Black white laser printer A4	No.	1
E.12.3	Heavy duty dot matrix printer	No.	1
E.12.4	Network Enclosure mounted with Ethernet switches	No.	1
E.12.5	UTP cable	Mtrs	300
E.12.6	Furniture - Operator desk 1 no, Printer table - 2 no, Chairs - 2 nos.	set	1
E.13	**BOP - Condenser polishing unit**		
E.13.1	Suit of three Cubicles Size: 2250 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 1200 kg. CRE 91,92&93 For Regeneration area	Nos	1
E.13.2	Suit of two Cubicles Size: 1500 mm(W) X 800 mm(D) x 2117 mm(H); Approx. weight 800 kg. CRE94 & 95 For Service vessel area	Nos	1
E.13.3	Suit of one Cubicles Size: 750 mm(W) X 800 mm(D) x 2415 mm(H); Approx. weight 400 kg. CTE06 & 07 (Interposing relay)	Nos	2
E.14	**HMI for Condenser polishing unit**		
E.14.1	OPS and EAS server station with 24 inch monitor alongwith original softwares	set	2
E.14.2	Black white laser printer A4	Nos	1
E.14.3	Heavy duty dot matrix printer	Nos	1
E.14.4	Network Enclosure mounted with Ethernet switches	No.	1
E.14.5	UTP cable	Mtrs	300
E.14.6	Furniture - Operator desk 1 no, Printer table - 2 no, Chairs - 2 nos.	set	1
E.15	**HMI PACKAGE - to be installed at TANGENCO Head qtrs**		
E.15.1	Remote diagnastic stations to be installed at TANGENCO head qtrs.- along with PC, softwares and accessories.	Nos	2
E.15.2	A4 black & white laser printer	Nos	2
E.15.3	Wall Mounted Network Enclourse (TANGEDCO Head Quater)	Nos	1

SL.NO	DESCRIPTION	Unit	qty
E.16	**STATION LAN / MIS SYSTEM installation and commissioning including media converter, LIU, router, cabling etc. at different locations**		
E.16.1	MIS server common qty 2 nos	set	2
E.16.2	MIS client work station common qty 44 nos, MIS future use 20 nos, MIS workstn for LED TV without monitor - qty 7 nos,	set	71
E.16.3	MIS LED TV 55" qty-7 nos, 40" qty-4 nos	set	11
E.16.4	MIS client laptop common qty 5 nos	set	5
E.16.5	A4 black & white laser printers common qty 21 nos	set	21
E.16.6	A3 color laser printer & multi function A3 printer common qty 10nos, CE office 1 no	set	11
E.16.7	Station LAN router firewall with IPS - Layer 3 core at CCR & 2 core at service building switch, with remote access	set	2
E.16.8	Network Enclosure mounted with Ethernet switches	Nos	8
E.16.9	OFC Cable for MIS/Station LAN (6 Core Single mode)	Mtrs	20000
E.16.10	VOID		
E.16.11	HDPE pipes for OFC	Mtrs	5000
E.16.12	UTP Cables	Mtrs	5400
E.16.13	MiniUPS 2 KVA sealed maintenance free battery Common MIS servers qty 2 nos	Nos	2
E.16.14	MiniUPS 1 KVA sealed maintenance free battery Common LED TV Wks qty 7 nos & MIS servers qty 44 nos	Nos	51
E.17	**Office WAN installation and commissioning including media converter, LIU, router,cabling, etc. at different locations**		
E.17.1	Office WAN Network Panel (CCR Area/Admin)	Nos	2
E.17.2	Total nodes for Wide area network	Nos	175
E.17.3	WAN Server with 22” LED Monitors	Nos	2
E.17.4	A3 Size color laser printer for WAN Server	Nos	2
E.17.5	Office User Station PC with 22” LED Monitor	Nos	100
E.17.6	A4 Size B/W Printer	Nos	50
E.17.7	Wall Mounted Network Enclourse (Various Location) for Ethernet switches	Nos	20
E.17.8	OFC Cable for office WAN	Mtrs	40000
E.17.9	VOID		
E.17.10	HDPE Pipe for OFC	Mtrs	10000
E.17.11	UTP Cables	Mtrs	9000
E.18	**GRAPHICAL INTERFACE UNIT**		
E.18.1	GIU and accessories with soft wares: location -pump house, FOPH,con. Polishing, LP dosing,AC & ventlation, ESP, Mill reject, service/potable water etc	Nos	16
E.18.2	Wall mounted enclosures rittal make to house GIU (600mm x 380mm x 350mm) aprox 20 kg	Nos	16
E.18.3	RS-485 cable	Mtrs	5400
E.18.4	3Cx1.5sqmm power cable	Mtrs	1500
E.18.5	Flexible GI pipe 1 inch	Mtrs	3000

SL.NO	DESCRIPTION	Unit	qty
E.19	**Video conference network system - Installation and commissioning assistance for MPLS VPN / Lease line at site conference room. Civil Work includes like chipping in floors / walls, cabling and conduits, etc. Total system configuration by OEM.**		
E.19.1	HD video conferencing system model scopia XT 5000	set	1
E.19.2	PAN tilt Zoom Camera unit	No.	1
E.19.3	Micro phones	Nos	2
E.19.4	Embeded 6 party licence	No.	1
E.19.5	55 inch LED display with wall mounting kit model DC55E	set	2
E.20	**COMPUTER FURNITURES**		
E.20.1	Operator desk- HMI (unit + common) Angular installation (9 sections) dimention 750mm x 10020mm x 1050mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	1
E.20.2	unit incharge desk (HMI) 750mm x 4550mm x 1050mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	1
E.20.3	Operator desk (simulator) 750mm x 7700mm x 1050mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	1
E.20.4	Station incharge incharge desk (HMI & Simulator) 750mm x 2820mm x 1050mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	2
E.20.5	PC/SERVER Rack - HMI 1500mm x 1000mm x 900mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	3
E.20.6	Work station furniture (Section of 2) HMI qty 8 nos, PADO qty 1 nos - Size 2000mm x 950mmx 1650mm	set	9
E.20.7	Work station furniture(Section of 1) HMI qty 5 nos - Size Size 1000mm x 950mmx 1650mm	set	5
E.20.8	computer table HMI qty 26 nos, PADO qty 4 nos, Simulator qty 6 nos - 750mm x 735mm x 1500mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	36
E.20.9	Printer table HMI qty 37nos, PADO qty 4 nos, simulator 3 nos - 740mm x 900mm x 650mm including fixing of power sockets, MCBs, ethernet switches hardwares etc	set	44
E.20.10	Computer chair adjustable armed HMI qty 62 nos, PADO qty 04 nos, Simulator qty 32 nos	Nos	98
E.20.11	Almirah CRCA sheel 18 guage 1980mm x 910mm x 480mm with glass window HMI qty 11, PADO qty 1, Simulator qty 4	Nos	16
E.20.12	Locker Set 415 mm x 457 mm x 1830 mm weight 10 kg, HMI qty 4 nos, Simulator qty 1 nos	Nos	5
E.21	**LVS SYSTEM**		
E.21.1	80"-84" Large Video Screen LED make DELTA having resolution 1600 x 1200 pixels with DLP based (UXGA) rear projection along with CPU and other loose supplied items like DVI matrix switch, video matrix switch, automatic data proceing unit, Video display controller, Border binder, interconnecting power & communication cables RJ45/DVI, Assembling of loose supply stand Mounting at control room for 6 nos LVS (unit) semi circular stand size height 2400mm x cord 9950mm x width 964mm and 2 nos LVS (common) mounting Height 2400mm x cord 3300mm x width 964mm. LVS (simulator) 1 no size height 2400mm x 16000mm x width 964mm.	set*	9

SL.NO	DESCRIPTION	Unit	qty
E.22	**Operator Training simulator - installation and commissioning assistance - layer 2 network configuration including ethernet switches, firewall, licenced softwares etc. Commissioning of System configuration by vendor.**		
E.22.1	operator work station includes 24 " flat monitors, CPU and accessories. Trainees qty 8 nos,Instructor station 2 nos, simulator server qty 1 no, HMI server qty 1 no, HMI programming stn qty 1 no, Simulator programming work stn qty 1 no	set	14
E.22.2	A4 color laser printer	set	2
E.22.3	A3 laser printers	set	1
E.22.4	LCD projector with 80 " Projector screen (white marker board)	set	1
E.22.5	ACDB size 1200mm x 1000mm x 600mm for Simulator work station.	Nos	1
E.22.6	CAT-6 Cable	Mtrs	305
E.22.7	3Cx2.5 sqmm flexible power cable	Mtrs	500
E.23	**Plant Security system - Installation commissioning assistance including mounting hardware, handing over software, location tags, media converters, distribution switch, data transfer drives, etc, erection of poles with civil foundation for mounting cameras.**		
E.23.1	**Perimeter intrusion detection system CCTV - Location Control room, Tg bldg, Boiler Area, cable gallery, Power house, AHP,CHP,FOPH,overall plant peripherial, EFT,CW, Service bldg etc**		
E.23.1.1	42U panel size 800mm x 800mm x 2200mm housing servers, network switches, etc	No.	1
E.23.1.2	Server with 29" monitor - Video management qty 2 nos, camera server qty 9 nos - loose supply to be mounted in 42U panel.	set	11
E.23.1.3	Work station with 32" & 40" monitor - 32" monitor qty 9 nos, 40:" monitor qty 4 nos,	set	13
E.23.1.4	A4 size color laser printer	Nos	2
E.23.1.5	PTZ honeywell make camera for plant and perimeter (fixing on pole/wall)	set	184
E.23.1.6	Explosion proof camera (fixing on pole/wall)	Nos	2
E.23.1.7	Junction Box/12U rack	Nos	30
E.23.1.8	L2 field edge network switches	Nos	35
E.23.1.9	OFC armoured cable 6 core single mode includes fixing of fibre optic components and termination kits LIU, face plates,cabinets,SC coupler,grounding etc	Mtrs	29000
E.23.1.10	OFC armoured cable 6 core single mode includes fixing of fibre optic components and termination kits LIU, face plates,cabinets,SC coupler,grounding etc (Excavation of different sizes of trenches in any type of soil and plcement of sand below and above the cable in the excavated trench and refilling the trench with excavated soil and levelling after cable laying with Cable markers.	Mtrs	6000
E.23.1.11	Permanently lubricated HDPE pipes (to be used for underground OFC)	Mtrs	10000
E.23.1.12	Shield twisted pair cable 4 pair (Cat-5/6)	Mtrs	6000
E.23.1.13	2P x 0.5 sqmm cable	Mtrs	2000
E.23.1.14	3c x 1.5 sqmm unarmoured power cable for camera to JB	Mtrs	2500

SL.NO	DESCRIPTION	Unit	qty
E.23.1.15	3c x 1.5 sqmm armoured power cable	Mtrs	29000
E.23.1.16	3c x 1.5 sqmm armoured power cable to laid underground around perimeter. (Excavation of different sizes of trenches in any type of soil and plcement of sand below and above the cable in the excavated trench and placement of bricks on top and sides of cable in the excavated trench and refilling the trench with excavated soil and levelling after cable laying. The scope includes supply of good qualty soil and bricks of size 225mm x 115mm x 75mm and cable markers)	Mtrs	6000
E.23.1.17	25 mm PVC conduit with coupler accessories	Mtrs	4000
E.23.1.18	GI poles 1/2" to 1 " (18 feet) for fixing cameras and JB	Nos	25
E.23.1.19	Single mode Media converters	Nos	55
E.23.1.20	Mini UPS 3 KVA sealed maintenance free battery	Nos	1
E.23.1.21	Mini UPS 1 KVA sealed maintenance free battery	Nos	15
E.24	**Access control system - Record cum movement of visitors**		
E.24.1	Server with 29" monitor with accessories	set	2
E.24.2	A4 size color laser printer	No.	1
E.24.3	Card reader with electromagnetic door locks	set	36
E.24.4	Access card controller	Nos	18
E.24.5	ID card printer with web camera	set	2
E.24.6	Armoured Data cable between access door t controller	Mtrs	1000
E.24.7	OFC armoured cable 4F & 6F single mode includes fixing of fibre optic components and termination kits LIU, face plates,cabinets,SC coupler,grounding etc	Mtrs	29000
E.24.8	3c x 1.5 sqmm armoured power cable	Mtrs	4000
E.24.9	25 mm PVC conduit with coupler accessories	Mtrs	500
E.24.10	Permanently lubricated HDPE pipes	Mtrs	500
E.25	**Patrol Guard System - Monitor guard movements with soft ware**		
E.25.1	Patrol guard PC with accessories, data tranfer cable with connector.	set	1
E.25.2	Card reader with rechargable battery and charger	set	100
E.26	**Visitor ID Gate pass system - Installation and commissioning**		
E.26.1	ID card printer, WEB camera	set	1
E.26.2	Server based OWS with 24" LED monitor with sofware	set	1
E.26.3	A4 size color laser printer	No.	1
E.26.4	MiniUPS 2 KVA sealed maintenance free battery	Nos	1
E.26.5	Digital camera qty 2 nos, Digital video camera Qty 1 no with all standard accessories	set	3
E.26.6	Furniture - Computer Table qty 1 nos, chair qty 2 nos	set	1
E.27	**PADO SYSTEM**		
E.27.1	PADO servers PC alongwith 24 inch monitor accessories power distribution boards	set	2
E.27.2	OWS PC alongwith 24 inch monitor power distribution boards	Nos	4
E.27.3	A4 Black & white printer (SWAS, Chemical lab)	Nos	2
E.27.4	A3 color printer	set	2
E.27.5	Lan switches	Nos	2

