

**TENDER SPECIFICATION  
BHEL: PSSR: SCT: 1639**

**FOR**

**Erection, Testing and Commissioning of  
Electrical, C&I and Illumination works package  
of Turbo Blower-5 (Capacity 4, 18,000 N cu m/hr  
at a discharge pressure of 5.75 ksca) and its  
Auxiliaries**

**AT**

**Vishakapatnam Steel Plant  
Rashtriya Ispat Nigam Limited, Vizag Site, AP**

**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  
Amendment 01 dated October 01, 2015
- Volume-IC : General conditions of Contract  
Rev 01 dated 1st June 2012,  
Amendment 03 dated October 01, 2015
- Volume-ID : Forms & Procedures  
Rev 01 dated 1st June 2012  
Amendment 03 dated October 01, 2015

**VOLUME -I BOOK - I**



**BHARAT HEAVY ELECTRICALS LIMITED**

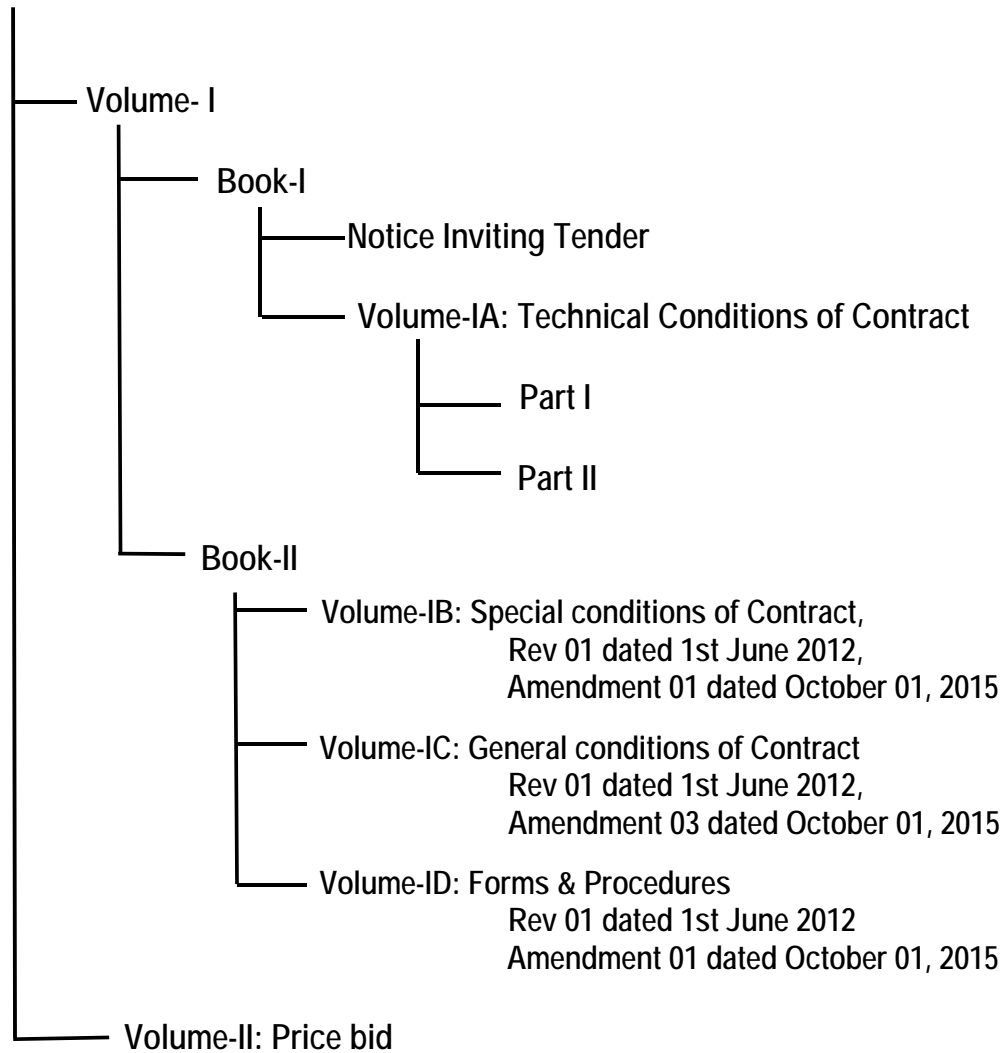
(A Government of India Undertaking)

Power Sector – Southern Region

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

TENDER SPECIFICATION CONSISTS OF

Tender Specification



# NOTICE INVITING TENDER

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

Tender Specification No. BHEL: PSSR: SCT: 1639

for

**Erection, Testing and Commissioning of  
Electrical, C&I and Illumination works package  
of Turbo Blower-5 (Capacity 4, 18,000 N cu m/hr  
at a discharge pressure of 5.75 ksca) and its  
Auxiliaries at Vishakapatnam Steel Plant,  
Rashtriya Ispat Nigam Limited, Vizag Site, AP**

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

Book Sl no .....

Issued to  
M/s

Refer NIT for Last date of submission  
Please note this tender document is not transferable

For and on behalf of  
Bharat Heavy Electricals Limited

Additional General Manager / SCT & Purchase

Place: Chennai -35  
Date:

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Tender Specification No.: BHEL PSSR SCT 1639



# NOTICE INVITING TENDER

Bharat Heavy Electricals Limited



# NOTICE INVITING TENDER

Ref: BHEL PSSR SCT 1639

Date: 05.11.2016

## **NOTICE INVITING TENDER (NIT)** **NOTE: BIDDER MAY DOWNLOAD FROM WEB SITES** **OR** **PURCHASE TENDERS FROM THIS OFFICE ALSO**

To

Dear Sir/Madam

Sub: NOTICE INVITING TENDER

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://bheleps.buyjunction.in> 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 1639	
ii)	Broad Scope of job	Erection, Testing and Commissioning of Electrical, C&I and Illumination works package of Turbo Blower-5 (Capacity 4, 18,000 N cu m/hr at a discharge pressure of 5.75 ksca) and its Auxiliaries at Vishakapatnam Steel Plant, Rashtriya Ispat Nigam Limited, Vizag Site, AP	
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, 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

Tender Specification No.: BHEL PSSR SCT 1639

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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	<p>1. <i>This is an E-tender floated online through our E-Procurement Portal</i>  <a href="https://bheleps.buyjunction.in">https://bheleps.buyjunction.in</a></p> <p>2. <u><i>Sale from BHEL PSSR Regional office at :Chennai</i></u>  <i>Start : 05.11.2016</i>  <i>Closes: 24.11.2016</i></p> <p>3. From BHEL website (<a href="http://www.bhel.com">www.bhel.com</a>)  Tender documents can however be downloaded from website till due date of submission</p>	Applicable
v)	Due Date & Time of Offer Submission	<p>Date : 25.11.2016, Time :15.00 Hrs</p> <p>Place : The bidder should submit their offer online in e-Procurement portal at <a href="https://bheleps.buyjunction.in">https://bheleps.buyjunction.in</a> only.</p> <p>Hard copy bid or bids through email/ fax shall not be accepted.</p>	Applicable
vi)	Opening of Tender	<p>Date : 25.11.2016, Time :15.30 Hrs</p> <p>Notes:</p> <p>(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.</p> <p>(2) Bidder may record their presence online, during tender opening. However this being an e-tender it shall be opened online</p>	Applicable
vii)	EMD Amount	Rs 1, 40,000/- (Rupees One Lakh forty Thousand Only) Refer Vol-1A Part-II Chapter-1 for mode of payment of EMD. One time EMD is not applicable.	Applicable
viii)	Cost of Tender	Rs. 2,000/- (Rupees Two Thousand Only)	Applicable
ix)	Last Date For Seeking Clarification	At least 5 days before the due date of offer submission or two days before the scheduled date of pre-bid meeting whichever is earlier along with soft version also, addressing to undersigned & to others as per contact address given below	Applicable

## NOTICE INVITING TENDER

x)	Schedule of Pre Bid Discussion (PBD)	Date:15.11.2016 Time 11.00AM at BHEL:PSSR:Chennai-35	Applicable
xi)	Integrity Pact & Details of Independent External Monitor (IEM)	<p>a. Integrity Pact (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. Details of IEM for this tender is furnished below:</p> <p style="text-align: center;">-----</p> <p>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.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 / issued shall be addressed directly to the tender issuing (Procurement) department.</p>	<i>Not Applicable</i>
xii)	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage only ( <a href="http://www.bhel.com">www.bhel.com</a> → Tender Notifications) & portal <a href="https://bheleps.buyjunction.in">https://bheleps.buyjunction.in</a> and not in the newspapers. Bidders to keep themselves updated with all such information. This also form part of tender hence the same shall be enclosed with their offer.	