SL.NO	DESCRIPTION	Unit	qty
E.27.6	CAT-6 Cable	Mtrs	305
E.27.7	6U wall mountable rack	No.	1
E.28	**TURBINE SUPERVISORY SYSTEM FOR MAIN TURBINE**		
E.28.1	Mgggitt VM600 system 19 inch Rack Control Cabinet (with I/O cards, relay cards) to be mounted in CJJ 41, Laptop, A3 printer, Ethernet to FO convertor, interconnecting cables, etc.	set*	2
E.28.2	Total loose supplied items to be mounted in the turbine is as follows: Absolute shaft Vibration sensors with isolators qty 16, relative shaft vibration with isolators qty 16 nos, HP turbine Rotor expansion with isolators qty 2, LP turbine rotor expansion sensors with isolators qty 2 nos, Overall expansion HP&IP casing LVDT - 2 nos, Axial shift probe sensor with isolators qty 3 nos Key phaser qty 1 nos, Junction box qty 12 nos. SS conduit with teflon coating for sensor cables 130 mtrs. along with Machinery protection software.	set*	1
E.29	**HART MANAGEMENT SYSTEM**		
E.29.1	Hart Management System (HMS) Comprising of the following : HART Panel- 04 nos., Desktop PC with 24" TFT Monitor-01 no., Colour laser Printer 01 no.Laptop, and MTL soft ware CD other loose supplied items like Hart / back plane communication modules, Patch cards & 20 way FRC intra panel cables134 set, RS485 to RS 232 Convertor1 nos, interconnecting Cables 200 mtrs, etc. Approx. Size and Weight of the Panel make Rittal 800(L) x 800(W) x 2117(H) mm; 700 Kg	set*	1
E.30	**INSTRUMENTS**		
E.30.1	Pressure guages H guru make dial size 150/ 250mm size.	Nos	182
E.30.2	Differential Pressure Gauges H guru make dial size 150/ 250mm size.	Nos	23
E.30.3	Temperature Gauges (capillary type) with thermowell	Nos	134
E.30.4	Duplex Thermocouples along with thermowell (K type/ R type) qty 261, 30 mtr long flexible thermocouples qty 22	Nos	283
E.30.5	Duplex RTDs along with thermowell	Nos	138
E.30.6	Pressure Switches	Nos	67
E.30.7	Guided Wave Radar Type Level Transmitter probe length 850mm to 3300mm, for LPH, Drain oil tank, hot well etc	Nos	24
E.30.8	Pressure Transmitters/DP transmitters/Level transmitters	Nos	452
E.30.9	Temperature Transmitters- Dual input	Nos	410
E.30.10	Ultrasonic level transmitter with masi bus controller-condenser storage tank	Nos	2
E.30.11	E/P Converters for burner Tilt & SADC	Nos	54
E.30.12	Air Filter Regulators for burner tilt & SADC	Nos	54
E.31	**EWLI for HP heaters**		
E.31.1	Water column for 19 channel along with conductivity probes qty 19 nos with accessories isolation cum drain and vent valves, impulse pipes 25 NB sch 160 long 4 mtrs, etc	set	6
E.31.2	Water column for 8 channel along with conductivity probes qty 8 nos with accessories isolation cum drain and vent valves, impulse pipes 25 NB sch 160 long 4 mtrs, etc	set	6
E.31.3	control cable 4 twisted pair x 0.5 sqmm	Mtrs	100
E.31.4	control cable for alarm/trip 10c x 0.5 sqmm	Mtrs	100
E.31.5	Control cable for 4 - 20 mA output 2c x 0.5 sqmm	Mtrs	200
E.31.6	Power cable 3c x 0.5 sqmm	set	4

SL.NO	DESCRIPTION	Unit	qty
E.31.7	Capacitance type lvel switches for clean/dirty oil tank contains capacitance probe 300mm long, with electronic controller size 80mmx150mmx70mm, sensor cabling each 5 mtr	set	4
E.31.8	Conductivity type level switch (CRH drain pot) consists of Stand pipe with 15 NB class 1500 drain and vent valves (ASTM A 106 Gr C) 2 nos, level probe 2 nos, field mounted electronic control unit qty 1 nos. inter connecting teflon cables 10 mtrs	set	2
E.32	**GAS ANALYSERS**		
E.32.1	High temp O2 Analyser for PSH outlet left/right Consisting of flange mounted zirconia (insitu) probe Flange mounted (lengh of probe is 900 mm)with Probe Protector ss316, Electronic controller unit with display board cum key pad, RTU converter ss316 tubing, interconnecting cables etc controller size 300mm x 400mm x 210mm, Junction boxes,Double stage gas regulators, Zero gas cylinder, Span gas cylinder, instrument air connection, rotometers,Airfilter, solenoids, and gas connection tubes, interconnecting power and control cables etc., Weight of analyser is 22 Kg	set*	3
E.32.2	Low temp O2 Analyser Make AIC Model 9027 Consisting of flange mounted zirconia (insitu) probe (lengh of probe is 1835 mm qty 8 nos & 925mm qty 1 no)with Probe Protector ss316,, Oxygen Analyser converter, Auto calibration unit enclosure(600mm x 600mm x 250mm), Double stage gas regulators capacity 10 ltrs, Zero gas cylinder, Span gas cylinder 1&2, instrument air connection, rotometers,Airfilter, solenoids, and gas connection tubes, interconnecting power and control cables etc., Weight of analyser is 22 Kg Location Economiser inlet & outlet qty 4 nos, Air heater outlet qty 2 nos, ID fan inlet qty 2 nos, Boiler bank outlet qty 1 no	set*	9
E.32.3	Opacity monitor Make Forbes marshal Model : FMDCEM2100 Dust Analyser (InSitu non contact Cross duct type) Consisting of Transceiver unit -02 No each with air purge connections, Signal processor unit, power supply unit, display control unit, actuator control unit, fail safe shutter with 10 mtr cable against power or purge air failure, Air Compressor Unit 2 nos with air distribution Hose for purge air connection , Remote control display unit inter connecting power & control cables etc. The analyser mounting at elevation 65 mts and temperature transmitter at 64.75 mtrs on chimney.	set*	1
E.32.4	SOX/NOX/CO (Combined) analyser system Make Forbes marshal Model GCEM 4080 qty 1 nos mounting location at Chemney elevation 33 mtrs Consisting of in-situ Probe (long 300 mm) flange mounted with sensor head temp and pressure transmitters, air dryer unit, 6mm OD ss tubing 25 mtrs, display unit,and pnematic panel size 600mm x 800mm x 300mm inter connecting power and control cables auto calibration solenoids, pressure guages, flow meter, air dryer with filter arrangement, calibration gas cylinders N2 & So2 Nox 10 ltr capacity 2 sets with rack stand. Total package weight 65 Kg	set*	1
E.32.5	Laptop for sox nox analyser along with software	set	1
E.32.6	Desk top computer with accessories, with software	set	1
E.32.7	Computer furniture Table and chair	set	1
E.32.8	6 core optical fibre cable multimode	Mtrs	1000
E.32.9	Over all connectivity system and software - MBTU panel mounted near analyser pnematic panels (model 4080/ 4010) size 760mm x 760mm x 300mm relay panel (for model 4010) size 300mm x 300mm x 200mm, data concentrator panel at CCR size 500mm x 400mm x 210mm	set	1

SL.NO	DESCRIPTION	Unit	qty
E.32.10	Velocity analyser model VCEM 5100 consisting of flow analyser probe with head length 1000 mm qty 2 nos mounted in chemney at 33 mtr (each one mtr apart) , air purging unit, signal processing unit, digital display unit etc	set	1
E.32.11	CO gas analyser model : GCEM 4010 (33 mtr elevation chemney 1 no, APH outlet 2 nos) cosisting of in-situ Probe (long 300 mm) flange mounted with sensor head temp and pressure transmitters, air dryer unit, 6mm OD ss tubing 45 mtrs, display unit,and pnematic panel size 600mm x 800mm x 300mm inter connecting power and control cables auto calibration solenoids, pressure guages, flow meter, air dryer with filter arrangement, calibration gas cylinders N2 & co 10 ltr capacity 2 sets with rack stand. Total package weight 65 Kg	set*	2
E.32.12	Mercury analyser Make DURAG, Model HM 1400 TAX consist of heated sample probe with heated filter, mounting flange, heated sample tubes with RTD (length 60 mtrs), span zero gas calibration cylinders, peristatic pumps 2 nos, out door PLC panel installed at "o" mtr location size 800mm(w) x 500mm (d) x 1600mm (h) aprox weight of panel 400 Kg, mounted on chimney at 36 mtr elevation.	set	1
E.33	STEAM AND WATER ANALYSIS SYSTEM (SWAS) 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.		
E.33.1	SAMPLE HANDLING SYSTEM		
E.33.1.1	Sampling handling system consisting of: Primary Rack: 02 Nos. dimention 1800mm x 800mm x2100mm, Wet panel 1 no dimention 6000mm x 2000mm x 2100mm, dry panel 1 no dimention 6000mm x 1000mm x2100mm, stand alone panel 1 no dimention 800mm x800mm 1800mm, Chiller unit (redundant) qty 1 dimension 4000mm x 2000mm x 2100mm, Aprox overall weight 5000 kg	set*	1
E.33.1.2	Conductivity analyser qty 26 nos, PH analysers qty 12 nos, Disolved oxygen analysers qty 7, sodium qty 1 no, silica (three stream) qty 2 nos, hydrazine qty 3 nos, Chorlide qty 2 nos, Residual Chloride- 1 no, Salinity-1 no, Turbidity - 1no, TOC analyser - Qty 1 no, SIlica analyser single channel Qty- 1 No.	set*	1
E.33.1.3	A 106 Gr. 2" NB SCH 40 for Cooling water for SWAS includes Tees and bends	Mtrs	140
E.33.1.4	SS316, 2" NB SCH 40 for Cooling water for SWAS includes Tees and bends	Mtrs	60
E.33.1.5	SS316 1/4" Between wet and dry panel	Mtrs	300
E.33.1.6	Special cables for sensors between wet and dry panel	Mtrs	1500
E.34	**Furniture for SWAS**		
E.34.1	STEEL ALMIRAH - Size - 900 (W) x 450(D) x1800(H) mm	Nos	2
E.34.2	OPERATOR CHAIR	No.	1
E.34.3	WORKBENCH FOR CALIBRATION & TESTING - Size - 1500(W) x 1000(D) x 800(H)mm	No.	1
E.35	**VIBRATION MONITORING SYSTEM**		
E.35.1	VMS panel for HT drives consists of three bay panel dimention 2250mm(l) x 800mm(d) x 2415mm(h) each panel weight aprox 1350 kg	Nos	1
E.35.2	Installation of vibration sensors, driver, extension cable with mounting block Qty-154 nos, Phase marker sensor, driver, extension cable with bracket - Qty 29 nos,	set*	1

SL.NO	DESCRIPTION	Unit	qty
	Shaft vibration sensors, driver, extension cable with probe holder - Qty 12 nos		
E.35.3	Junction boxes (24way)	Nos	75
E.35.4	Loop checking of VMS system through Portable shaker table for 195 sensors as above. Portable shaker table will be provided by BHEL.	set*	1
E.35.5	Server PC with monitors accessories along with net work cables. With computer table	set*	1
E.36	**MAIN UPS WITH ACDB & BATTERY**		
E.36.1	2 X200 KVA UPS parallel redundent comprising of the following (shipping section 5 set) : UPS-1 , UPS 2, Rectifier Panels, nverter panels nd Aux panel 1,2 ,with Input Iso. Transformer & SVR panels over all size 9660 mm (L) x 1050 mm(W) x 2240 mm(H) aprox weight 6000 Kg. wall mounted Battery isolation JB size 450mm x 300mm x750mm weight 80 Kg aprox (qty 1 no).Battery tie breaker 400mm x 600mm x 300mm aprox weight 50 kg (qty 2 nos) Wall mounted BHMS Display box aprox size 1000mm x 300mm x 1500mm and accessories alongwith kit cable 30 mtrs.	set*	1
E.36.2	ACDB :over all size 1700 mm(L) x 600 mm(D) x 2215 mm(H) mm; aprox weight 1200 kg.	Nos	2
E.36.3	Power distribution board over all size 1100mm x 400 mm x 1850mm aptox weight 500 kg	Nos	1
E.36.4	UPS to Battery cable 2 runs 1 C copper cable uninyvin 240 sqmm copper	Mtrs	200
E.36.5	UPS to ACDB cable 2 runs 1 C Copper cable uninyvin 400 sqmm copper	Mtrs	640
E.36.6	Modbus Communication cable 4C shielded cable	Mtrs	150
E.36.7	UPS BATTERY make HOPPECKE model 15 GroE 1500 : Lead Acid Plante Battery 1500 AH made up of around 252 cells, housed in wooden racks 5 rows of 52 cells in one row & 50 cells in four rows along with inter cell connectors, inter block connectors , inter row connectors, cell mounting insulators, filling of electrolyte 32 liters/cell, petroleum gelly and Ms lead plated fastners, Each Cell dimension: 330(L) x 350(W) x 545(H).Cell weight: 150 Kg. Approx without acid. with safty aparatus accessories of batteries and test measuring instruments.	set*	2
E.36.8	24 V DC Lead Acid Battery for Charger : Model 12 YHP 17 Make EXIDE rating 860 AH 24 V DC. Total cells 12 nos housed in wooden racks one row with inter cell connectors, inter block connectors, inter row connectors, cell mounting insulators, filling electrolyte for each cell 64.2 ltrs. petroleum gelly and Ms lead plate fastners, Each cell dimension : 433mm x 368mm x 682mm each cell weight without acid 97 kg aprox. along with safty apparatus accessories of batteries and test measuring instruments.	set*	2
E.36.9	24 V/ 324 A Battery Charger for TG Siemens panels & MFT consising of Charger cum DCDB panel size 1300mm x 700mm x 1815mm, Wall mounted Battery health monitoring size 550mm x 400mm x 500mm communication CAT 5 cable 200 mtrs, connecting cables of size 1.5 sqmm BHMS to each cell 1 set.	set*	2
E.36.10	1Cx50 sqmm Cu cable from charger to DCS cabinets	Mtrs	2520
E.36.11	1Cx240 sqmm Cu cable from charger to battery	Mtrs	720
E.37	**SERVICE BUILDING - UPS WITH ACDB & BATTERY**		

SL.NO	DESCRIPTION	Unit	qty
E.37.1	2 X35 KVA UPS parallel redundent comprising of the following : UPS-1 , UPS 2, Rectifier Panel, inverter panels and Aux panel 1,2 ,with Input Iso. Transformer overall size 4000 mm (L) x 950 mm(W) x 2415 mm(H) aprox weight 3000 Kg. wall mounted Battery isolation JB size 600mm x 300mm x800mm weight 80 Kg aprox. Wall mounted BHMS Display box aprox size 450mm x 500mm x 150mm and accessories.	set*	1
E.37.2	ACDB : over all size 1000 mm(L) x 950 mm(D) x 2200 mm(H) mm; 1000 kg.	Nos	2
E.37.3	UPS to Battery 2Cx35 sqmm PVC FRLS copper cable	Mtrs	160
E.37.4	UPS to ACDB 2Cx35 sqmm PVC FRLS copper cable	Mtrs	60
E.37.5	Communication cable 4C shielded cable	Mtrs	60
E.37.6	UPS BATTERY make Exide : Lead Acid Plante Battery Model: YHP11 (220V/535AH) made up of around 110 cells, housed in wooden racks 4 rows of 27/28 cells in alternate row along with inter cell connectors, inter block connectors , inter row connectors, cell mounting insulators, filling of electrolyte 27.7 liters/cell, petroleum gelly and Ms lead plated fastners, Each Cell dimension: 230(L) x 368(W) x 682(H).Cell weight: 60 Kg. Approx.	set*	2
E.38	**AUX BOILER, MRS & HVAC LCR building- UPS WITH ACDB & BATTERY**		
E.38.1	2 X 15 KVA UPS parallel redundent comprising of the following : UPS-1 , UPS 2, Rectifier Panel, inverter panels and Aux panel 1,2 ,over all size 4000 mm (L) x 950 mm(W) x 2415 mm(H) aprox weight 3000 Kg. wall mounted Battery isolation JB size 600mm x 300mm x800mm weight 80 Kg aprox. Wall mounted BHMS Display box aprox size 450mm x 500mm x 150mm and accessories.	set*	3
E.38.2	ACDB : over all size 1000 mm(L) x 950 mm(D) x 2200 mm(H) mm; 1000 kg.	Nos	6
E.38.3	UPS to Battery 2Cx35 sqmm PVC FRLS copper cable	Mtrs	240
E.38.4	UPS to ACDB 2Cx35 sqmm PVC FRLS copper cable	Mtrs	180
E.38.5	Communication cable 4C shielded cable	Mtrs	180
E.38.6	UPS BATTERY make Exide : Lead Acid Plante Battery Model: YKP17 (220V/200AH) made up of around 110 cells, housed in wooden racks 2 rows of 27/28 cells stacked one and above along with inter cell connectors, inter block connectors, inter row connectors, cell mounting insulators, filling of electrolyte 7.3 liters/cell, petroleum gelly and Ms lead plated fastners, Each Cell dimension: 210(L) x 203(W) x 426(H).Cell weight: 22 Kg. Approx.	set*	3
E.39	**CPU Regeneration Area & ESP building - UPS WITH ACDB & BATTERY**		
E.39.1	2 X 10 KVA UPS parallel redundent comprising of the following : UPS-1 , UPS 2, Rectifier Panel, inverter panels and Aux panel 1,2 ,over all size 4000 mm (L) x 950 mm(W) x 2415 mm(H) aprox weight 3000 Kg. wall mounted Battery isolation JB size 600mm x 300mm x800mm weight 80 Kg aprox. Wall mounted BHMS Display box aprox size 450mm x 500mm x 150mm and accessories.	set*	2
E.39.2	ACDB : over all size 1000 mm(L) x 950 mm(D) x 2200 mm(H) mm; 1000 kg.	Nos	4
E.39.3	UPS to Battery 2Cx35 sqmm PVC FRLS copper cable	Mtrs	160
E.39.4	UPS to ACDB 2Cx35 sqmm PVC FRLS copper cable	Mtrs	120
E.39.5	Communication cable 4C shielded cable	Mtrs	120

SL.NO	DESCRIPTION	Unit	qty
E.39.6	UPS BATTERY make Exide : Lead Acid Plante Battery Model: YKP13 (220V/150AH) made up of around 110 cells, housed in wooden racks 2 rows of 27/28 cells stacked one and above along with inter cell connectors, inter block connectors , inter row connectors, cell mounting insulators, filling of electrolyte 5.4 liters/cell, petroleum gelly and Ms lead plated fastners, Each Cell dimension: 173(L) x 203(W) x 426(H).Cell weight: 18 Kg. Approx.	set*	2
E.40	**LOCAL INSTRUMENT ENCLOSURES/ RACKS**		
E.40.1	Local Instrument Enclosures (Type - A)-Size: 1450(W) x 1000(D) x 2200 (H)mm; Approximate weight: 900 kg each	Nos	9
E.40.2	Local Instrument Enclosures (Type - B)-Size: 1100(W) x 1000(D) x 2200 (H)mm; Approximate weight: 600 kg each	Nos	32
E.40.3	Local Instrument Enclosures (Type - C)-Size: 800(W) x 1000(D) x 2000 (H)mm; Approximate weight: 400 kg each	Nos	25
E.40.4	Local Instrument Racks (Type - A)-Size: 1300(W) x 1250(D) x 2200(H) mm; Approximate weight: 600 kg each	Nos	16
E.40.5	Local Instrument Racks (Type - B)-Size: 950(W) x 600(D) x 2200(H) mm; Approximate weight: 400 kg each	Nos	31
E.40.6	Local Instrument Racks (Type - C)-Size: 700(W) x 650(D) x 1500(H) mm; Approximate weight: 250 kg each	Nos	7
E.40.7	Local Instrument Racks (Type - D)-Size: 1500(W) x 1450(D) x 2200(H) mm; Approximate weight: 700 kg each	Nos	2
E.41	**CABLES**		
E.41.1	**T/C extension Cables**		
E.41.1.1	2 pair ,16 AWG 'KX' type T/C cable	Mtrs	17075
E.41.1.2	2 pair ,16 AWG 'RX' type T/C cable	Mtrs	600
E.41.1.3	4 Pair, 16 AWG " KX type", T/C cable	Mtrs	16000
E.41.1.4	6 Pair, 16 AWG " KX type", T/C cable	Mtrs	43550
E.41.2	**PVC/FRLS, armoured, individually and overall shielded, Cu cables**		
E.41.2.1	2 pair x 0.5 sq. mm cable	Mtrs	33417
E.41.2.2	4 pair x 0.5 sq. mm cable	Mtrs	32180
E.41.2.3	6 pair x 0.5 sq. mm cable	Mtrs	13550
E.41.2.4	8 pair x 0.5 sq. mm cable	Mtrs	27287
E.41.2.5	12 pair x 0.5 sq. mm cable	Mtrs	2000
E.41.3	**PVC/FRLS, armoured, Overall shielded, Cu Cables**		
E.41.3.1	2 pair x 0.5 sq. mm cable	Mtrs	20675
E.41.3.2	4 pair x 0.5 sq. mm cable	Mtrs	26762
E.41.3.3	8 pair x 0.5 sq. mm cable	Mtrs	24326
E.41.4	**Control cables copper, armoured**		
E.41.4.1	2C X 2.5 sqmm cable	Mtrs	2000
E.41.4.2	3C X 2.5 sqmm cable	Mtrs	8228
E.41.4.3	5C X 2.5 sqmm cable	Mtrs	2860
E.41.5	**PTFE CABLES FOR TG**		
E.41.5.1	PTFE EXTRD 7/0.3 600V 2/2X0.5MM² IT-	Mtrs	9000
E.41.5.2	PTFE EXTRD 7/0.3 600V 4/2X0.5MM² IT-	Mtrs	2500
E.41.5.3	CBL PTFE 5Cx 1.5 SQ MM 30/0.25 600V	Mtrs	3000

SL.NO	DESCRIPTION	Unit	qty
E.42	**CABLE TRAYS WITH COVERS**		
E.42.1	Perforated Cable Trays, 50 mm wide	Mtrs	3000
E.42.2	Perforated Cable Trays, 100 mm wide	Mtrs	3000
E.42.3	Cable duct trays for TG	Mtrs	500
E.43	**JUNCTION BOXES**		
E.43.1	12 way Junction Boxes	Nos	21
E.43.2	24 way Junction Boxes	Nos	42
E.43.3	36 way Junction Boxes	Nos	33
E.43.4	48 way Junction Boxes	Nos	7
E.43.5	64 way Junction Boxes	Nos	2
E.43.6	96 & 128 way Junction Boxes	Nos	3
E.44	**Junction box for Temp. transmitters**		
E.44.1	Type A Size 900mm x800mm x 500mm	Nos	13
E.44.2	Type B Size 800mm x600mm x 500mm	Nos	29
E.44.3	Type C Size 800mm x400mm x 500mm	Nos	49
E.45	**IMPULSE PIPES**		
E.45.1	ASTM A335 P91 - ½" NB XXS (IBR)	Mtrs	900
E.45.2	ASTM A335 P22 - ½" NB sch 160 (IBR)	Mtrs	850
E.45.3	ASTM A106 GR C 1/2" NB SCH 160 (IBR)	Mtrs	1750
E.45.4	ASTM A106 Gr C- ½" NB SCH 80 (IBR)	Mtrs	9000
E.45.5	ASTM A106 GR C 1" NB SCH 80	Mtrs	600
E.45.6	ASTM A335 P22 - 3/4" NB sch 80	Mtrs	1100
E.45.7	ASTM A106 Gr C - 3/4" NB SCH 80	Mtrs	6500
E.45.8	ASTM D1784 CPVC PIPE 1/2" NB SCH 80 (for SWAS)	Mtrs	850
E.45.9	ASTM A312 TP 316 H– ½" NB SCH 80 (for SWAS)	Mtrs	2100
E.45.10	ASTM A213 TP 316 H– 3/4" NB SCH 160 (IBR)	Mtrs	750
E.45.11	ASTM A213 TP 316 H– 3/4" NB SCH 80 (for SWAS) (IBR)	Mtrs	1150
E.45.12	SEAMLESS TUBE A213 TP 316 1/4" OD X 1.1	Mtrs	100
E.46	**OTHER ERECTION MATERIALS**		
E.46.1	100 x 50 x 5 mm MS Channels, 50 X 50 X 5 MS Angles, HR sheet 2.5mm thick, Plate 10mm thick	MT	20
E.46.2	½" heavy duty GI pipes	Mtrs	10000
E.46.3	1" heavy duty GI pipes	Mtrs	500
E.47	**MASTER AND SLAVE CLOCK SYSTEM**		
E.47.1	Fully wired Master clock System Panel alongwith accessories power supply unit, signal conditioners etc Size: 800 x 800 x 2415 mm; 300 kg approx.	Nos	1
E.47.2	100 mm Slave clock (Rs 485 base) Approximate Size: 800(W) x 120(D) x 200(H) mm	Nos	45
E.47.3	100mm Slave clock NTP Approximate Size: 800(W) x 120(D) x 200(H) mm	Nos	5

SL.NO	DESCRIPTION	Unit	qty
E.47.4	installation of antenna 2 nos, lightning arrester 2 nos, inline amplifier 2 nos alongwith FRLS cable from antenna to GPS receiver unit (100+100) - 200 mtrs.	set	1
E.47.5	FO cable 6c single mode out door armoured cable	Mtrs	3500
E.47.6	RG 58 Coaxial Cable FRLS armoured	Mtrs	6000
E.47.7	4 pair Cable - CAT 5 for NTP / SNTP	Mtrs	1200
E.47.8	2 pair 7/0.3 mm ,0.5 sq mm ATC armoured	Mtrs	5000
E.47.9	Flexible GI conduit Pipe	Mtrs	200
E.47.10	Junction Box (size 105mm x 105mm x 40mm)	Nos	25
E.48	**EPABX SYSTEM**		
E.48.1	IP EPABX Panel (with Ethernet switch & media gateway) at EPABX room in Service Building	set	1
E.48.2	Network Panels (with Ethernet switch)	set	2
E.48.3	Network Panel (with Ethernet switch & 50 lines media gateway) at Sea Water Intake Pump House in NCTPS stage-III and FO based IP interface with main plant IP EPABX server	set	1
E.48.4	Branch Exchange of 256 lines expandable upto 800 lines (wired rack) at Vayallur camp. The exchange shall work as stand-alone also. The exchange shall have IP based interface link through FO cable to main plant IP-EPABX system. Branch Exchange shall be consisting of	set	1
E.48.5	Branch Exchange of 100 lines.	set	1
E.48.6	FCBC with 48V Ni-Cd battery bank - 1 set	set	3
E.48.7	1 KVA UPS with battery	set	1
E.48.8	2x100% 48V FCBC	set	1
E.48.9	2x100% Ni-Cd battery (48 V DC) with stand.	set	1
E.48.10	Operator Console (PC based)	No.	1
E.48.11	Analog Desktop Telephone Set with caller ID with RJ-11 telephone cord (min 5 mtr length)	Nos	750
E.48.12	Analog Wall mounted Telephone Set with caller ID with RJ-11 telephone cord (min 5 mtr length)	Nos	50
E.48.13	SIP IP telephones	Nos	25
E.48.14	Digital telephone with speaker phone and display with RJ-11 telephone cord (min 5 mtr length)	Nos	50
E.48.15	Digital cordless phone	Nos	50
E.48.16	Chief/Secretary phone with RJ-11 telephone cord (min 5 mtr length)	Nos	10
E.48.17	Desktop PC (One PC for Operator console & One PC for Maintenance & Diagnostics/Call billing)	Nos	2
E.48.18	Multi-function printer with duplex printing mode	Nos	2
E.48.19	Table for PC & printers (2no for PC & 2 no for printer)	Nos	4
E.48.20	Chair for operator	Nos	2
E.48.21	3 KVA UPS with 12 hr backup(for PCs, printers)	No.	1
E.48.22	MDF, Connector Blocks and accessories for 1000 extensions with all necessary protection arrangements	set	1
E.48.23	MDF, Connector Blocks and accessories for 80 extensions with all necessary protection arrangements	set	1
E.48.24	MDF, Connector Blocks and accessories for 800 extensions with all necessary protection arrangements	set	1