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- 2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, **duly signed & stamped on each page**, as part of offer. Rates / Price including discounts / rebates, if any, mentioned anywhere / in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.
- 3.0 Unless specifically stated otherwise, bidder shall remit cost of tender and courier charges if applicable, in the form of Demand Draft drawn in favour of Bharat Heavy Electricals Ltd, payable at Chennai. Bidder may also choose to deposit the Tender document cost by cash at the Cash Office as stated above against sl no iv of 1, on any working day; and in such case copy of Cash receipt is to be enclosed with the Techno Commercial offer. Sale of tender Documents shall not take place on National Holidays, holidays declared by Central or State Governments and BHEL PS HQ at Chennai, Sundays and second / last Saturdays.
- 4.0 Refer Vol-1A Part-II Chapter-1 for mode of payment of EMD.  
**One time EMD is not applicable.**
- 5.0 Procedure for Submission of Tenders: This is an E-tender floated online through our E-Procurement portal <https://bheleps.buyjunction.in>. The bidder should respond by submitting their offer online only in our e-Procurement portal at <https://bheleps.buyjunction.in>. Hard copy bid or bids through email/ fax shall not be accepted.

I. Pre-requisite for Offer Submission:-

The process of utilizing e-procurement necessitates usage of DSC (Digital Signature Certificate)( Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION) and you are requested to procure the same immediately, if not presently available with you.

The Tenderer should own and use the Digital Signature Certificate (Class 3 – SHA2 – 2048 BIT – Signing & Encryption) (DSC) issued on behalf of their / his - firm/organization/company/proprietor. Tenderer to register with E-Procurement Portal <https://bheleps.buyjunction.in> with their DSC.

Please note that only with DSC, you will be able to login the e-procurement secured site and take part in the tendering process.

The contact details of the DSC Certifying Authority as given below

1	e-Mudhra	<a href="http://www.e-Mudhra.com">http://www.e-Mudhra.com</a>
2	GNFC	<a href="http://www.ncodesolutions.com">www.ncodesolutions.com</a>
3	IDRBT	<a href="http://www.idrbtca.org.in">www.idrbtca.org.in</a> ,
4	MTNL Trustline	<a href="http://www.mtnltrustline.com">www.mtnltrustline.com</a>
5	NIC	<a href="http://www.nic.in">www.nic.in</a>
6	Safescrypt	<a href="http://www.safescrypt.com">www.safescrypt.com</a>

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7	TCS	<a href="http://www.tcs-ca.tcs.co.in">www.tcs-ca.tcs.co.in</a>
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## II. Digital Signing of e-Tender

Tenders shall be uploaded with all relevant PDF/zip format. The relevant tender documents should be uploaded by an authorized person having Class 3- SHA2-2048 BIT- SIGNING & ENCRYPTION digital signature certificate (DSC).

### i) The Requirement:

- a. A PC with Internet connectivity &
- b. DSC (Digital Signature Certificate)( Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION)

## III. E-procurement service Provider-:

M/s Mjunction services Limited, Kolkata  
Godrej Water Side, 3rd Floor, Tower-1,  
Plot-V, Block - DP Sector - V,  
Salt Lake, Kolkata-700091,  
West Bengal, INDIA

The contact details of the service provider are given below:

### 1. First level:

Customer care Help Desk of M/s MJUNCTION SERVICES LIMITED,  
Kolkata:

Tel ~ 033 - 66011717 (From 9.30 am to 5.30 pm),

Mob - 9163348280 / 9163348283 / 9163348284 / 9163348285 / 9163348286  
/ 8584008116 / 8336925964 / (From 5.30 pm to 8.30 pm)

HELPDESK email: [eps.customercare@mjunction.in](mailto:eps.customercare@mjunction.in)

### 2. Second Level:

Mr. Bhaskar Chakraborty - Cell No 08584008205,

[bhaskar.chakraborty@mjunction.in](mailto:bhaskar.chakraborty@mjunction.in), [harish.ramu@mjunction.in](mailto:harish.ramu@mjunction.in)

### 3. Third Level:

Mr. P.Dhanaraj - Cell No 09500199108, [p.dhanaraj@mjunction.in](mailto:p.dhanaraj@mjunction.in)

## 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)

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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. Alternatively, documentary evidence for claiming exemption as per clause 29 of NIT
  - 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.

V. DO NOT'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. Also, uploading of the price bid in prequalification bid or technical bid may RESULT IN REJECTION of the tender.

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Vendors are also requested to go through seller manual available on [www.bheleps.buyjunction.in](http://www.bheleps.buyjunction.in)

6.0 DOCUMENTS TO BE UPLOADED & MODALITY OF UPLOADING in E-PROCUREMENT PORTAL <https://bheleps.buyjunction.in> 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 "Add Attachments"
ii.	Duly filled-in 'No Deviation Certificate' as per prescribed format to be placed after document under sl no (i) above. <b>Note:</b> a. In case of any deviation, the same should be submitted separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be attached along with document under sl no (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. b. BHEL reserves the right to accept / reject the deviations without assigning any reasons, and BHEL decision is final and binding. (i) In case of acceptance of the deviations, appropriate loading shall be done by BHEL (ii) In case of unacceptable deviations, BHEL reserves the right to reject the tender.	To be uploaded under "Add Attachments"
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 "PREQUALIFICATION"
iv.	All Amendments / Correspondences / Corrigenda / Clarifications / Changes / Errata etc pertinent to this NIT.	To be uploaded under "Add Attachments"
v.	Integrity Pact Agreement (Duly signed by the authorized signatory) (As applicable)	To be uploaded under "Add Attachments"

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		Attachments”
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification / NIT	To be uploaded under “Add Attachments”
vii.	Notice inviting Tender (NIT)	To be uploaded under “Save and goto quotation format” as “Technical & Commercial”
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 “Add Attachments”
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only ‘QUOTED’ or ‘UNQUOTED’ against each item	To be uploaded under “Add Attachments”
xiii.	Any other details preferred by bidder with proper indexing.	To be uploaded under “Add Attachments”

**Caution to Bidders:-**

The duly signed & stamped copies of Volume – 1 Book 1 & Volume 1 Book 2 are to be attached in “Save and goto quotation format” as “Technical & Commercial” and not “Price”

	<b>PRICE BID</b> consisting of the following shall be attached as mentioned below	
ii	<p>Volume II – PRICE BID ( Duly Filled in Schedule of Rates – rate / price to be entered in words as well as figures)</p> <p><b>Caution to Bidders:-</b> Bidders to note that while uploading/entering pricebid document, the “Type of Format” in e-tendering module is selected as “Price” and not “Technical &amp; Commercial”</p> <p>Any other document uploaded in the price bid, apart from above tender format, shall not be taken into cognizance for evaluation of offer.</p>	To be uploaded under “Save and goto quotation format” as “Price format”

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## 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. 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 this tender shall be assessed 'LOAD' wise and 'PERFORMANCE' wise as per the following:

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

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

- i). Total number of Packages

Total number of Packages in hand = P

Where

- 'P' is the sum of all unit wise identified packages under execution with BHEL Regions as of the cut off month defined above, including packages yet to be commenced, excepting packages which are on HOLD due to reasons not attributable to Bidder.