SL.NO	DESCRIPTION	Unit	qty
E.48.25	MDF, Connector Blocks and accessories for 150 extensions with all necessary protection arrangements	set	1
E.48.26	PVC FRLS telephone cable (1/2/5/10 pair)	Mtrs	24000
E.48.27	Jelly filled DOT/TEC cable of various sizes (5/10/20/50/100 pair)	Mtrs	43000
E.48.28	CAT 6 UTP cable	Mtrs	3500
E.48.29	Single mode fibre optic cable ring formation all BOP and power house	Mtrs	15000
E.48.30	PVC conduits & box type casing from 1/2 " to 3/4" (includes erection of hardwares)	Mtrs	12700
E.48.31	Power cable 3c x 1.5 sqmm	Mtrs	1500
E.48.32	Field mounted junction box	Nos	245
E.49	**C&I lab instruments to be demonstrated and handing over to customer**		
E.49.1	Electronic Test Bench - 1 no, Computer aided calibration system - 1 set, 4&1/2, 5&1/2,7&1/2 portable digital multimeter - 19 nos, RCL bridge model 6440B - 1no, Circuit testermodel DAT55000 -1 no, Function generator model AFG 3101c - 1no, Digital osilascope - 1no, Tachometer - 2nos, Soldering iron - 3 nos, Solder sucker & desoldering station- 2nos, Potentiometer - 10 nos, AC thermometry bridge - 1 no, Stop watch - 2 no, mA/mV calibrator 12 nos, Thermocouple/RTD calibrator - 6 nos, Multifunctional calibrator - 2 nos, digital insulation tester - 2 nos, Sound level monitor - 2 nos, Vibration meter - 5 nos, Vibration shock pulse analyser - 1 no, Decade resistance Box - 6 nos, Lan tester - 2 nos, Earth resistance tester - 2 nos, Fibre optic testing tool kit 2 nos,Tong tester - 2 nos, Stroboscope -1 no, Auto transformer - 4 nos , RTD test detector - 2 nos, Over head projector - 2 nos, White board projector - 1 nos, Portable PH calibrator - 1 no, Logic probe - 1no, Marker printer - 1 no, DC regulator supply - 4 nos, Frequency counter - 1 no, Portable conductivity meter - 1 no, Vibration pickup tester - 1 no, Stablised power supply - 3 nos, Continuity tester - 9 nos, Optical time domain reflectometer - 2 set, Decade capacitance & inductance box - 2 nos, Pneumatic Test Bench- 1No, Portable calibrator for Vacuum - 3 Nos, U tube Manometer-2 nos, Incline tube manometer- 2 nos, Test Manometer- 2 nos, Digital manometer- 2 nos, Dead Weight Tester- 1no, Vacuum tester- 1no, Standard pressure gauges - 2 nos, Microprocessor based fluidised temperature bath - 2 nos, Dry block type calibrator - 3 nos, Mercury Thermometer- 2 nos, Flow meter calibrator- 3 nos, Digital Thermograph/Hygrometer - 1no, Portable Flue gas analyser -1 No, Aneroid Barometer- 1no, Miscellaneous tool box items - 1 Set, Pressure and Differential pressure calibrator - 6 nos, Pressure & Vaccuum Air Pump - 1 no, Air set- 2nos, Portable Electro-pneumatic calibrator - 4 nos, Portable Infrared Radiation thermometers - 1no, Thermocouple Test furnace- 1no, Portable H2 gas analyser- 1no, Industrial portable Vacuum cleaner- 6 nos, Averaging pitot tube - 2 nos, Oil condition monitor- 1no, Portable Infrared Radiation thermograph (IR imaging device & camera)- 1 no, Grinding wheel - 1 no, Laser based Shaft Alignment System - 1no.	set*	1
E.50	Furniture for Lab - Instrument stock cupboard - 4 sets, Plain test bench- 3 nos, Table & chair - 6 nos, Record cupboard - 4 nos.	set	1
F	**HYDERABAD**		
F.1	**PUMPS (TDBFP, MDBFP, CEP)**		
F.1.1	Miniature RTD along with thermowells	Nos	6
F.1.2	RTD along with thermowells for BFP, CEP	Nos	103

SL.NO	DESCRIPTION	Unit	qty
F.1.3	Temperature Indicators of BFP, CEP (Removal, calibration & re-fixing only)	Nos[$]	8
F.2	**IMPULSE TUBES**		
F.2.1	Impulse Tube, Dia 16 x 2.6, CS	Mtrs	1700
F.3	**JUNCTION BOXES**		
F.3.1	48 way Junction Boxes	Nos	3
F.3.2	64 way Junction Boxes	Nos	11
F.3.3	72 way Junction Boxes	Nos	1
F.4	**CABLES/ CABLE TRAYS**		
F.4.1	4 Pair, 0.5 sq. mm cable	Mtrs	1000
F.4.2	Perforated cable tray, 50 mm wide	Mtrs	80
F.4.3	Perforated cable tray, 150 mm wide	Mtrs	45
F.5	**LOCAL GAUGE BOARD (LGB) / LOCAL I NSTRUMENT RACK (LIR) (including removal, calibration and re-fix ing of LGB mounted instruments)**		
F.5.1	LGB (LGB -1)Assembly for Feed Water Service for TDBFP/MD BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs. Approximate Size 1100 x900 x 2200 mm ; Weight = 600 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)	Nos	3
F.5.2	LGB (LGB-2) Assembly for SW & Cooling Water Service of TD/MD Booster Pump & BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs. Approximate Size 1100 x 900 x 2200 mm ; Weight = 600 kg each.Quantity of instruments per set is Temperature Gauges: 8 Nos. Pressure Gauge - 1 Nos. DP Gauges - 3	Nos	3
F.5.3	LGB (LGB-2) Assembly for Lub oil service of TD / MD Booster Pump & BFP including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs.Approximate Size 1100 x 900 x 2200 mm ; Weight = 600 kg each.Quantity of instruments per set is Temperature Gauges: 4 Nos. Pressure Gauge - 4 Nos.	Nos	3
F.5.4	LGB (LGB-1) Assembly for 3 Nos. CEP Suction/discharge side including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs.Quantity of instruments per set is Pressure Gauges: 6 Nos..Diff. pressure Gauges: 3 Nos.temp. gauge qty 3 nos Approximate Size 1100 x 900 x 2200 mm; Weight = 600 kg each	Nos	1
F.5.5	LGB (LGB-1) Assembly for 2 Nos. Drip pump suction/ discharge including instruments, tubing, valves, fittings, junction boxes and wiring from switches to JBs.Quantity of instruments per set is Pressure Gauges: 4 Nos..Diff. pressure Gauges: 2 Nos. Temp. gauge 2 qty Approximate Size 1100 x 900 x 2200 mm; Weight = 600 kg each	Nos	1
F.5.6	Local instrument rack (LIR) assembly for TDBFP/MDBFP Transmitters. This LIR includes PT & DPTs,tubing , fittings, JBs, Main-fold valves and wiring from JBs to transmitters. Approximate Size 2000 x 650 x 2150 mm; Weight = 350 kg each. Quantity of instruments per set is DP transmitters: 05 Nos.Pressure transmitter : 05 Nos.	Nos	3
F.5.7	Local Instrument Rack (LIR) assembly for CEP-A,B&C pumps to mount Pr. Transmitters. This LIR includes Transmitters, tubing, fittings, JBs, Manifolds Valves Approximate Size: 2000 x 600 x 2150 mm;and wiring from JBs to transmitters Weight = 300 kg Quantity of instruments per set is Pressure transmitters: 9 Nos, DP transmitters : qty 3 nos	Nos	1

SL.NO	DESCRIPTION	Unit	qty
F.5.8	Local Instrument Rack (LIR) assembly for Drip pumps to mount Diferential Pressure Transmitters. This LIR includes Differential Pressure Transmitters, tubing, fittings, JBs,Manifolds Valves and wiring from JBs to transmitters Approximate Size: 1050 x 650 x 1500 mm;Weight = 200 kg Quantity of instruments per set is Differential Pressure transmitters: 2 Nos, DP transmitters qty 2 nos	Nos	1
F.6	**SUPPORT MATERIALS**		
F.6.1	Structural steel (ISMC 100 x 50 mm qty 20 mtrs, Angle 45 x 45 x 5 mm-qty 24 mtrs etc.)	Kg	500
F.7	**CHECKING AND COMMISSIONING OF THE FOLLOWING**		
F.7.1	RTDs fixed on BFP, CEP motors (Checking healthiness only)	Nos$	56
F.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. 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.	set*$	1
F.8	**TG - C&I BFP Drive turbine**		
F.8.1	**INSTRUMENTS (LOCAL/FIELD MOUNTED)**		
F.8.1.1	Pressure Gauges	Nos	52
F.8.1.2	DP Gauges	Nos	5
F.8.1.3	Pressure Transmitters/DP transmitters	Nos	63
F.8.1.4	Temp. Transmitters	No.	1
F.8.1.5	Pressure Switches	Nos	2
F.8.1.6	Level gauges (reflex type)	Nos	2
F.8.1.7	Temperature Gauges with thermowell (capillary type)	Nos	24
F.8.1.8	RTDs with thermowell	Nos	23
F.8.1.9	Cr-Al Thermocouples with thermowell	Nos	15
F.8.1.10	Level Transmitters (guided wave Radar type, top mounted) along with probes, electronic unit etc.	set*	2
F.8.1.11	Speed measuring loop, with probe,	Nos	6
F.8.1.12	proximeter unit, local field cable etc. for Governing System	set*	16
F.8.1.13	E/P Converter	Nos	3
F.9	**PANEL / FIELD MOUNTED INSTRUMENTS**		
F.9.1	TSI System for BFP Drive Turbine and gear box consisting of the following- configuration LAPTOP with soft ware qty 1 nos Monitor rack with modules (to be mounted on CJJ panel)approximate wt 40 kg per rack qty 1 set. relative shaft Vibration sensor probes 8mm reverse mounted Turbine and gear box qty 8 nos, for Axia shift qty 3 nos, ececentricity qty 1 no,Zero speed qty 1 no, key phaser qty 1 no, bearing housing vibration qty 4 nos, Diferencial expn qty 1 nos, casing expancian qty 1 nos, with probe extension cables qty 20 nos. Probe drivers qty 16 nos, Driver Housing JB qty 12nos, Flexible conduit 150 mtrs, cable seal, cable connectors, Mounting brackets for vibration/diferencial exp/ brg housings, Rs 485 cable with connector for DCS 35 mtr long etc. and calibration Kit	set*	2
F.9.2	Fabrication of Local Instrument Racks, each of size 1500 x1700 mm, with the following material 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.	MT	2

SL.NO	DESCRIPTION	Unit	qty
F.9.3	Open type transmitter rack assembly for Drive turbine rack fitted with tubing , fittings, JBs, Main-fold valves and wiring from JBs to transmitters. Approximate Size 2000 x 1250 x 600 mm; Weight = 350 kg each.	Nos	12
F.10	**IMPULSE PIPES & FITTINGS**		
F.10.1	CS Pipe 21.3 x 3.73	Mtrs	400
F.10.2	CS Pipe, 60.3 x 3.91	Mtrs	65
F.10.3	Cr-Al Pipe 21.3 x 3.73	Mtrs	250
F.10.4	SS tube, 12.7 x 2.1 mm	Mtrs	750
F.10.5	SS tube, 6 x 1.5 mm	Mtrs	35
F.11	**Checking and commissioning of the following erected by Mechanical agency**		
F.11.1	Control Valves with smart positioner, AFR, air lock valves etc LO TCV,Gland steam inlet and dump	Nos$	3
F.11.2	Position Transmitters	Nos$	3
F.11.3	Governing Console Board The scope includes removal, calibration and refixing of Instruments, wiring etc. Size of panel 1200 x 1650 x 450 mm The approximate quantity of instruments is Pressure Gauges: 10 Nos. Pressure Switches: 24 Nos.	set*$	1
F.11.4	LT drives for Lube oil system system	Nos$	7
F.11.5	servo motor Motor operated valve lube oil system	Nos$	8
F.11.6	Oil purification unit drives	Nos$	1
F.12	**HEAT EXCHANGERS AND DEAERATOR**		
F.12.1	Pressure Gauges	Nos	8
F.12.2	Level Switches (float type)	Nos	3
F.12.3	Temperature Gauges with thermowell (capillary type)	Nos	37
F.12.4	PULVERISER		
F.12.5	RTDs along with thermowell	Nos	48
F.12.6	Temperature Indicators (Removal, calibration and refixing only)	Nos$	16
F.13	**Commissioning of the following Erected by Mechanical agency**		
F.13.1	PulveriserLub Oil Skid Removal, calibration and re-fixing of following instruments, checking of wiring from skid junction box to equipment in lub oil skid. Equipment per set level transmitter qty 3 nos,RTD qty 5 nos,Temp.gauge qty 3 nos, DP transmitter – 1 No. DP indicator – 1 No. Pressure Gauge- 3 Nos. Pressure transmitter qty 3 nos.	set*$	9
F.13.2	VFD Dynamic classifier panel for pulveriser 800mm x 600mm x 2055 mm	Nos	9
G	**BHEL-PEM SCOPE**		
G.1	Ultrasonic Flow transmitter with controller (CW and ACW)	set	2
G.2	INSTRUMENTATION CABLES		
G.2.1	Individual & Overall Shielded screened, Twisted Pair, Armoured cables Type F		
G.2.1.1	2 Pair x 0.5 mm2	Mtrs	100000
G.2.1.2	4 Pair x 0.5 mm2	Mtrs	60000
G.2.1.3	8 Pair x 0.5 mm2	Mtrs	34000
G.2.1.4	12 Pair x 0.5 mm2	Mtrs	10000
G.2.1.5	24 Pair x 0.5 mm2	Mtrs	8000
G.2.2	Overall Screened, Twisted Pair, Armoured cables Type G		
G.2.2.1	2 Pair x 0.5 mm2	Mtrs	30000
G.2.2.2	4 Pair x 0.5 mm2	Mtrs	105000
G.2.2.3	8 Pair x 0.5 mm2	Mtrs	146000

SL.NO	DESCRIPTION	Unit	qty
G.2.2.4	12 Pair x 0.5 mm2	Mtrs	30000
G.3	**COMMISSIONING OF FOLLOWING**		
G.3.1	Control Valves with smart positioner, AFR, air lock valves etc LO TCV,Gland steam inlet and dump	Nos$	22
G.3.2	11 KV HT drives - ID/FD/PA - each 2 nos, MDBFP - 1 no	Nos$	7
G.3.3	6.6 KV HT motor - DMCW(TG) 3nos, MILLS 9 nos, CEP 3 nos, BCW 1 no, Drip motor 2nos, FD aux boiler 1 no	Nos$	45
G.3.4	Winding RTD for HT drives 7 + 45 nos	Nos$	624
G.3.5	Capilary type Temp. guages mounted on HT motor	Nos$	104
G.3.6	Oxygen Dosing Skid - Approximate qty of instruments per skid is Pressure Gauges: 3 Nos., Mass flow controllers- 1 Nos Pressure relif valve - 2 nos. Pressure Transmitter: 3 Nos. Solenoid Valves : 5 No. Junction boxes: 2 Nos, oxygen cylinders - 8 Nos+ 11 loose cylinders	Nos$	2
G.3.7	Ammonia Dosing Skid - Approximate qty of instruments per skid is Pressure Gauges: 6 Nos., Level Gauge- 3 Nos, Pressure Transmitter: 2 No, level Transmitter: 4 No Differential Pressure indicating, Transmitter - 1 No,	Nos$	1
G.3.8	NaOH Dosing Skid - Approximate qty of instruments per skid is., Level Gauge- 1 Nos, Level Transmitters: 1 No. Pressure transmitter	Nos$	1
G.3.9	Hydrazine dosing system Approximate qty of instruments per skid is Pressure Gauges: 6 Nos., Level Gauge- 3 Nos, Pressure Transmitter: 2 No, level Transmitter: 4 No Differential Pressure indicating, Transmitter - 1 No,	Nos$	1
H	**BHEL- HARDWAR SCOPE**		
H.1	GENERATOR AUXILIARY CONTROL CABINETS		
H.1.1	Generator Instrumentation Cabinet (CXW01B)-Approx.size& weight: 1000 x 800 x 2200 mm; 450 kg	No.	1
H.1.2	Gas Analyser Cabinet (CXW01C & 1D) Approx. size & weight: 1200 x 800 x 2200 mm; 450 kg. to be installed near gas filling station. Includes laying of ss tubing for gas sample and zero and span cylinders with pressure regulating valves and vent lines.	set*	2
H.1.3	Moisture Measurement System for Generator, including indicator cum controller placed in control room 144 x 72 and sampling system in field 760 x 600 x 210 . Weight : 100 Kg	set*	1
H.1.4	Gen end vibration monitoring cabinet (CXW01E) dimention 800mm(W) x 600mm (D) x 2200mm (H) Including preamlifier units, special cables interconnecting, PC based monitor and printer computer table etc.aprox weight 150 kg	No.	1
H.1.5	Grounding Brush Monitor (Wall mounted) Approx. size & weight : 235 x 235 x 285 mm; 100 Kg.	set	1
H.2	**GENERATOR INSTRUMENTS:**		
H.2.1	Pressure Gauges	Nos	32
H.2.2	Temperature Gauges	Nos	15
H.2.3	Pressure Transmitters	Nos	8
H.2.4	Differential Pressure Transmitters	Nos	13
H.2.5	Level Transmitter	No.	3
H.2.6	Level Switches (capacitance type)	Nos	10
H.2.7	RTDs	Nos	18
H.2.8	Pressure Switches	Nos	2

SL.NO	DESCRIPTION	Unit	qty
H.2.9	Thermocouples (NiCrNi) (Generator Bearing Temp: 4 Nos.& Exciter Bearing Temp: 2 Nos.)	Nos	6
H.3	**Removal, Calibration & Refixing of Generator Instruments**		
H.3.1	Pressure Guage	Nos$	13
H.3.2	DP guages	Nos$	2
H.3.3	Temp Guages	Nos$	8
H.3.4	Pressure transmitter	Nos$	5
H.3.5	DP transmitters	Nos$	5
H.3.6	Pressure switches	Nos$	8
H.3.7	Level switches	Nos$	6
H.3.8	Flow meters	Nos$	8
H.3.9	Conductivity Cells	Nos$	3
H.3.10	PW Conductivity Indicator	Nos$	1
H.3.11	Checking the healthiness of theRTDs/Thermocouples	Nos$	180
H.4	**Power cable for 24V solenoids**		
H.4.1	4C X 2.5 sq mm	Mtrs	72000
H.5	**LOOSE SUPPLIED INSTRUMENTS FOR GENERATOR PIPING**		
H.5.1	Vacuum Switches	Nos	2
H.5.2	Pressure Gauges	Nos	7
H.5.3	Pressure Switches	No.	1
H.5.4	Pt RTD, Duplex	Nos	2
H.5.5	Dial Thermometer	Nos	5
H.6	**LOOSE SUPPLIED INSTRUMENTS FOR H2 COOLER PIPING**		
H.6.1	Pressure Gauges	Nos	8
H.6.2	Pressure Switches	No.	1
H.6.3	Pt RTD, Duplex	Nos	17
H.6.4	Moisture Sensor Probes	Nos	2
H.6.5	Dial Thermometer	Nos	6
H.7	**LOOSE ITEMS TO BE MOUNTED ON UCB**		
H.7.1	Digital Indicators	Nos	10
H.7.2	Bar Graph Indicators	Nos	5
H.7.3	Pressure Indicators (Moving Coil Type)	Nos	2
H.7.4	Temperature Indicators (Moving Coil Type)	Nos	2
H.7.5	Vibration Indicator along with Selector Switch	Nos	4
H.8	**Turbine instrumentation GAUGES AND SENSORS supplied by BHEL HARDWAR**		
H.8.1	RTDs	Nos	21
H.8.2	Thermocouples (for MAV,LBA,LBB,LBG,PGB,MAW,MAA,MAB,MAN etc	Nos	137
H.8.3	Thermocouples routed alongwith innercasing as per drawing only installation and healtiness checking for TSE, IPC exhaust, LPC outer, LPC-2 outer etc	Nos	14
H.8.4	Temperature Gauges	Nos	21
H.8.5	Pressure Transmitters/ Absolute Pressure Transmitters	Nos	67
H.8.6	DP Transmitters	Nos	6
H.8.7	Pressure Switches	Nos	10
H.8.8	Temperature switch (main oil tank)	Nos	2
H.8.9	DP Switches	Nos	8
H.8.10	Pressure Gauges	Nos	49

SL.NO	DESCRIPTION	Unit	qty
H.8.11	Level transmitters with amplifier, bar probe	set*	9
H.8.12	Level Switches (Float type)	Nos	16
H.8.13	Limit switches	Nos	11
H.8.14	Position Transmitters	Nos	34
H.8.15	Speed Probe qty 6 nos + spare 1 no	Nos	6
H.8.16	Emergency Push button mounted in CCR, turbine hall, LPBP	Nos	12
H.9	**PRESSURE INSTRUMENTS RACKS**		
H.9.1	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 8 racks: Approx. 300 Kgs		
H.9.2	Instrument rack TYPE A 2150mm(W) x 700mm(D) x 2150mm(H)	Nos	6
H.9.3	Instrument rack TYPE B 1250mm(W) x 700mm(D) x 880mm(H)	Nos	4
H.10	**IMPULSE PIPES - TURBINE**		
H.10.1	Carbon Steel Tube, D=13.5 x 2.6	Mtrs	524
H.10.2	seamless Carbon Steel Tube D= 88.9X4 (condenser)	Mtrs	80
H.10.3	seamless Carbon Steel Tube, D=21.3 x 2.3 (condenser,gland seal & water inj)	Mtrs	320
H.10.4	Seamless S.S. tube D=13.5 x 2.6 20+10	Mtrs	153
H.10.5	Seamless tube(Gr T22) D=21.3 x 2.77 ST -2.25 CR-IMO-TUBE	Mtrs	60
H.10.6	Seamless alloy steel tube D=21.3 x 2.77 (HRH, MS)	Mtrs	200
H.10.7	Seamless alloy steel tube D=13.5 x 2.6 - 2.25 CR-IMO-TUBE	Mtrs	60
H.10.8	Carbon Steel Tube, D=33.7 x 3.38	Mtrs	2
H.10.9	Seamless Tube Gr -T92- D 13.5 x 2.6	Mtrs	10
H.10.10	Seamless Tube Gr -T92- D 21.3 x 7.47 (Main steam)	Mtrs	350
H.11	**JUNCTION BOXES**		
H.11.1	Junction Box (to be mounted as per hardwar drg)	Nos	50
H.11.2	JB for thermocouple HPT, IPT, LPT1&2, TSE, IPC exhaust, LPC outer etc	Nos	12
H.11.3	Push button for TG and lube oil room	Nos	12
H.11.4	STRUCTURAL STEEL (for both turbine and generator instruments) 50x50x6 angle	MT	1
H.12	**INSTRUMENTS FOR HEAT EXCHANGERS (CONDENSER, GSC, LP HEATER-1, TOC, CFC)**		
H.12.1	Level Switches (Float type)	Nos	5
H.12.2	Temperature Gauges with thermowell	Nos	20
H.12.3	Pressure Gauges	Nos	4
H.13	**Siemens Core part of Turbine package**		
H.13.1	IC cabinet size 1200mm x 800mm x 2200mm aprox weight 300 Kg (CJJ11, CJJ12, CJJ13,10CRY01)	Nos	4
H.14	**I&C siemens system configuration**		
H.14.1	EWS qty 1no, OWS qty 2 nos, programmer PC qty 1 no, Laptop - 1 no, OPC client (EDN) qty 2 nos,	set	1
H.14.2	Station LAN router firewall with Automation highway station 1 & 2, ethernet switches between siemens panels to EWS , OWS.	set	1
H.14.3	CAT 6 UTP cable	Mtrs	2000
H.15	**Commissioning of the following erected by Mechanical agency**		
H.15.1	**Condenser Vacuum Pump** Removal, calibration and commissioning of CVP skid mounted instruments including CVP PLC and motor mounted on the skid. The	set*$	4

SL.NO	DESCRIPTION	Unit	qty
	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 – 8		
H.15.2	LT drives for vaccum pump, recirculation pump, vapour extn	Nos$	10
H.15.3	Oil Centrifuge Unit - Removal, calibration and refixing of all instruments mounted on centrifugal unit, checking and commissioning of the system.	Nos$	2
H.15.4	NRV Valves, Stop Valves, Control Valves, HP/LP Bypass Valves	Nos$	40
H.15.5	Position Transmitters (Removal, calibration and re-fixing)	Nos$	19
H.15.6	Limit Switch (checking only)	Nos$	76
H.15.7	Solenoid Valves (checking only) (steam turbine ext.valves & condenser)	Nos$	61
H.15.8	Motorized temperature control valve for cold gas	Nos$	1
H.15.9	Motorized temperature control valve for primary water	Nos$	1
H.15.10	Turbine speed monitor consisting of switch amplifier, mesuring converter diode clamp Hydraulic Speed Control Equipment Rack (LR1)	set$	1
H.15.11	**Governing System Control rack** : 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.	set*$	1
H.15.12	**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)-7 Nos. Switches(Pressure, DP& Flow)-6 Nos. Pressure gauges:5 Nos	set*$	1
H.15.13	**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 : 8 Nos. Pressure Switches: 5 Nos DP Switches : 2 Nos. Pressure transmitters :3 Limit switch:3	set*$	1
H.15.14	Seal Oil Rack	set*$	1
H.15.15	Stator Water Rack	set*$	1
H.15.16	Seal Oil Level / PrTxr Instrument Rack	set*$	1
H.15.17	Stator Water DP Instrument Rack	set*$	1
H.15.18	H2 Dryer Unit	set*$	1
I	**BHOPAL**		
I.1	**Commissioning of the following erected by Mechanical agency**		
I.1.1	Electrical actuator for CW - 4 NOS. ACW butterfly valves- 6 NOS, DMCW TG- 9 NOS,DMCW SG- 3 NOS,	Nos$	22
J	**BHEL - HP&VP- Vizag**		
J.1	**Aux Boiler**		
J.1.1	Flame Scanner Head Assembly, mounting flange accessories,flexible hoses,fibre optic cable, Lens Barrel Assembly, Miniature 6 way Junction Box etc.	set	2
J.1.2	Microprocessor based flame scanner amplifier 19” Racks of size 482 x 263 x 134 (W x D x H) to be mounted in Flame Scanner Panel (CJF07/ 76) supplied by EDN.	set	1
J.1.3	H.E.A Exciter box alongwith retractor assembly , flexible spark rod, spark tip, flexible cable assembly,maintainence switch, SS hose, Air filter regulator etc.,	set*	2

SL.NO	DESCRIPTION	Unit	qty
J.2	Instruments		
J.2.1	Pressure guage	Nos	28
J.2.2	Temperature gauge	Nos	10
J.2.3	24 Way stainless steel Junction boxes	Nos	4
J.2.4	48 way stainless steel junction boxes	Nos	1
J.2.5	3c x 2.5 sqmm control cable	Mtrs	200
J.2.6	Cable tray 50 mm Width	Mtrs	100
J.2.7	Cable tray 100 mm width	Mtrs	40
J.2.8	Impulse pipe OD 21.3 x 3.73 - SA106 Gr B	Mtrs	110
J.2.9	Structural steel angles and channels (50 x 50 x 6mm, 100 x 50 x 6mm)	MT	1
J.2.10	FD fan inlet damper actuator with linkage rod, feed back smart positioner and transmitter,	set	2
J.3	**Commissioning of the following**		
J.3.1	**Pnumatic actuator (regulating)**		
J.3.1.1	Trip valves & Control valves alongwith Positioner, AFR etc - LO PCV, SB drain, Feed water CV, DM water CV, Spray CV	set$	14
J.3.1.2	Furnace to WB DP control damper with feed back smart positioner and transmitter	set$	2
J.3.1.3	soot blower/Lo trip valve with solenoids, AFR etc	set$	2
J.4	**Electrical actuator**		
J.4.1	FD Fan outlet electrical actuator	set$	2
J.4.2	LT Drives 11 KW (FOPH)	Nos$	2
J.4.3	LT drives 0.5 KW (SB)	Nos$	4
J.4.4	Motor operated actuator	Nos$	7
J.4.5	HT motor 6.6 KV, 220 KW (FD)	Nos$	2
J.4.6	HT motor winding temp	Nos$	12
J.4.7	HT motor speed switch	Nos$	1
J.5	**CITRIC ACID CLEANING FOR BOILER - Installation and removal**		
J.5.1	Temp. gauge	Nos	2
J.5.2	Pressure Gauges	Nos	2
J.5.3	Thermocouple stem type and MTM	Nos	8
J.5.4	Junction box	Nos	3
	TERMINATION OF POWER CABLE XLPE Armoured/UnArmoured cu/Al power cables		
K.1	3C x 10 sq mm	Nos	10
K.2	3C x16 sq mm	Nos	54
K.3	void		
K.4	3c x 6 sqmm	Nos	4
K.5	3c x 25 sqmm	Nos	8
K.6	3c x 35 sqmm	Nos	14
K.7	3c x 50 sqmm	Nos	10
K.8	3c x 70 sqmm	Nos	16
K.9	3c x 95 sqmm	Nos	22
K.10	3c x 120 sqmm	Nos	26
K.11	1CX240 sqmm	Nos	20
K.12	1CX400 sqmm	Nos	14
K.13	1Cx50 sqmm	Nos	52
K.14	2Cx35 sqmm	Nos	20

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 Bidders are requested to furnish the following at PSSR-HQ

i) Security Deposit and additional Security Deposit.
ii) Unqualified Acceptance for Detailed LOI/ Work Order.
iii) Rs.100/- Stamp Paper for preparation of Contract Agreement.

1.10.2 Bidders are requested to furnish the proof of documents for the following at PSSR-Site

i) PF Regn No.
ii) Labour License No.
iii) Workmen Insurance Policy No.

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

1.10.3.1 BOCW Act & BOCW Welfare Cess Act

1.10.3.1.1 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) Appropriate State Authorities in respect of the project premises which is under the purview of State Govt.

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

1.10.3.1.3 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.

1.10.3.1.4 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.

1.10.3.1.5 Contractor shall make remittance of the BOCW cess as per the Act **in consultation with BHEL** as per the rates in force (presently 1%). BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and contribution of Beneficiaries remitted.

1.10.3.1.6 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as it deems fit. Only upon total compliance to the BOCW Act and also discharge of total payment of Cess under the BOCW Cess Act by the Contractor, BHEL shall consider refund of the Amounts.