- II. PERFORMANCE: Here 'Monthly Performance' of the bidder for all the packages (under execution/ executed during the 'Period of Assessment' in all the Power Sector Regions of BHEL) SIMILAR to the packages covered under the tendered scope, excepting packages not commenced shall be taken into consideration. The 'Period of

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Assessment' shall be 6 months preceding the cut off month. The cut off month for reckoning 'Period of Assessment' shall be the month two (2) months preceding the month corresponding to the 'latest date of bid submission', in the following manner:

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

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

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

- a)  $P_1, P_2, P_3, P_4, P_5, \dots, P_N$  etc be the packages (under execution/ executed during the 'Period of Assessment' in all Regions) SIMILAR to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions =  $P_T$  ( ie  $P_T = P_1 + P_2 + P_3 + P_4 + \dots P_N$  )
- 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 ' $T_T$ ' for total similar Packages ' $P_T$ ' for all Regions ( i.e  $T_T = T_1 + T_2 + T_3 + T_4 + \dots T_N$  )
- c) Sum ' $S_1$ ' of 'Monthly Performance Evaluation' Scores ( $S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, S_{1-5}, \dots S_{1-N}$ ) for similar package  $P_1$ , for the 'period of assessment' ' $T_1$ ' (i.e  $S_1 = S_{1-1} + S_{1-2} + S_{1-3} + S_{1-4} + S_{1-5} + \dots S_{1-N}$ ). Similarly  $S_2$  for package  $P_2$  for period  $T_2$ ,  $S_3$  for package  $P_3$  for period  $T_3$ , etc for the tendered scope for all Regions. Now calculate cumulative sum ' $S_T$ ' of 'Monthly Performance Evaluation' Scores for total similar Packages ' $P_T$ ' for all Regions (i.e ' $S_T = S_1 + S_2 + S_3 + S_4 + S_5 + \dots S_N$ ')
- d) Overall Performance Rating ' $R_{BHEL}$ ' for the similar Package/Packages (under execution/ executed during the 'Period of Assessment') in all the Power Sector Regions of BHEL):

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

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

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 <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>	...	P <sub>N</sub>	Total No of similar packages for all Regions = P <sub>T</sub> ie Sum (Σ) of columns (iii) to (ix)
2	Number of Months for which 'Monthly Performance Evaluation' as per relevant formats should have been done in the 'period of assessment for corresponding similar Package ( as in row 1)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	...	T <sub>N</sub>	Sum (Σ) of columns (iii) to (ix)  = T <sub>T</sub>
3	Monthly performance scores for the corresponding period (as in Row 2)	S <sub>1-1</sub> , 1, S <sub>1-2</sub> , 2, S <sub>1-3</sub> , 3, S <sub>1-4</sub> , 4, ...	S <sub>2-1</sub> , S <sub>2-2</sub> , S <sub>2-3</sub> , S <sub>2-4</sub> , ...	S <sub>3-1</sub> , 1, S <sub>3-2</sub> , -2, S <sub>3-3</sub> , -3, S <sub>3-4</sub> , -4, ...	S <sub>4-1</sub> , 1, S <sub>4-2</sub> , -2, S <sub>4-3</sub> , -3, S <sub>4-4</sub> , -4, ...	S <sub>5-1</sub> , S <sub>5-2</sub> , S <sub>5-3</sub> , S <sub>5-4</sub> , ...	.. ... ... ...	S <sub>N-1</sub> , S <sub>N-2</sub> , S <sub>N-3</sub> , S <sub>N-4</sub> , ...	-----
4	Sum of Monthly Performance scores of the corresponding Package for the corresponding period (as in row-3)	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	S <sub>5</sub>	...	S <sub>N</sub>	Sum (Σ) of columns (iii) to (ix)  = S <sub>T</sub>

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- ii) Calculation of Overall 'Performance Rating' ( $R_{BHEL}$ ) in case 'similar Package / Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment':

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

- 'Period of Assessment.
- 12 months preceding the cut-off month
- 24 months preceding the cut-off month
- 36 months preceding the cut-off month

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

- iii) Factor "L" assigned based on Overall Performance Rating ( $R_{BHEL}$ ) at Power Sector Regions.:

Sl. No.	Overall Performance Rating ( $R_{BHEL}$ )	Corresponding value of 'L'
1	=60	NA
2	> 60 and $\leq$ 65	0.4
3	> 65 and $\leq$ 70	0.35
4	> 70 and $\leq$ 75	0.25
5	> 75 and < 80	0.2
6	$\geq$ 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:

- 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
- For  $R_{BHEL} = 60$ ,  $P_{Max} = '1'$
- For  $R_{BHEL} \geq 80$ , there will be no upper limit on  $P_{Max}$

The Bidder shall be considered 'Qualified' as per 'Assessment of Capacity of Bidder' for the subject Tender if  $P \leq P_{Max}$

(Where P is calculated as per clause 9.1)

# NOTICE INVITING TENDER

IV. **Explanatory note:**

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

**Table-1**

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

- c) Bidders who have not been evaluated for at least six package months in the last 36 months in the online BHEL system for contractor performance

# NOTICE INVITING TENDER

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evaluation in BHEL PS Regions, wef July'2010 shall be considered "NEW VENDOR".

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

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

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

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

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

d) In the unlikely event of all bidders shortlisted against Technical and Financial Qualification criteria not meeting the criteria on 'Assessment of Capacity of Bidders' detailed above, OR leads to a single tender response on applying the criteria of 'Assessment of Capacity of Bidders' or due to non-approval by Customer, then BHEL at its discretion reserves the right to consider the further processing of the Tender based on the Overall Performance Rating 'R<sub>BHEL</sub>' only, starting from the upper band.

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

- i. up to Boiler Steam Blowing in case of Steam Generator and Auxiliaries
- ii. upto Synchronisation in case of all other works excepting sl no (i) and (iii)
- iii. Upto execution of at least 90% of anticipated contract value in case of Civil & Structures (unit wise), Enabling works and upto 90% of material unloading (in tonnage) as per the original contract in case of MM Package.

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

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

## NOTICE INVITING TENDER

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- 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 writing or through e-mail or clarification-provision available in procurement portal - <https://bheleps.buyjunction.in>, 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 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.

## NOTICE INVITING TENDER

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- 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 authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful / Disqualified bidders under intimation to the respective bidders.
- 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 decide the successful bidder on the basis of Reverse Auction process. In such case all qualified bidders will be intimated regarding procedure / modality for Reverse Auction process prior to Reverse Auction and price will be decided as per the rules for Reverse Auction.
- However, if reverse auction process is unsuccessful as defined in the RA rules / procedures, or for whatsoever reason, then the sealed 'PRICE BIDS' will be opened for deciding the successful bidder. BHEL's decision in this regard will be final and binding on bidder.
- 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 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.
- 24.0 Void
- 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 on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site "[www.bhel.com](http://www.bhel.com) → tender notification".
- 28.0 It may be noted that guidelines / rules in respect of 'Suspension of Business dealings', 'Vendor evaluation format', Quality, Safety & HSE guidelines', etc may undergo change from time to time and the latest one shall be followed.