1.10.3.2 PROVIDENT FUND

1.10.3.2.1 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. In case 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.

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

1.10.3.3 OTHER STATUTORY REQUIREMENTS

1.10.3.3.1 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.

1.10.3.3.2 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.

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

1.10.3.3.4 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 Act 1948 (if applicable) to BHEL along with the Final Bill.

1.10.3.3.5 In case of any dispute pending before the appropriate authority under ID 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.

1.10.3.3.6 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.

1.10.3.3.7 **DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN**

The following clause is applicable in case the contract value / contract price is Rs. Five crores and above.

The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on

the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.10.4 **GENERAL**

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

1.10.4.2 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.

1.10.4.3 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.

1.10.4.4 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.

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

1.10.4.6 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.

1.10.4.7 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.

1.10.4.8 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.

1.10.4.9 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.

1.10.4.10 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.

1.10.4.11 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.

1.10.4.12 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.

1.10.4.13 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.

1.10.4.14 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.

1.10.4.15 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.

1.10.4.16 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.

1.10.4.17 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.,

1.10.4.18 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.

1.10.4.19 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.

1.10.4.20 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.

1.10.4.21 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.

1.10.4.22 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.

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

1.10.4.24 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.

1.10.4.25 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.

1.10.4.26 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.

1.10.4.27 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.

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

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

1.10.4.30 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.

1.10.4.31 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.

1.10.4.32 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.

1.10.4.33 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.

1.10.4.34 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.

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

1.10.4.36 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.

1.10.4.37 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.

1.10.4.38 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.

1.10.4.39 SITE INSPECTION

1.10.4.39.1 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.

1.10.4.39.2 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.

1.10.4.39.3 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.

1.10.4.39.4 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.

1.10.4.40 **MANPOWER REQUIREMENT**

1.10.4.40.1 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 7 years of experience in Thermal Power Station.

c. Area Engineer should have a minimum qualification of Diploma in Engineering or any graduate with minimum 3 years of experience in Thermal Power Station.

d. Supervisor should have a minimum qualification of Diploma in Engineering or any graduate with minimum 3 years of experience in Thermal Power Station.

e. Lab Technicians should have 2 experience in Thermal Power Stations.

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

g. Planning / safety Engineers should have 3 experience in construction field especially in power plant

1.10.4.40.2 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.

1.10.4.40.3 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 package and the minimum requirement shall be as indicated in previous Clause.

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

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

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

1.10.4.40.7 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.

1.10.4.40.8 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

1.10.4.40.9 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.

1.10.4.40.10 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.

1.10.4.40.11 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.

1.10.4.40.12 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.

1.10.4.40.13 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.

1.10.4.41 DOCUMENTATION

1.10.4.41.1 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.

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

1.10.4.41.3 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:

1.10.4.41.4 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.

1.10.4.41.5 VOLUME-IA PART- II CHAPTER -3 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 taken over will be deemed to have been received in good condition and in correct quantities except for intrinsic defects which cannot be observed by visual and dimensional inspection and weighing.

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 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 VALMETDNA 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 / Five 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 / HMI / STATION LAN / PLANT SECURITY / OPERATOR STIMULATOR / HART MANAGEMENT / MASTER AND SLAVE CLOCK / PADO SYSTEM / EPBAX/ WIRELESS COMMUNICATION / OPERATING DESK AND FURNITURES etc WITH RELATED INSTRUMENTATION:

1.13.2.1 BHEL will supply sophisticated VALMETDNA 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, VALMETDNA DCS for Main plant DCS control panels, I/O panels, Ethernet switching panels, Network Enclosure cabinets, GIU, CPU, MIS System, Engineers workstations, operator workstations, large video screen, server, printers, plant security system, portable UPS power supply, furniture and interconnecting cables like Ethernet/ Fiber-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 Laying and termination of all cables including Ethernet and fiber optic cables as detailed in the scope of work for cabling refer 1.13.10.

1.13.2.6 Unit rate quoted for Plant security system cabling for power, C&I cable and optical fiber cable to be laid underground in and around perimeter. Excavation of different sizes of trenches in any type of soil and placement of sand below and above the cable in the excavated trench and placement of bricks on top and sides of cable in the excavated trench and refilling the trench with excavated soil and levelling after cable laying. The scope includes supply of good quality soil and bricks of size 225mm x 115mm x 75mm and cable markers.

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 / fiber 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.

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

1.13.3.1 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 equipment's 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.

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.

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, Smart wall blowers, Large video screen, Sonic Tube Leak Detection system, Automatic leakage controller for air preheater, SWAS, Flue Gas analyzers, Station LAN / HMI plant management system, PC based instruments, C&I lab, EPABX, Wireless communication, Plant security system, Hart management system, UPS with battery and charger, GPS clock system, Graphical interphase system, Video conference network as per configuration, operator training simulator, computer furniture, 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 Flue Gas Analyzers are to be installed at Chimney 65 Mtrs 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 Mtrs 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 supply, fixing / erection of the sensors onto legs of Bunkers is in the **scope of customer**. 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, Siemens core turbine panel 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 air line 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 air line, and adjusting the stroke length. No separate rate shall be paid for the above works. For all pneumatic and electrical actuators, the necessary Linkage Mechanism shall be supplied by BHEL as part of actuators. No separate rate shall be paid for erection of linkage mechanism. For fabrication and erection of steel supports and frames, the rate shall be paid on Tonnage basis.

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 upto 2.5 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, underground,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 and termination including fixing of fibre optic components and termination kits LIU,space splits cabinets, couplers, grounding etc. 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, fibre optic cable is part of the scope.

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 earthingi.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 earthingdrawing 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 equipment's 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

TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

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

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**	BOP and Misc	**TOTAL**
Engineer (C&I)	1 No.	1 No.	1 Nos.	1 nos	**4 Nos.**
Supervisor (C&I)	3 Nos.	3 Nos.	3 Nos.	3 nos	**9 Nos.**
Technician(C&I/ Electrical)	8 Nos.	6 Nos.	8 Nos.	8 nos	**30 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-XVI
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 quoted rate / price shall be inclusive of supply and application of final painting of all the erected equipments as per the painting specifications of customer / BHEL like supports, racks, frames, canopy, LIE / LIR / LGB, impulse pipes etc. carried out by the contractor. Painting shall be carried out for any bare copper tube also.

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

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

1.16.5 All the exposed metal parts of the equipments including busducts, transformers,, 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.

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

1.16.7 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.

1.16.8 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.

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

1.16.10 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.,

1.16.11 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.

1.16.12 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.

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

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

1.16.15 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.

1.16.16 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.

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

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

1.16.19 PRESERVATION / TOUCH UP PAINTING

1.16.19.1 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.

1.16.19.2 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.

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

1.16.19.4 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.

1.16.19.5 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.

1.16.19.6 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-I CHAPTER-XVII

FORMATS

1. List of Completed jobs executed by the Bidder.

S.No	PROJECT NAME	OWNER/ CLIENT	MAIN CONTRACTOR (if not a direct order)	DETAILED DESCRIPTION OF SCOPE OF WORK	COUNTRY	EXECUTED WORK AS INDICATED IN PQR	COPY OF COMPLETION CERTIFICATE

2. List of Ongoing jobs being executed by the Bidder.

S.No	PROJECT NAME	OWNER/ CLIENT	MAIN CONTRACTOR (if not a direct order)	DETAILED DESCRIPTION OF SCOPE OF WORK	COUNTRY	EXECUTED WORK AS INDICATED IN PQR	COPY OF COMPLETION CERTIFICATE

Note: Bidders to provide LOI and Completion certificate copies for supporting details filled in the above Annexure

VOLUME-IA PART – II CHAPTER 1

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

Sl No: 1

Clause 4.1.11 of SCC is deleted.

Sl No: 2:

OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME

The following clauses in Occupational Health, Safety & Environment Management / Quality Assurance Programme published in Chapter-IX of Special Conditions of Contract (Volume I Book-II) is revised as under.

Chapter IX Clause 9.1 is modified as below:

Contractor will comply with HSE (Health, Safety & Environment) requirements of BHEL as per the "HSE Plan for Site Operations by Subcontractor" (Document No. HSEP: 14 Rev00) enclosed.

Chapter IX Clause 9.1.1 to 9.1.25 stands deleted.

Chapter IX Clause 9.2 to 9.62 stands deleted.

Sl No: 3:

- Void -

Sl No: 4

The EARNEST MONEY DEPOSIT (EMD) clause 1.9 published in General Conditions of Contract (Volume I Book-II) is revised as under.

1.9 EARNEST MONEY DEPOSIT

1.9.1 Every tenderer shall submit the prescribed amount of Earnest Money Deposit (EMD) to BHEL PSSR, only in any one of the following forms: -

i. Electronic Fund Transfer credited in BHEL account (before tender opening).
ii. Through Online EMD payment portal of BHEL with SBI (before tender opening) by following steps as below:-
    1. Visit www.onlinesbi.com -> Go to State Bank Collect (In the tab section)
    2. Click Check box to proceed for payment -> Click on Proceed
    3. Under State of Corporate/Institution ->Select Tamilnadu

4. Under Type of Corporate/Institution -> Select PSU – Public Sector Undertaking ->Go
5. Under PSU – Public Sector Undertaking Name -> Select BHEL PSSR CHENNAI and Submit
6. Under Select Payment Category ->-> SCT Tender EMD & Tender Fees

iii. Banker's Cheque or Pay order or Demand Draft in favour of 'Bharat Heavy Electricals Limited' (along with offer) and payable at Chennai.

iv. Fixed Deposit Receipt (FDR) issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL).

v. In case EMD amount is more than Rs. Two Lakhs, Tenderer has the option to submit Rs. Two lakhs in any one of form described above in clause no. 1.9.1. (i) to (iv) and remaining amount over and above Rs. Two Lakhs in the form of Bank Guarantee from Scheduled bank.

Note:

a) The Bank Guarantee shall be valid for at least six months from the scheduled due date of tender submission mentioned in the Notice Inviting Tender. Proforma of BG for EMD enclosed.
b) Date of Expiry of Claim shall be minimum of 60 days after the validity of Bank Guarantee.
c) Performa for Bank Guarantee for EMD is enclosed with this Tender.

Bank Details for the purpose of Taking EMD BG

Name and Address of Beneficiary:	Bharat Heavy Electricals Ltd. #690, EVR Periyar Building, Nandanam, Anna Salai, Chennai - 35
Name of Bank of Client :	State Bank Of India
Bank Branch Address:	SBI Saidapet Branch, EVR Periyar Building, Nandanam, Anna Salai, Chennai - 35
IFSC Code :	SBIN0000912
Account No. :	10610819499

Details for SFMS (Structured Financial Messaging System) transmission of BG

Bank and Branch	SBI TFCPC Branch
Branch Code	5056
IFSC Code	SBIN0005056

1.9.2 EMD shall not carry any interest.

1.9.3 EMD by the Tenderer will be forfeited as per NIT Conditions, if:

i. After opening the tender and within the offer validity period, the Tenderer revokes his tender or makes any modification in his tender which is not acceptable to BHEL.

ii. The Contractor fails to deposit the required Security deposit or commence the work within the period as per LOI/Contract

1.9.4 EMD given by all unsuccessful tenderers will be refunded normally within 15 days of award of work.

1.9.5 EMD of successful tenderer will be retained as part of Security Deposit.

1.9.6 EMD by the tenderer shall be withheld in case any action on the tenderer is envisaged under the provisions of extant" Guidelines on Suspension of Business dealings with suppliers/contactors" and forfeited / released based on the action determined under these guidelines.

Sl No: 5

SECURITY DEPOSIT The SECURITY DEPOSIT (SD) clause 1.10 published in General Conditions of Contract (Volume I Book-II) is revised as under.

1.10 Security Deposit:

1.10.1 Upon acceptance of Tender, the successful Tenderer should deposit the required amount of Security Deposit for satisfactory completion of work, as given below:

1.10.2 The total amount of Security Deposit will be 5% of the contract value. EMD of the successful tenderer shall be converted and adjusted towards the required amount of Security Deposit.

1.10.3 The security Deposit should be furnished before start of the work by the contractor.

1.10.4 Modes of deposit:

1.10.4.1 The balance amount to make up the required Security Deposit of 5% of the contract value may be furnished in any one of the following forms

1) Cash (as permissible under the extant Income Tax Act)

2) Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL

3) Bank Guarantee from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats.

4) Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C BHEL, duly discharged on the back.

5) Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL and discharged on the back)

(Note: BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith)

1.10.5 At least 50% of the Security Deposit including the EMD should be deposited in any form as prescribed before start of the work and the balance 50% of the Security Deposit will be recovered by deducting 10% of the gross amount progressively from each running bills of the contractor till the total amount of the required Security Deposit is collected.

1.10.6 The recoveries made from running bills (cash deduction towards balance SD amount) will be released against submission of equivalent Bank Guarantee in the prescribed formats, but only once, before completion of work.

1.10.7 The Security Deposit shall not carry any interest.

1.10.8 If the value of work done at any time exceeds the contract value, the amount of Security Deposit shall be correspondingly enhanced and the excess Security Deposit due the enhancement shall be immediately deposited by the Contractor or recovered from payment/s due to the Contractor.

1.10.9 The validity of Bank Guarantees towards Security Deposit shall be initially upto the completion period as stipulated in the Letter of Intent/Award + 3 months, and the same shall be kept valid by proper renewal till the acceptance of Final Bills of the Contractor, by BHEL

1.10.10 BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfill any of the contractual obligations or in the event of termination of contract as per terms and conditions of contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.

1.10.11 Penalty for Delayed Remittance of Security Deposit

If the contractor fails to furnish SD before start of work, in line with 1.10.3 above, Simple Interest against delayed remittance of the Security Deposit shall be deducted from the sub-contractor at the rate of SBI PLR + 2% on the value of 50% SD of the contract, for the delayed period (i.e., period between start of work and date of remittance of Initial SD, i.e., atleast 50% of SD). In case, the delayed period has different SBI PLR rates, Simple Interest shall be calculated based on different rates by considering the corresponding time period. On similar lines Penalty shall be levied for delayed remittance of Additional Security Deposit (if applicable).

Note: - Bank details & SFMS details provided above in Sl. No. 04 Earnest Money Deposit) may be used for the purpose of arranging Bank Guarantees towards Security Deposit / Additional Security Deposit also.