## NOTICE INVITING TENDER

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- 29.0 MSE suppliers can avail the intended benefits only if they submit along with offer, attested copies of either EM II certificate having deemed validity (Two years from the date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM II certificate along with CA certificate (Format enclosed as per Annexure -8) applicable for the year, certifying quantum of investment in plant and machinery within the permissible limit as per the act for relevant status (Micro or small) where the deemed validity of EM II is over. Date to be reckoned for determining the deemed validity will be the last date of technical bid submission. Non submission of such documents will lead to consideration of their bids at par with other bidders and MSE status of such suppliers shall be shifted to Non MSE supplier till the supplier submits these documents”.
- 30.0 The Bidder along with its associate/ collaborators/ sub-contractors/ subvendors/ 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 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, Rev 01 dated 1st June 2012, Amendment 01 dated October 01, 2015
- f. General conditions of Contract, Rev 01 dated 1st June 2012, Amendment 03 dated October 01, 2015
- g. Forms & Procedures, Rev 01 dated 1st June 2012, Amendment 01 dated October 01,2015

For BHARAT HEAVY ELECTRICALS LTD

Additional General Manager / SCT

# NOTICE INVITING TENDER

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## Enclosure

1. Annexure-1: Pre Qualifying criteria.
2. Annexure-2: Check List.
3. Annexure-3 Technical Pre qualifying criteria
4. Annexure-4 PQR format
5. Annexure-5 Performance certificate
6. Annexure-6 Tender Schedule.
7. Annexure-7 Declaration for Reverse auction
8. Annexure-8 Certificate by Chartered Accountant
9. Other documents as per this NIT

# NOTICE INVITING TENDER

## ANNEXURE - 1

### PRE QUALIFYING CRITERIA

JOB	Dismantling of Site Office and Semi-Storage Shed at Jindal, Angul, Transportation, conversion to closed Storage Shed and Re-Erection of Site Office and Closed Storage Shed at 1 x 800MW Kothagudam Thermal Power Station, Stage VII, Unit-12, Telangana
TENDER NO	BHEL PSSR SCT 1636

Sl. No.	PRE QUALIFICATION CRITERIA	Bidders claim in respect of fulfilling the PQR Criteria	
		Name and Description of qualifying criteria	Page no of supporting document. Bidder must fill up this column as per applicability
A	Submission of Integrity Pact duly signed (if applicable)	Not Applicable	
B	<u>Technical</u> Refer Annexure -3	Applicable	
C: C-1	<u>FINANCIAL</u> <u>Turnover</u> Bidders must have achieved an average annual financial turnover of Rs. 20 Lakhs or more over last three Financial Years (FY) i.e 2013-2014, 2014-2015, 2015-2016.	Applicable	
C-2	<u>Networth (only in case of Companies)</u> Net worth of the Bidder based on the latest Audited Accounts as furnished for C-1' above should be positive	Applicable	
C-3	<u>Profit</u> Bidder must have earned profit in any one of the three Financial Years as applicable in the last three Financial Years as furnished as furnished for C-1 above.	Applicable	
D	<u>Assessment of Capacity of Bidder</u>	Applicable	By BHEL
E	<u>Approval of Customer (if applicable)</u>	Applicable	BY BHEL
F	Submission of all documents as prescribed in the tender including "no deviation certificate"	Applicable	
G	<u>Price Bid Opening:</u> <u>Note:</u> Price Bids of only those bidders shall	Applicable	BY BHEL

## NOTICE INVITING TENDER

	be opened who stand qualified after compliance of criteria A to F		
H	Consortium criteria (if applicable)	Not applicable	
	<p><u>Explanatory Notes for the PQR (unless otherwise specified in the PQR):</u></p> <ol style="list-style-type: none"> <li>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</li> <li>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.</li> <li>3. If Financial Statements are not required to be audited statutorily, then instead of audited financial statements are required to be certified by Chartered Accountant.</li> <li>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).</li> <li>5. C-3:- PROFIT : shall be PBT earned during any one year of the three financial years as in C-1 above</li> <li>6. For evaluation of PQR, the credential of the bidder alone, and not that of the group company shall be considered.</li> <li>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</li> <li>8. Boiler means HRSG or WHRB or any other types of Steam Generator</li> <li>9. Power Cycle piping means Main Steam, Hot Reheat, Cold Reheat, HP Bypass, LP Bypass lines</li> <li>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.</li> <li>11. <i>In case the experience/PO/WO certificate enclosed by bidders do not have separate break up prices for the E&amp;C portion of Electrical and CI Works, (i.e. the certificates enclosed are for composite order for supply and erection of Electrical &amp; CI and other works if any), then value of Erection and Commissioning for the Electrical &amp; CI portion shall be considered as 15% of the supply &amp; erection of Electrical &amp; CI, unless otherwise specifically indicated in the PQR.</i></li> <li>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.</li> <li>13. In case the Experience/PO/WO certificate enclosed by bidders do not have separate break up of prices for the E&amp;C portion for Electrical and C&amp;I works (i.e. the certificates enclosed are for composite order for supply and erection of</li> </ol>		

## NOTICE INVITING TENDER

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	Electrical and C&I and other works if any), then value of Erection & Commissioning for the Electrical and C&I portion shall be considered as 15% of the price for supply & erection of Electrical and C&I.
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BIDDER SHALL SUBMIT ABOVE PRE-QUALIFICATION CRITERIA FORMAT, DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT INCLUSIVE OF WORK ORDER AND WORK COMPLETION CERTIFICATE ETC IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

# NOTICE INVITING TENDER

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	Mode of Remittance: Ref No : Date :                      Amount: <u>Please tick ( √ ) whichever applicable:-</u>	
5	Validity of Offer	To be valid for six months from due date	
		<b>Applicability (By BHEL)</b>	<b>Bidder Reply</b>
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 profit and Loss Account for the last three years	Applicable	YES / NO
8	Submission of Copy of PAN Card	Applicable	YES / NO

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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	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. 10 to 20 above, the formats are available in "Volume ID of Volume I Book-II – Forms and Procedures" of this tender specification.

**DATE :**

AUTHORISED SIGNATORY

(With Name, Designation and Company seal)

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# NOTICE INVITING TENDER

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## ANNEXURE-3

### QUALIFICATION CRITERIA:-

1. Bidders should have executed the following in Power/Industrial/Infra Projects in the last seven years reckoned from the latest due date of bid submission

One (1) Electrical/ C&I/ Electrical and C&I work of value not less than Rs 55 Lakhs in power / industrial projects in the last seven years ending on the latest due date of bid submission.

(OR)

Two (2) Electrical/ C&I/ Electrical and C&I works each of value not less than Rs 34 Lakhs in power / industrial projects in the last seven years ending on the latest due date of bid submission.

(OR)

Three (3) Electrical/ C&I/ Electrical and C&I works each of value not less than Rs 27 lakhs in power / industrial projects in the last seven years ending on the latest due date of bid submission.

Note: Executed above means the Vendor should have achieved the criteria specified in the PQR even if the Contract has not been completed or closed.

(AND)

Bidder should have Executed# Erection, testing and commissioning of Control Instrumentation works for BTG/GT or Erection, testing and commissioning of Control Instrumentation works consisting of DCS/DDC/Station C&I in one unit of Thermal/Gas Power Plant  $\geq$  30 MW rating. Note: - Executed# above means "Synchronization of the unit".

(OR)

Bidder should have executed at least one contract of Erection, Testing and commissioning of Control Instrumentation works consisting of DCS/DDC/station C&I in any industry with its executed value of Rs. 60 Lakhs or more in the last seven years ending on the latest due date of bid submission.

# NOTICE INVITING TENDER

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Note:-

- i. The term 'Executed' in the above QR means; the Bidder should have achieved the criteria specified in QR even if the Contract has not been completed or closed.
- ii. The value of work executed will be updated as per PVC formula of GCC with indices for All India average consumer price index for Industrial workers with base month as the date of completion of execution and indexed upto two months prior to the bid opening month.