Sl No: 6

Clause 2.7.2 and 2.7.3 in GCC regarding Rights of BHEL is revised as under:

2.7.2

2.7.2.1 To terminate the contract or withdraw portion of work and get it done through other agency, at the risk and cost of the contractor after due notice of a period of 14 days' by BHEL in any of the following cases:

i. Contractor's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution.
ii. Withdrawal from or abandonment of the work by contractor before completion of the work as per contract.
iii. Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor.
iv. Termination of Contract on account of any other reason (s) attributable to Contractor.
v. Assignment, transfer, subletting of Contract without BHEL's written permission.
vi. Non-compliance to any contractual condition or any other default attributable to Contractor.

Risk & Cost Amount against Balance Work:

Risk & Cost amount against balance work shall be calculated as follows:

Risk & Cost Amount= [(A-B) + (A x H/100)]

Where,

A= Value of Balance scope of Work (*) as per rates of new contract

B= Value of Balance scope of Work (*) as per rates of old contract being paid to the contractor at the time of termination of contract i.e. inclusive of PVC & ORC, if any.

H = Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

* Balance scope of work (in case of termination of contract):

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for

'Termination of Contract', shall be taken as balance scope of Work for calculating risk & cost amount. Contract quantities are the quantities as per original contract. If, Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose. Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

NOTE: Incase portion of work is being withdrawn at risk & cost of contractor instead of termination of contract, contract quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work' for calculating Risk & Cost amount.

LD against delay in executed work in case of Termination of Contract:

LD against delay in executed work shall be calculated in line with LD clause no. 2.7.9 of GCC, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of "LD against delay in executed work in case of termination of contract" is given below.

i). Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1

ii). Let the value of executed work till the time of termination of contract= X

iii). Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y

iv). Delay in executed work attributable to contractor i.e. T2=[1-(X/Y)] x T1

v). LD shall be calculated in line with LD clause (clause 2.7.9) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

2.7.2.2 In case Contractor fails to deploy the resources as per requirement, BHEL can deploy own/hired/otherwise arranged resources at the risk and cost of the contractor and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.

2.7.3 **Recoveries arising out of Risk & Cost and LD or any other recoveries due from Contractor**

Following sequence shall be applicable for recoveries from contractor:

a) Dues available in the form of Bills payable to contractor, SD, BGs against the same contract.

b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above.

c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery:

i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery.

ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor.

iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

SL No: 7

In addition to clause 2.7.9 of General Conditions of Contract (GCC), a New clause 2.7.9.1 is added as below.

2.7.9.1 Penalty for Intermediate Milestones

2.7.9.1.1 M1 and M2 shall be intermediate Milestones for each unit of this work.

2.7.9.1.2 In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to Form 14.

2.7.9.1.3 Incase delay in achieving M1 milestone is solely attributable to the contractor,0.5% per week of executable contract value* limited to Maximum 2% of executable contract value will be withheld.

2.7.9.1.4 Incase delay in achieving M2 milestone is solely attributable to the contractor,0.5% per week of executable contract value* limited to maximum 3% of executable contract value will be withheld.

2.7.9.1.5 Amount already withheld, if any, against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 milestone.

2.7.9.1.6 Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.

2.7.9.1.7 Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of intermediate milestones shall be adjusted against LD or released as the case may be.

2.7.9.1.8 In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted in to recovery.

Note: *Executable contract value-value of work for which inputs/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

SL No: 8

OVERRUN COMPENSATION (ORC)

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

2.12**OVERRUN COMPENSATION (ORC)**

2.12.1 **ORC during original contract period:** No ORC shall be applicable during the original contract period.

2.12.2 **ORC during extended period for the reasons solely attributable to contractor:** No ORC shall be applicable during the extended period granted for the reasons solely attributable to contractor and work executed during this period shall be paid as per original contract rates.

2.12.3 **ORC during extended period for the reasons not attributable to contractor:** ORC shall be payable as per following procedure:

2.12.3.1 For initial period of twelve months of extended period, ORC rate applicable over executed value shall be 5%. For every subsequent period of twelve months, ORC rate shall be further increased by 5% over the previous rate. For example, ORC rates applicable for initial period of 12 months and subsequent period of 12 months are given below.

Sl. No.	Extended Period for the reasons attributable to BHEL	ORC rate applicable over executed value
1	First 12 months	5%
2	13^{th}-24^{th} month and so on	10.25% {[(1.05 x 1.05)-1] x 100}

This process of increasing ORC rate for each subsequent period of 12 months shall continue till applicability of ORC.

2.12.3.2 On completion of original contract period as well as on completion of each subsequent period of twelve months i.e. at the time of change in applicable ORC rate, Delay Analysis shall be carried out and percentage shortfall attributable to both BHEL & Contractor shall be calculated.

2.12.3.3 For the purpose of calculation of ORC, executed value of work in the month shall be divided in Part-1 and Part-2 in proportion of percentage shortfall attributable to BHEL and contractor respectively, based on the last delay analysis as worked out in 2.12.3.2. ORC shall be payable only on Part-1 and no ORC shall be payable on Part-2.

Value of Part-1 shall be further limited to the value of actual inputs provided by BHEL i.e. "Plan - Shortfall attributable to BHEL" for the month, as per Form-14 for calculation of ORC.

2.12.3.4 Payment of ORC amount shall be further regulated as follows:

(i) 50% of the ORC is allocated for deployment of matching resources (with weightages) agreed as per the joint programme drawn vide 2.11.4. ORC Payment against resources shall be calculated in proportion to percentage of resources actually deployed w.r.t. planned resources, as per Form-14.

(ii) 50% of ORC is allocated for achieving of planned progress agreed as per the joint programme drawn vide 2.11.4. ORC Payment shall be reduced in proportion to percentage shortfall attributable to contractor w.r.t.–"Plan - Shortfall attributable to BHEL" for the month, as per Form-14.

2.12.3.5 The maximum amount of ORC payable for the month shall be limited to Rs. 5,00,000/-

2.12.3.6 In case, there is no shortfall attributable to contractor for the month and also contractor has deployed the resources as agreed in Form-14 but ORC amount payable for the month worked out as per procedure mentioned in clause 2.12.3.3, 2.12.3.4 and 2.12.3.5, is less than Rs.1,00,000/-, then ORC amount payable for the month shall be Rs.1,00,000/- otherwise ORC amount payable for the month shall remain same.

2.12.3.7 In case execution is on **HOLD** (Other than Force Majeure), ORC shall be payable as per following:

i). Contractor has not been permitted by BHEL to de-mobilize

a) ORC amount of Rs. 1,00,000/- per month shall be applicable during the period of HOLD provided resources as planned are deployed (not demobilized) during the period of hold.

b) Subsequent to lifting of HOLD, Period of HOLD shall not be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.

ii). Contractor has been permitted to demobilize and to remobilize after lifting of HOLD
a) No ORC shall be payable to contractor for the period of HOLD.
b) Subsequent to lifting of HOLD, Period of HOLD shall not be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.

2.12.3.8 In case **Force Majeure** is invoked:

i). No ORC shall be applicable during the period of Force Majeure.

ii). Subsequent to revocation of Force Majeure, period of Force Majeure shall be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.

2.12.4 Applicability of ORC: ORC shall not be applicable for following activities.

(i) Area cleaning, removal of temporary structures and return of scrap.
(ii) Punch list points / pending points liquidation pending due to reasons attributable to contractor
(iii) Submission of "As built Drawing"
(iv) Material Reconciliation
(v) Completion of Contract Closure formalities like HR Clearance/ No dues from various dept./ Statutory Authorities etc.

2.12.5 Total Over Run Compensation shall be limited to 10% of the cumulatively executed contract value till the month (excluding Taxes and Duties if payable extra). For this purpose, executed contract value excludes PVC, ORC and Extra/Supplementary Works.

Sl No: 9

Clauses 2.13.1, 2.13.6 & 2.13.7 in GCC on Interest Bearing Recoverable Advances,

9.1 Clauses 2.13.1,2.13.6 & 2.13.7 in GCC is revised as under:

9.1.1 Clause 2.13.1 in GCC is revised as "Normally no advance payment shall be payable to the contractor. Mobilization advance payment in exceptional circumstances shall be interest bearing and secured through a Bank Guarantee and shall be limited to a maximum of 5% of contract value. This 'Interest Bearing Recoverable Advance' shall be payable in not less than two installments with any of the installment not exceeding 60% of the total eligible advance".

9.1.2 Clause 2.13.6 in GCC is revised as "The rate of interest applicable for the above advances shall be the Base rate of State Bank of India prevailing at the time of disbursement of the advance + 6%, and such rate will remain fixed till the total advance amount is recovered".

9.1.3 Clause 2.13.7 in GCC is revised as "Unadjusted amount of advances paid shall not exceed 5% of the total contract value at any point of time. Recovery of advances shall be made progressively from each Running Bill such that the advance amounts paid along with the interest is fully recovered by the time the contractor's billing reaches 90% of contract value."

Sl. No: 10

- Void -

Sl No: 11

PRICE VARIATION COMPENSATION (PVC)

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

2.17 PRICE VARIATION COMPENSATION

2.17.1 In order to take care of variation in cost of execution of work on either side, due to variation in the index of LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS, Price Variation Formula as described herein shall be applicable (only for works executed during extended period, if any, subject to other conditions as described in this section).

2.17.2 **85%** component of executed Contract Value shall be considered for PVC calculations and remaining 15% shall be treated as fixed component. The basis for calculation of price variation in each category, their component, Base Index, shall be as under:

Sl. No	CATEGORY	BASE INDEX	PERCENTAGE COMPONENT ('K')				
			CIVIL PACKAGES (See Note A/B/C)			MECHANICAL PACKAGES	Electrical, C&I, Material Management / Handling and other labour oriented packages
			A	**B****	**C**		
i)	LABOUR (ALL CATEGORIES)	'MONTHLY ALL-INDIA AVERAGE CONSUMER PRICE INDEX NUMBERS FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)	**40**	**25**	**30**	**65**	**80**

ii)	HIGH SPEED DIESEL OIL	Name of Commodity: HSD Commodity code: 1202000005 (**See Note E**)	**5**	**3**	**5**	**5**	**5**
iii)	WELDING ROD	Name of Commodity: MANUFACTURE OF BASIC METALS Commodity code:1314000000 (**See Note E**)				**15**	
iv)	CEMENT	Name of Commodity: ORDINARY PORTLAND CEMENT Commodity code: 1313050003 (**See Note E**)		**20**	**30**		
v)	STEEL (Structural and Reinforcement Steel)	Name of Commodity: MILD STEEL: LONG PRODUCTS Commodity code: 1314040000 (**See Note E**)		**25**			
vi)	ALL OTHER MATERIALS (Other than Cement & Steel)	Name of Commodity: ALL COMMODITIES Commodity code: 1000000000 (**See Note E**)	**40**	**12**	**20**		

Note: A) Cement & Steel: Free Issue (BHEL Scope)

B) Cement & Steel: In Contractor Scope

C) Cement in Contractor Scope, and Steel is Free Issue (BHEL Scope)

D) For Composite packages (i.e. Civil + Mechanical + Electrical and / or CI or Civil + Mechanical or Mechanical + Electrical and / or CI), the Component ('K') for various categories shall be as per respective packages as above

E) As per the 'MONTHLY WHOLE SALE PRICE INDEX' for the respective Commodity and Type, published by Office of Economic Adviser, Ministry of Commerce and Industry, Government of India. (Website: http://www.eaindustry.nic.in/download data 0405.asp). Revisions in the index or commodity will be re adjusted accordingly.

2.17.3 **Void**

2.17.4 Payment / recovery due to variation in index shall be determined on the basis of the following notional formula in respect of the identified component ('K') viz LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS.

$$P = K \times R \times \frac{(X_N - Xo)}{Xo}$$

Where

P = Amount to be paid/recovered due to variation in the Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials

K = Percentage component ('K') applicable for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials

R = Value of work done for the billing month (Excluding Taxes and Duties if payable extra)

XN = Revised Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials for the billing month under consideration

Xo = Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials as on the Base date.

2.17.5 **Base date shall be the calendar month of the schedule completion date (i.e. Actual Start date + Scheduled Contractual Completion period as per Letter of Intent / award and / or work order).**

2.17.6 PVC shall not be payable for the ORC amount, Supplementary / Additional Items, Extra works. However, PVC will be payable for items executed under quantity variation of BOQ items under originally awarded contract.

2.17.7 The contractor shall furnish necessary monthly bulletins in support of the requisite indices from the relevant websites along with his Bills.

2.17.8 The contractor will be required to raise the bills for price variation payments on a monthly basis along with the running bills irrespective of the fact whether any increase/decrease in the index for relevant categories has taken place or not. In case there is delay in publication of bulletins (final figure), the provisional values as published can be considered for payments and arrears shall be paid/recovered on getting the final values.

2.17.9 PVC shall be applicable only, during extended period of contract (if any) after the scheduled completion period and for the portion of work delayed/backlog for the reasons not attributable to the contractor.

However, the total Quantum of Price Variation Amount payable/recoverable shall be regulated as follows:

1. For the portion of shortfall/backlog not attributable to contractor, PVC shall be worked out on the basis of indices applicable for the respective month in which work is done. Base index shall be applicable as defined in clause 2.17.5
2. In case of Force Majeure, the PVC shall be regulated as per (a) or (b) below.
   a. Force Majeure is invoked before "Base Date" / "revised base date" (as explained below) OR immediately after "base date" / "revised base date" in continuation (i.e. during the period when PVC is not applicable):
      vii. Base date shall be revised: Revised Base date = Previous base date + duration of Force Majeure.

      No PVC will be applicable for the work done till revised base date.

viii. PVC will be applicable for the work done after "base date"/" revised date" as the case may be (during extended period when delay is not attributable to contractor). PVC shall be worked out on the basis of indices applicable for the respective month in which work is done with base index as on "base date"/ "revised base date" as the case may be.

b. Force Majeure is invoked after "base date"/ "revised base date" as the case may be (during extended period when delay is not attributable to contractor).

1. PVC shall be applicable for the work done after revocation of Force Majeure.
2. PVC for the work done after revocation of Force Majeure shall be worked out on the basis of indices applicable for the respective month on which work is done excluding the effect of change in indices during total period of Force Majeure(s) invoked after "base date" / "revised base date" as the case may be. Base index shall be taken as on "base date" / "revised base date" as the case may be.

The total amount of PVC shall not exceed 15% of the cumulatively executed contract value. Executed Contract value for this purpose is exclusive of PVC, ORC, Supplementary / Additional items and Extra works except items due to quantity variation

Sl No: 12

Clauses 2.21 in GCC regarding Arbitration is amended as below

2.21 ARBITRATION & CONCILIATION

2.21.1 ARBITRATION:

2.21.1.1 Except as provided elsewhere in this Contract, in case Parties are unable to reach amicable settlement (whether by Conciliation to be conducted as provided in Clause 2.21.2 herein below or otherwise) in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or. in any manner touching upon the Contract (hereinafter referred to as the 'Dispute'), then, either Party may, commence arbitration in respect of such Dispute by issuance of a notice in terms of section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice'). The Notice shall

contain the particulars of all claims to be referred to arbitration in sufficient detail and shall also indicate the monetary amount of such claim. The arbitration shall be conducted by a sole arbitrator to be appointed by the Head of the BHEL Power Sector Region issuing the Contract within 60 days of receipt of the complete Notice. The language of arbitration shall be English.