**Example Calculation for value updation:**

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

Tender opening date is say Feb 01, 2014

Consumer Price Index for labour as published in [www.labourbureau.nic.in](http://www.labourbureau.nic.in) is as follows:

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

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

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

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

$$=7500000 + (7500000 \times 0.4 \times 50/189)$$

$$=Rs. 82,93,650.00 /-$$

## NOTICE INVITING TENDER

### "Annexure-4 to Pre-Qualifying Criteria"

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

Additional Format to be submitted by Bidders in a separate cover superscribed as "Annexure to Pre-Qualifying Criteria"							
Sl.No	PQR Ref	PQR	Qualifying Experience	Work order Ref with page no in Offer for supporting documents	Completion certificate ref for the referred Work with page no in Offer for supporting documents	Details of work with Project, Unit, Qty & Period	Remarks
1.1	B: Technical	<p>1. Bidders should have executed the following in Power/Industrial/Infra Projects in the last seven years reckoned from the latest due date of bid submission</p> <p>One (1) Electrical/ C&amp;I/ Electrical and C&amp;I work of value not less than <u>Rs 55 Lakhs</u> in power / industrial projects in the last seven years ending on the latest due date of bid submission.</p> <p>(OR)</p> <p>Two (2) Electrical/ C&amp;I/ Electrical and C&amp;I works each of value not less than <u>Rs 34 Lakhs</u> in power / industrial projects</p>					

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	<p>in the last seven years ending on the latest due date of bid submission.</p> <p>(OR)</p> <p>Three (3) Electrical/ C&amp;I/ Electrical and C&amp;I works each of value not less than <u>Rs 27 Lakhs</u> in power / industrial projects in the last seven years ending on the latest due date of bid submission.</p> <p>Note: Executed above means the Vendor should have achieved the criteria specified in the PQR even if the Contract has not been completed or closed.</p> <p>(AND)</p> <p>Bidder should have Executed# Erection, testing and commissioning of Control Instrumentation works for BTG/GT or Erection, testing and commissioning of Control Instrumentation works consisting of DCS/DDC/Station C&amp;I in one unit of Thermal/Gas Power Plant <math>\geq</math> 30 MW rating Note:- Executed# above means "Synchronization of the unit"</p> <p>(OR)</p>					
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		Bidder should have executed at least one contract of Erection, Testing and commissioning of Control Instrumentation works consisting of DCS/DDC/station C&I in any industry with its executed value of Rs. 60 Lakhs or more in the last seven years ending on the latest due date of bid submission					
2	C:Financial Criteria						
	C1	<u>Financial TURNOVER</u> Bidders must have achieved an average annual financial turnover (Audited) of Rs. 20 Lakhs or more over last three Financial Years (FY) i.e 2013-2014, 2014-2015, 2015-2016.					
	C2	<u>NETWORTH</u> (only in case of Companies) Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive					
	C3	<u>PROFIT</u> Bidder must have earned profit in any one of the last three financial years as defined in '1'. Note: PROFIT shall be PBT earned during any one year of the last three financial years as defined in 'C1'.					
<p><b>Non submission of this additional format will make the bid liable for rejection.</b>  <i>Note: Indicate the page nos in the respective columns for the enclosed PQR supporting documents in the offer</i></p>							

# NOTICE INVITING TENDER

ANNEXURE-5

## PERFORMANCE CERTIFICATE

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

Performance of the Agency \_\_\_\_\_ in Project \_\_\_\_\_

Name of the Agency :

Address of the agency :

Work Order issued :

Erection and Commissioning works in Project \_\_\_\_\_ under work order dated \_\_\_\_\_ under reference number / Lol number \_\_\_\_\_ for the scope of \_\_\_\_\_ (Copy of work order issued enclosed)

Duration of work as per contract without extended periods : \_\_ months

Time taken for actual completion of works : \_\_ months

(Actual completion of works will mean the completion of contracted works enabling the intended purpose of contract, and not necessarily the closure of contract)

Delays in execution of works attributable to contractor : \_\_ months

Performance of the Contractor in the referred works :

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

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

\_\_\_\_\_

Signature

Name and Seal of the issuing Authority

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**Note:**

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

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

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

# NOTICE INVITING TENDER

ANNEXURE-6

## Tender Schedule

Description	Schedule	Remarks
Technical Bid Opening	As mentioned in Notice Inviting Tender.	
Communication from BHEL for Clarifications, if any, required by BHEL	On or before third day of tender opening	
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	Tenth 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.

# NOTICE INVITING TENDER

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Annexure 7

## DECLARATION BY BIDDER FOR PRICE OPENING THROUGH REVERSE AUCTION (To be typed and submitted in the Letter Head of the Company / Firm of Bidder)

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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)

# NOTICE INVITING TENDER

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Annexure 8

Certificate by Chartered Accountant on letter head

This is to certify that M/s. \_\_\_\_\_, (hereinafter referred to as 'company') having its registered office at \_\_\_\_\_ is registered under MSMED Act 2006, (Entrepreneur Memorandum No (Part-II) \_\_\_\_\_ dtd. \_\_\_\_\_, Category: \_\_\_\_\_ (Micro / Small)). (Copy enclosed)

Further verified from the Books of Accounts that the investment of the company as per the latest audited financial year \_\_\_\_\_ as per MSMED Act 2006 is as follows:

1. For Manufacturing enterprises: Investment in plant and machinery (i.e., original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No.S.O.1722(E) dated October 5, 2006 :

Rs. \_\_\_\_\_ Lacs

2. For Service Enterprises: Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:

Rs. \_\_\_\_\_ Lacs

(Strike off whichever is not applicable)

The above investment of Rs. \_\_\_\_\_ Lacs is within permissible limit of Rs. \_\_\_\_\_ Lacs for \_\_\_\_\_ Micro / small (Strike off which is not applicable) category under MSMED Act 2006.

Or

The company has been graduated from its original category (Micro / Small) (Strike off which is not applicable) and the date of graduation of such enterprise from its original category as notified vide S.O.No. 3322(E) dated 01-11-2013 published in gazette notification dated 04-11-2013 by Ministry of MSME.

Date:

(Signature)

Name-

Membership number-

Seal of Chartered Account

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

BHARAT HEAVY ELECTRICALS LIMITED



## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## TECHNICAL CONDITIONS OF CONTRACT (TCC)

### VOLUME-IA PART –I CHAPTER –I PROJECT INFORMATION

01	Owner	RASHTRIYA ISPAT NIGAM LIMITED VISAKHAPATNAM STEEL PLANT
02	Project Title	TURBO BLOWER # 5 & ITS AUXILIARIES , RINL – VSP
03	Location	Visakhapatnam district in the state of Andhra Pradesh Situating South of National High Way No 5 and the East Coast Railway Line between Visakhapatnam And Chennai Located at Latitude Of 17°37' N And Longitude of 83°12' E
04	Power Station Site	Elevation above Mean Sea Level (MSL) : 10.5 Mt
05	Nearest Railway Station	Duvvada on The Visakhapatnam-Chennai Line about 10 km from the Plant and Visakhapatnam Railway Station is about 30 km from the plant
06	Nearest City	Visakhapatnam
07	Nearest Airport	Visakhapatnam (12 Kms)
08	Nearest Seaport	Visakhapatnam (16 Kms)
09	Road Approach	National Highway No 5 is about 5 Kms from Site
10	Dry Bulb Temperature	45 deg C
11	Relative Humidity	4 % ( MIN) TO 100% ( MAX)
12	Altitude	10.5 M above MSL
13	Ambient Range	
13a	Mean Ambient Temperature	16.5 deg C
13b	Normal/Average Temp	35 deg C
13c	Maximum Temperature	45 deg C
14	Rain Fall Data	
14a	Rain Fall For 24 Hour Period	370 mm
14b	Highest Monthly Rain Fall	606 mm
14c	Design Wind Speed	35.2 Kmph
14d	Earth Quake Factor	This Plant is falling under ZONE-II as per IS 1893

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

- 1.2 SCOPE OF WORK
  - 1.2.1 The Erection, Testing and commissioning of Electrical, C&I, Illumination works covered for the Turbine, Turbo blower, and all its associated auxiliaries.
  - 1.2.2 The Scope of Electrical/ C&I and work covered in the above packages shall be as follows
    - 1.2.2.1 Erection and commissioning of Transformers
    - 1.2.2.2 Erection and commissioning of LT MCC, AC/DC Distribution Boards Starter Panels, Electrical/ Instrumentation control panels etc.
    - 1.2.2.3 Erection and commissioning of Battery & Battery Charger/ UPS system.
    - 1.2.2.4 Erection and commissioning of all Types of Field Instruments like Temperature, Pressure and Flow instruments (local & remote) and special instruments like EWLI, Vibration Monitoring System, Acoustic Pyrometer System, and Steam Leak Detection System.
    - 1.2.2.5 Erection and commissioning of all types of Control room mounted instruments like Indicators, Microprocessor based panels, DCS system and its accessories like system panels, PC's, printers, furniture etc.
    - 1.2.2.6 Erection and commissioning of all Types of Pneumatic Power Cylinders, Controllers etc.
    - 1.2.2.7 Commissioning of all Types of Pneumatic operated Valves / Actuators / Power Cylinders / Controllers and Relief Valves.
    - 1.2.2.8 Erection of all types of Hardware like impulse pipes, trays & tray supports, instrument airline, etc.
    - 1.2.2.9 Laying & Termination of all types of LT power/ control/ instrumentation cables etc.
    - 1.2.2.10 Installation of local Push Button stations, Junction Boxes etc.
    - 1.2.2.11 Installation of below ground and above ground earthing grid, equipment earthing of all equipment, cable racks, trays etc. as applicable.
    - 1.2.2.12 Installation of Lightning protection as applicable.
    - 1.2.2.13 Fabrication and installation of steel supports wherever required.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 1.2.2.14 Installation of Illumination Package for Turbo blower Area.
- 1.2.2.15 Supply and installation of cable sealing material for sealing of unused openings in panels/ JB's etc.
- 1.2.2.16 Supply of all consumables required for installation as detailed elsewhere in the contract.
- 1.2.2.17 Supply of paints and painting of items covered in the scope of works.
- 1.2.2.18 Commissioning of LT drives, and electrically operated equipment erected by Mechanical contractor.
- 1.2.2.19 Nomenclature of all equipment covered under the scope of contract which include feeders of electrical panels, control panels, batteries, chargers, UPS, Lighting panels, Junction boxes, local control stations, Field instruments, earth pits etc with painting as per instructions of BHEL engineer.
- 1.2.2.20 Installation of any other items that have not been specifically indicated, but required for completing installation.

Note: BHEL will provide vendor's technical support for commissioning of various proprietary type special instruments/systems like Analysers, SWAS, Vibration Monitoring System, Master Clock System, Hart Management System, Communication System, Battery/ Battery Charger, UPS, Microprocessor based relays, etc. The contractor shall carry out the works as per instructions of BHEL/ Vendor Engineer.

For detailed scope refer enclosed Bill of quantity (rate schedule), Technical Specifications & drawings, as in Volume 1A, Part II-Technical Specifications.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

### VOLUME-IA PART – I CHAPTER – III FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description  PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.3.1	<b>ESTABLISHMENT</b>			
1.3.1.1	<b>FOR CONSTRUCTION PURPOSE:</b>			
a	Open space for office	Yes		Free
b	Open space for storage	Yes		Free
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipments, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
f	Fire fighting equipments like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.3.1.2	<b>FOR LIVING PURPOSES OF THE BIDDER</b>			
a	Open space for labour colony		Yes	
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
1.3.2	<b>ELECTRICITY</b>			
1.3.2.1	Electricity For construction purposes (to be specified whether chargeable or free)			Free
a	Single point source	Yes		
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
1.3.2.2	Electricity for the office, stores, canteen etc of the bidder which include:			

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description <b>PART I</b>	Scope / to be taken care by		Remarks
		BHEL	Bidder	
a	Distribution from single point including supply of materials and service		Yes	
b	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	
c	Duties and deposits including statutory clearances for the above if applicable		Yes	
1.3.2.3	Living facilities for office use including charges			
a	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc. in the above lines (in case BHEL provides this facility, the scope should be given without ambiguity)		Yes	
b	Demobilization of the facilities after completion of works		Yes	
c	Electricity For construction purposes (to be specified whether chargeable or free)		Yes	
1.3.3.0	<b>WATER SUPPLY</b>			
1.3.3.1	<b>For construction purposes</b>		Yes	
a	Making the water available at single point	Yes		Free
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.3.2	<u>Water supply for bidder's office, stores, canteen etc</u>			
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.3.3	<u>Water supply for Living Purpose</u>			
a	Making the water available at single point		Yes	

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description <b>PART I</b>	Scope / to be taken care by		Remarks
		BHEL	Bidder	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.4.0	<b>LIGHTING</b>			
a	For construction work (supply of all the necessary materials) a)At office/storage area b)At the preassembly area c)At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
1.3.5.0	<b>COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER</b>			
a	Telephone, fax, internet, intranet, e-mail etc		Yes	
1.3.6.0	<b>COMPRESSED AIR</b> wherever required for the work		Yes	
1.3.7.0	Demobilization of all the above facilities		Yes	
1.3.8.0	<b>TRANSPORTATION</b>			
a	For site personnel of the bidder		Yes	
b	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI.No	Description  PART II	Scope / to be taken care by		Remarks
		BHEL	Bidder	
	1.3.9.0 ERECTION FACILITIES			
1.3.9.1	Engineering works for construction:			
a	Providing the erection/construction drawings for all the equipments covered under this scope	Yes		
b	Drawings for construction methods	Yes	Yes	In consultation with BHEL
c	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		YES	”
d	Shipping lists etc for reference and planning the activities	Yes		”
e	Preparation of site erection schedules and other input requirements		Yes	”
f	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	”
g	Weekly erection schedules based on SI No. e	yes	Yes	”
h	Daily erection / work plan based on SI No. g	yes	Yes	”
i	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
j	Preparation of preassembly / Batching Plant bay		Yes	
k	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself			

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl.No	Description  PART II  1.3.9.0 ERECTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
L	Arranging the materials required for preassembly/ Batching Plant		YES	

### 1.3.10.0 OPEN SPACE:

- 1.3.10.0.1 To establish a temporary site office and storage area at the site of erection, open space will be provided free of charges. Contractor has to make his own arrangements for labour colony.
- 1.3.10.0.2 BHEL will 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.
- 1.3.10.0.3 Contractor has to furnish along with their offer, the details of requirements of area of space for his office, stores, storage shed.
- 1.3.10.0.4 Location and area requirement for office/storage sheds/ pre assembly yard shall be discussed and mutually agreed to.

### 1.3.11.0 ELECTRICITY:

- 1.3.11.0.1 For construction purpose, electricity will be provided at a single point for free of charge. Construction power shall be provided from the nearest Substation / tapping point which may be approx.500 metres away from the erection site. For the purpose of measurement of power consumed, the contractor shall provide Energy meter with valid calibration certificate. Distribution from this source for different locations is to be arranged by the bidder at his cost.
- 1.3.11.0.2 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.
- 1.3.11.0.3 Provision of distribution of electrical power from the given single central common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.
- 1.3.11.0.4 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.
- 1.3.11.0.5 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Contractor shall make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets with consumables 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.