The Arbitrator shall pass a reasoned award.

Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder as in force from time to time shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be **Chennai** (the place from where the contract is Issued). The Contract shall be governed by and be construed as per provisions of the laws of India. Subject to this provision 2.21.1.1 regarding ARBITRATION, the principal civil court exercising ordinary civil jurisdiction over the area where the seat of arbitration is located shall have exclusive jurisdiction over any DISPUTE to the exclusion of any other court.

2.21.1.2 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:

In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations (excluding disputes concerning Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative Mechanism for Resolution of CPSEs Disputes) as mentioned in DPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22-05-2018 as amended from time to time.

2.21.1.3 The cost of arbitration shall initially be borne equally by the Parties subject to the final allocation thereof as per the award/order passed by the Arbitrator.

2.21.1.4 Notwithstanding the existence of any dispute or differences and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and expedition

in a professional manner unless the dispute inter-alia relates to cancellation, termination or short-closure of the Contract by BHEL.

2.21.2 CONCILIATION:

If at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which term shall mean and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, effect, interpretation or breach of the agreement, contract), which the Parties are unable to settle mutually, arise inter-se the Parties, the same may, be referred by either party to Conciliation to be conducted through Independent Experts Committee (IEC) to be appointed by competent authority of BHEL from the BHEL Panel of Conciliators.

Notes:

1. No serving or a retired employee of BHEL/Administrative Ministry of BHEL shall be included in the BHEL Panel of Conciliators.
2. Any other person(s) can be appointed as Conciliator(s) who is/are mutually agreeable to both the parties from outside the BHEL Panel of Conciliators.

The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in Procedure 2.3 (enclosed in Vol 1A Part II Chapter 09). The Procedure 2.3 together with its Formats will be treated as if the same is part and parcel hereof and shall be as effectual as if set out herein in this GCC.

The Contractor hereby agrees that BHEL may make any amendments or modifications to the provisions stipulated in the Procedure 2.3 (enclosed in Vol 1A Part II Chapter 12) from time to time and confirms that it shall be bound by such amended or modified provisions of the Procedure 2.3 with effect from the date as intimated by BHEL to it.

2.21.3 No Interest payable to Contractor

Notwithstanding anything to the contrary contained in any other document comprising in the Contract, no interest shall be payable by BHEL to Contractor on any moneys or balances including but not limited to the Security Deposit, EMD, Retention Money, RA Bills or the Final Bill, or any amount withheld and/or appropriated by BHEL etc., which becomes or as the case may be, is adjudged to be due from BHEL to Contractor whether under the Contract or otherwise.

Sl No: 13

Reverse Auction

The chapter Reverse auction procedure published in 'Forms and Procedures' of Volume I Book-II stands deleted. Reverse Auction Guidelines available in the website http://www.bhel.com shall be applicable.

Sl No: 14

Existing format on Monthly Plan Review of Contractor, as available in Form No F-14 of Volume ID Forms and procedure stands Deleted. Form No.- F-14 (Rev 01) is enclosed.

Sl No: 15

Existing format on Monthly Performance Evaluation of Contractor, as available in Form No F-15 of Volume ID Forms and procedure stands Deleted. Form No.- F-15 (Rev 02) is enclosed.

Sl No:16

Clause 2.22 in GCC regarding Retention Amount is revised as under:

2.22 Performance Security Deposit

2.22.1 After award of work, before commencement of work at site Vendor shall submit 5% of the contract value towards Performance Security Deposit, in the form of (a) or (b) below.

(a) CASH (DD/ Online payment), 5% of the contract Value towards Performance Security Deposit, before commencing the contract

(or)

(b) Recovery 5% from Each Running Bill towards Performance security deposit.

(Note: Subcontractor has to choose either Option (a) or (b) before issue of Detailed LOI).

(c) However, Performance Security Deposit on part of PVC will be recovered at the rate of 5% from every running bill towards performance security deposit.

2.22.2 Refund of Performance Security Deposit:

a) 50% of Performance Security Deposit shall be released along with the final bill.

b) Balance 50% will be released after completion of Performance Guarantee Period (i.e., after expiry of Guarantee period), provided all the defects noticed during the guarantee period have been rectified to the satisfaction of BHEL Site Engineer/ BHEL Construction Manager, and after deducting all expenses/ other amounts due to BHEL under the contract/ other contracts entered into by BHEL with them. This portion of Performance Security Deposit, amount can be released on commencement of the Guarantee Period, on submission of equivalent Bank Guarantee.

Sl No: 17

Void

VOLUME-IA PART – II CHAPTER 2

DATA SHEET

2.2.1 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	**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.	LT cables	1%
	b.	Control, Instrument & Special cables	2%
	c.	Fire Survival cables	1%
	d.	Structural Steel materials	2% (by weight)
	e.	Impulse Pipe/tubes/GI pipes/copper tube	1%
	f.	Cable trays and earth Flats	2%

VOLUME 1A PART- II CHAPTER 3

GENERAL TECHNICAL REQUIREMENTS AND GUIDE LINES FOR INSTALLATION, TESTING & COMMISSIONING

2.3.1 Guidelines for Installation of C & I Equipments

2.3.1.1 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.

2.3.1.2 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.

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

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

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

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

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

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

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

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

2.3.1.11 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.

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

2.3.1.13 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

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

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

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

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

2.3.1.17 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.

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

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

2.3.1.20 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.

2.3.2 Guide Line for Erection of Impulse Lines

2.3.2.1 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.

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

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

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

2.3.2.5 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'

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

2.3.2.7 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.

2.3.2.8 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.

2.3.2.9 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.

2.3.2.10 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.

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

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

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

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

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

2.3.2.16 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.

2.3.3 Impulse Piping for Air & Flue Gas System

2.3.3.1 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.

2.3.3.2 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.

2.3.3.3 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.

2.3.4 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.

2.3.5 Impulse Piping for Steam and Water System

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

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

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

2.3.5.4 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.

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

2.3.5.6 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.

2.3.5.7 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.

2.3.6 Bending

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

2.3.6.2 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.

2.3.6.3 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.

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

2.3.7 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.

2.3.8 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.

2.3.9 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.

2.3.10 Guidelines for Installation of Pneumatic Line

2.3.10.1 Copper tubing shall be connected with Olive type of compression fittings,

2.3.10.2 When two or more lines run together, the joint in the adjacent alternate line shall be a offset.

2.3.10.3 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.

2.3.10.4 Multi-core copper tubing shall not to be bend less than 10 deg and D is the OD if the multi-core copper.

2.3.10.5 All air distribution, main and branch lines shall be galvanised internally as well as externally and the galvanized pipe, never, shall be braced or welded.

2.3.10.6 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.

2.3.10.7 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.

2.3.10.8 Instrument airline should not be routed where severe vibration, high temperature exists and adequate space should be available for maintenance.

2.3.10.9 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.

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

2.3.10.11 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.

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

2.3.11 Instrument Air line Testing

- All instrument air lines shall be isolated from the instruments and pressurized 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 pressurized pneumatically 20 psi, and checked with soap solution for leak.

2.3.12 General Guidelines on Installation of Flexible Hoses

2.3.12.1 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).

2.3.12.2 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).

2.3.12.3 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.

2.3.12.4 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.

2.3.12.5 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.

2.3.12.6 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.

2.3.12.7 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.

2.3.13 General Notes on Installation of Local Instrument Racks and JB Frames

2.3.13.1 In cases where the local instrument stands are to be installed on a concrete foundation, it shall be fixed by anchor bolts.

2.3.13.2 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.

2.3.13.3 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.

2.3.13.4 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 equipment, or even hand grilled or floor grilled, as peer safety norms.

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

2.3.14 General Guideline on Flow Instruments Installation

2.3.14.1 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.

2.3.14.2 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.

2.3.14.3 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.

2.3.14.4 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.

2.3.14.5 The Measuring instrument shall be located close to the flow-sensing element. The speed of response is reduced if there is a long run,

2.3.14.6 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.

2.3.14.7 Location of Flow element should have clear straight run of 10D in upstream and 5D in downstream.

2.3.14.8 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.

2.3.14.9 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.

2.3.14.10 If the flow of any dry gases are to be measured, the location of instrument can be kept above or below the tapping points.

2.3.14.11 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.

2.3.14.12 The condenser pot should be located nearer to the tapping point and both condenser chamber should be at the level of upper tapping,

2.3.14.13 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.

2.3.14.14 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.

2.3.14.15 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.

2.3.14.16 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.

2.3.14.17 The commonly used sealing liquid includes water, light oil, glycerol, ethylene glycol and mixtures of the last two with water.

2.3.14.18 The sealing chambers, in each pressure pipe, should be installed at the same level and as close as possible to the pressure tappings.

2.3.14.19 The general arrangement for pressure tappings from the Sealing Chamber to the instrument is shown in the sketch.

2.3.14.20 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.

2.3.15 General Guideline on Installation of Valves

2.3.15.1 Primary isolating valves (root valves) must be located at the tapping which can be of globe valves.

2.3.15.2 These valves shall be installed where access is possible.

2.3.15.3 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.

2.3.15.4 For pressure more than exceeding 40 kg, 2 isolating valves shall be provided.

2.3.15.5 In the case of heavy duty isolating valves, suitable support shall be provided to avoid any loading on the stubs.

2.3.15.6 In viscous fluids, suitable steam tracing shall be provided.

2.3.15.7 These valves are always located as nearer to the measuring device as possible.

2.3.16 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.

2.3.17 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.

2.3.18 GUIDELINES FORCABLE LAYING

2.3.18.1 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.

2.3.18.2 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.

2.3.18.3 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.

2.3.18.4 GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends.

2.3.18.5 In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy-duty PVC pipes shall be provided.

2.3.18.6 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.

2.3.18.7 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.

2.3.18.8 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.

2.3.18.9 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.

2.3.18.10 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.

2.3.18.11 Wherever direct heat radiation exists, heat isolating barriers (subject to customer's approval), for cabling system shall be adopted.

2.3.18.12 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.

2.3.18.13 If required, a few number of cables in exceptional areas may be directly buried into the earth.

2.3.18.14 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.

2.3.18.15 At certain places where hazardous fumes / gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.

2.3.18.16 In corrosive atmosphere, PVC conduits shall be used for cables.

2.3.18.17 Single core cables, when pulled individually shall be taken through PVC pipes only.

2.3.18.18 Laying and installation of power, control and special cables shall generally conform to IS : 1255

2.3.18.19 The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).

2.3.18.20 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.

2.3.18.21 Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.

2.3.18.22 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.

2.3.18.23 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.

2.3.18.24 When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.

2.3.18.25 Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material.

2.3.18.26 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.

2.3.18.27 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.

2.3.18.28 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.

2.3.18.29 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).

2.3.18.30 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.

2.3.18.31 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.

2.3.18.32 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.

2.3.18.33 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.

2.3.18.34 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.

2.3.18.35 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.

2.3.18.36 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.

2.3.18.37 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.

2.3.18.38 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.

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

2.3.19 Support Spacings & Clampings

Support spacing and clamping suitably provided and as required.

2.3.20 Laying of cables directly buried in ground

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

2.3.21 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.

2.3.22 Guidelines For Erection of Cable Trays, GI Pipes, Supports and Accessories

2.3.22.1 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.

2.3.22.2 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.

2.3.22.3 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.

2.3.22.4 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.

2.3.22.5 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.

2.3.22.6 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way or maintenance of adjacent equipment.

2.3.22.7 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.

2.3.22.8 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.

2.3.22.9 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.

2.3.22.10 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.

2.3.22.11 Bends of G.I. pipes / conduits shall be made without causing damage to the pipes / conduits.

2.3.22.12 Occupancy of conduits shall not be greater than 40%.

2.3.22.13 The adopter for coupling rigid GI pipe / conduits and flexible conduit shall be of aluminum or galvanized steel.

2.3.22.14 Transportation and storage of cable drums

2.3.22.15 Transportation and storage of cable drums shall generally conform to the requirements of IS : 1255

2.3.22.16 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.

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

2.3.23 Guidelines for Cable Termination and Jointing

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

2.3.23.2 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.

2.3.23.3 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.

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

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

2.3.23.6 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.

2.3.23.7 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.

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

2.3.23.9 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.

2.3.23.10 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.

2.3.23.11 Termination and jointing of aluminium / copper conductor power cables shall be done by means of compression method using compression type aluminium / tinned copper lugs.

2.3.23.12 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.

2.3.23.13 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.

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

2.3.23.15 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.

2.3.24 Design Requirements of Items supplied for cabling installation work (if supply is covered in contractor scope).

2.3.24.1 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.

2.3.24.2 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.

2.3.24.3 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 coloring 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.

2.3.24.4 Tags

a. Cables shall be provided with cable number tags for identification.

b. Cable tags shall be of durable fiber, aluminum, stainless steel sheets or lead of suitable thickness

c. Cable number shall be engraved type in case of aluminum or stainless steel tags, and printed type in case of fiber 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 tagging's.

2.3.25 GUIDELINES FOR EARTHING INSTALLATION

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

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

2.3.25.3 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.

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

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

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

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

2.3.25.8 Conduits shall be bonded together and grounded at all switchgear and control centers.

2.3.25.9 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.

2.3.25.10 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.

2.3.26 Guidelines for Erection of Control Panels and Distribution Boards

2.3.26.1 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.

2.3.26.2 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.

2.3.26.3 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.

2.3.26.4 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.

2.3.27 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.

2.3.28 415 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

2.3.29 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%

2.3.30 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.

2.3.31 Guidelines for landing and storage of Electronic Cubicles / sub-assemblies / loose items.

2.3.31.1 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.

2.3.31.2 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.

2.3.31.3 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.

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

2.3.31.5 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.

VOLUME 1A PART- II

CHAPTERS 4 to 11

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Performa of Bank Guarantee for Earnest Money Deposit (EMD)	Chapter-08	03
Procedure for conduct of conciliation proceedings	Chapter-09	11
Format for Form no.: F-14 (Rev 01); Monthly Plan & Review with Contractor	Chapter-10	05
Format for Form no.: F-15 (Rev 02); Monthly Performance-Evaluation of Contractor	Chapter-11	06