1.3.11.0.6 If required, necessary "Capacitor Banks" to improve the Power factor to a minimum of 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.

### 1.3.12.0 CONSTRUCTION WATER

1.3.12.0.1 For construction purpose water will be provided at one single point free of charge and further distribution to be done by contractor at his cost.

1.3.12.0.2 In case of non-availability of water, the contractor shall make his own arrangements for uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

### 1.3.13.0 DRINKING WATER

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

### 1.3.14.0 POSSESSION OF GENERATORS

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. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting.

### 1.3.15.0 LIGHTING FACILITY:

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.

### 1.3.16.0 CONTRACTOR'S OBLIGATION ON COMPLETION:

On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instructions 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.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 1.3.17.0 Bid Drawings  
Void
- 1.3.18.0 MATERIALS/CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR WITHIN THE RATE QUOTED FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENT/ ITEMS.
- 1.3.18.0.1 Welding electrodes and gas
- 1.3.18.0.2 Provision for Temporary Scaffoldings.
- 1.3.18.0.3 "U" Clamps with nuts and washers for impulse pipes and GI pipe clamping.
- 1.3.18.0.4 Tags- Plates. Al/Fiberglass/ Stainless Steel, Insulation tape.
- 1.3.18.0.5 Teflon tape for instrument air system piping.
- 1.3.18.0.6 Paints required for primer coating and final coating of synthetic enamel paint of approved colour, Consumables like thinner, brushes, emery paper etc.
- 1.3.18.0.7 Solder wire ( Lead) -(60/40)
- 1.3.18.0.8 Protocol/Calibration report sheets as per BHEL Format.
- 1.3.18.0.9 Fastener for mounting JB and local PB Boxes.
- 1.3.18.0.10 Panel/ JB Sealing compound material (for cable entry from bottom/Top of Panel).
- 1.3.18.0.11 PVC cable tie, Aluminium or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing, grommet, Printed Ferrules, sleeves for cables Yellow/White
- 1.3.18.0.12 Lugs up to 2.5 sq. mm Solder less crimping type
- 1.3.18.0.13 The above list is not exhaustive. The bidder to arrange all necessary consumables required for satisfactory completion of work.

VOLUME-IA PART – I CHAPTER – IV

T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR

1.4.1 T&Ps to be arranged by Bidder

All the tools and plants required for execution of the above work are in contractor's scope.

For more details please refer Volume 1A, Part II-Technical Specifications, Chapter-III, Annexure VI-B sub-para A, B and C & Annexure VI-C.

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## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### VOLUME-IA PART – I CHAPTER - V T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

- 1.5.1 List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis is as below:

Sl.No	T&P Description	Quantity
1	EOT crane of 100T/25T capacity inside TG hall on shareable basis	1 No.

- 1.5.2 All the above T&Ps shall be issued on free of hire charges on need basis for erection/pre-commissioning activities only and to be shared with other contractors. Allotment will be made by BHEL Site I/C depending on the requirement.

- 1.5.3 For handling at store and transportation, contractor shall make his own arrangement.

- 1.5.4 EOT Crane :

- 1.5.4.1 Since EOT crane is customer's crane, Allotment will be made only on need basis. Experienced EOT crane-operators are to be arranged in shifts by the contractor within the quoted rates. Contractor has to plan the activities on item wise where the EOT crane is required to be used and submit to BHEL site for approval. In case the erection can be carried out by using other T&Ps, contractor shall make his own arrangement. The decision of BHEL Site in-charge on this will be final and binding.

- 1.5.4.2 The availability of EOT 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.

- 1.5.4.3 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.

- 1.5.4.4 In case of non-availability of these equipments, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make arrangement at his own cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipments. No delay in execution of work shall be accepted on this account.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### VOLUME-IA PART – I CHAPTER-VI TIME SCHEDULE

#### 1.6 TIME SCHEDULE & MOBILIZATION

- 1.6.1 The contractor shall mobilise his resources and work force within two weeks from the date of LOI in such a manner that the entire C&I work covered in his scope is completed to match the Unit commissioning schedule.
- 1.6.2 BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule. Contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.
- 1.6.3 The contractor shall reach site and establish his site office and mobilize to commence the work as per directions of BHEL engineer. The date of starting the work at site shall be fixed in consultation with BHEL's engineer and the same will be recorded in measurement book while entering the first RA bill.
- 1.6.4 Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the monthly progress and keep up the schedules.
- 1.6.5 Contractor shall draw the monthly erection programme along with BHEL engineer indicating the work to be achieved and events to be completed. Once the programme is drawn, he shall adhere to the same. Contractor shall plan and erect the materials as it is received at site. The monthly planned percentage shall take into consideration the material available at site before the start of the month and also any material received during the month. Contractor shall mobilize his resources required to achieve the monthly programmes.
- 1.6.6 The entire scope of work erection, testing and commissioning shall be completed within 07 months from the date of commencement of work.
- 1.6.7 The work under this scope of contract is deemed to be completed in all respects only when all the items/materials/equipment are erected and trial runs, testing and commissioning the equipment are completed and the unit is handed over to Customer. The decision of BHEL in this respect shall be final and binding with the contractor.
- 1.6.8 During the tenure of contract, if BHEL is not satisfied with the progress of work, BHEL have the right to withdraw any portion of work / balance work and get the same done either directly employing their own personnel or through other agency at the risk & cost of the Contractor. The contractor shall not be entitled for any compensation whatsoever in this regard.
- 1.6.9 **INITIAL MOBILIZATION**  
The contractor is required to refer Form F15 in Volume 1 Book -2 for all the instructions to be taken immediately after receipt of LOI.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### 1.6.10 COMMENCEMENT OF CONTRACT PERIOD AND TENTATIVE SCHEDULE

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

### 1.6.11 MOBILISATION

The Contractor has to subsequently augment his resources in such a manner to achieve the COMPLETION SCHEDULES:

The above time allowed for completion of work including Sundays and Holidays is from the date of commencement of work. Detailed program to be prepared by the tenderer taking in to consideration of the COMPLETION SCHEDULES /site decision on drawings flow (latest) and submitted for BHEL's approval. In order to meet the 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 Engineer.

### 1.6.12 CONTRACT PERIOD

The contract period for completion of entire work under this scope shall be 07 (Seven) months from the "date of commencement of work at site".

### 1.6.13 GUARANTEE PERIOD

All the works executed by the contractor including supplies are to be guaranteed for a period of 12 months from the date of taking over of the work or 6 months from the date of trial run of TB5 whichever is earlier (provided all erection, testing and commissioning is completed in all aspects). The contractor shall be responsible for the quality of workmanship and shall guarantee the work done, shall rectify/replace at no extra cost, all defects due to faulty supply/erection and commissioning during the guarantee period. In the event of contractor failing to replace/repair the defective supplies/works within the time required BHEL may proceed to undertake the replacement/repairs of such defective supplies/works at the contractor's risk and cost without prejudice to any other points/right.

### 1.6.14 PERT CHART AND PROGRESS REPORTS

The contractor shall submit a detailed L2 network in MS Projects to meet the agreed project schedule covering various mile stone activities and their split up details such as construction, procurement of materials, fabrication & erection activities. This network shall also clearly indicate the interface facilities/inputs to be provided by BHEL/Customer and the dates by which such facilities/inputs are required

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

### 1.7.1 Terms of payments

The contractor should submit his monthly on account monthly bill with all the detail required by BHEL on specified date every month covering progress of work in all respects and areas from the 25th of previous calendar month to 24th of the current month.

- a. 85% payment will be made on prorata basis on Erection and commissioning as detailed below.

<b>TERMS OF PAYMENT FOR ELECTRICAL/ C&amp;I WORKS</b>		
<b>Sl. No.</b>	<b>Activity / Work Description</b>	<b>% of unit rate</b>
	<b>PRO RATA PAYMENTS (85%)</b>	
1.0	Switch Gears / MCC / PCC / Distribution Boards / Marshalling Box / Starter Units / Electrical Hoists/ Panels / Cubicles / Desks / UPS / Batteries / Chargers / Miscellaneous Equipments/ etc	
1.1	Placement, Alignment and coupling / interconnection where ever applicable, erection of associated accessories etc	50%
1.2	Pre commissioning checks and tests	10%
1.3	Charging, Loop testing and commissioning	15%
1.4	System commissioning	10%
	<b>Total =</b>	<b>85%</b>
2.0	<b>Cable tray and accessories</b>	
2.1	Fabrication and fixing / welding / bolting in position	60%
2.2	Earthing of cable trays (if not applicable, then this portion to be clubbed with next activity)	10%
2.3	Tagging of cable trays (including touch up painting & cable tray numbering on sides)	8%
2.4	Covering of trays where ever envisaged	7%
	<b>Total =</b>	<b>85%</b>
3.0	<b>Cable laying including earthing wires</b>	
3.1	Laying of cables	45%
3.2	Glanding, Termination and tagging of cables	15%
3.3	Dressing and clamping of cables	10%
3.4	Testing and charging of cables	15%
	<b>Total =</b>	<b>85%</b>

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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4.0	<b>Junction box/Push button station (local)</b>	
4.1	Erection including fixing of terminal blocks where ever applicable	75%
4.2	Name plate fixing where ever applicable and labelling (inside and outside)	10%
4.3	Total =	85%
5.0	<b>Earthing/Lightning protection strips, Earthing pits</b>	
5.1	Fabrication, erection, alignment, welding/bolting of earthing/lightning protection strips; earth pits completion	60%
5.2	Testing/commissioning	25%
5.3	Total =	85%
6.0	<b>Instrumentation Panels / Cubicles / Desks / Racks / Enclosures / Monitors / Computers / Computer peripherals/PLCs/UPS/Batteries</b>	
6.1	Erection and alignment	50%
6.2	Fixing of loose items/instruments where ever applicable	5%
6.3	Pre commissioning checks, Charging of panel and Loop testing etc	15%
6.4	System commissioning	15%
6.5	Total =	85%
7.0	<b>Conduits/impulse pipe/tubes</b>	
7.1	Fabrication, Laying and Erection	50%
7.2	Leak Test/Hydraulic Test (where ever applicable, otherwise clubbed with next activity)	20%
7.3	Dressing, clamping, tagging and painting where ever applicable	8%
7.4	Testing & commissioning of associated equipment/system	7%
7.5	Total =	85%
8.0	<b>Miscellaneous Structural steel including frames for LIR/LIE Panels/Racks/Instruments, supports for cable tray/pipes/tubes, Canopies etc</b>	
8.1	Fabrication, Erection, Alignment , Welding/bolting and where ever applicable chipping/grouting/painting	65%
8.2	Erection of associated Items/Equipments/Systems as applicable	20%
8.3	Total =	85%

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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9.0	Instruments/Devices including Sensors/ Cells/ Probes etc	
9.1	Calibration/Testing/Pre erection checks	30%
9.2	Erection/Placement and fixing of loose items/accessories	30%
9.3	Pre commissioning checks/loop testing/Simulation testing as required	10%
9.4	Remote/local commissioning as required	15%
9.5	Total =	85%
10.0	Commissioning and Testing activities for Equipments erected by other agencies, like control valves, on/off valves, electrical/ pneumatic valves, actuators, solenoid valves, valves, limit switches, ERV controllers, power cylinders, Pressure & Temperature Guages / Transmitters etc	
10.1	Removal & refixing/ fixing loose supplied components, including tubing/hose, regulators, etc	30%
10.2	Calibration / Local testing - commissioning readiness	30%
10.3	Local Commissioning & Loop Testing as required	10%
10.4	System Commissioning or Remote Commissioning as required	15%
10.5	Total =	85%
11.0	Power Cylinders	
11.1	Erection and Alignment of power Cylinders	30%
11.2	Fixing of loose items and Commissioning readiness	30%
11.3	Loop checking, Calibration and Local Commissioning	20%
11.4	System/Remote Commissioning as required	5%
11.5	Total=	85%
12.0	Miscellaneous items (items not covered under above heads)	
12.1	Erection	50%
12.2	Alignment	10%
12.3	Testing	15%
12.4	Completion	10%
12.5	Total =	85%

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- b. 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.

STAGE / MILESTONE PAYMENTS (15%)	
Barring Gear	1%
Turbine Solo run completion	2%
Turbine Coupled run with Blower	1%
Readiness of Turbo Blower for Surge test	2%
Trial Operation of unit	3%
Painting	1%
Area cleaning, temporary structures, cutting/ removal and return of scrap	1%
Punch List points / pending points liquidation	1%
Submission of 'As Built Drawings'	1%
Material Reconciliation	1%
Completion of Contractual Obligation	1%
<b>Total for Stage / Milestone Payments (15%)</b>	<b>15%</b>

NO CLAIM WHAT SO EVER MAY BE, WILL BE ENTERTAINED UNDER THIS CONTRACT, AFTER DULY SIGNING THE FINAL BILL ALONG WITH MEASUREMENT BOOKS AND ACCEPTED BY BHEL.

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

#### 1.8.0 TAXES

#### 1.8.1 Value Added Tax (VAT) for the works

- 1.8.1.1 Price quoted shall be inclusive of VAT (works contract) under the Local VAT Laws of the respective States.
- 1.8.1.2 Notwithstanding the fact that this is only a service contract, being labour oriented job work, for the purpose of VAT the contractor has to maintain the complete data relating to the expenditure incurred towards wages etc. in respect of the staff/workers employed for this work as also details of purchases, if any of materials like consumables, spares etc., inter alia indicating the name of the supplier, address and VAT Registration No. and VAT paid for the purchases, etc
- 1.8.1.3 The bidder shall get registered with State VAT authorities and the registration certificate shall be forwarded to BHEL immediately after commencement of work. In case the bidder had already registered under respective State VAT, they must quote their registration Number and forward copy of Registration Certificate while submitting this tender.
- 1.8.1.4 Deduction of VAT (WCT) at source would be enforced from the running bills at the rates prescribed unless exemption certificate is produced from the concerned authorities. Tax invoice if required under the relevant State VAT Law shall be submitted along with other compliances as per VAT Act.
- 1.8.1.5 The monthly/quarterly VAT return, duly incorporating the income from BHEL as turnover, should be submitted to BHEL at regular intervals with all annexure and details of payment of VAT (WCT).
- 1.8.1.6 Copies of the Assessment Orders under the State VAT Acts are also to be submitted to BHEL. If Assessment Orders are not forth-coming, then a Certificate of Tax paid for the project (year wise), from the concerned CTO, is to be submitted.
- 1.8.1.7 You have to obtain VAT Clearance Certificate from the concerned authorities as per the provisions of local VAT act, at the start of the project and on completion of the project and submit along with the final bill.
- 1.8.1.8 E-way bills/ Transit passes, if required for materials/ T&Ps etc., bought into the project site is to be arranged by the Contractor only.
- 1.8.1.9 The bidder shall quote very competitive price after taking into consideration of above points.

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### 1.8.2 Service Tax

- 1.8.2.1 Price quoted shall be exclusive of Service Tax. The service tax as statutorily leviable and payable by the bidder under the provisions of service tax Law / Act shall be paid by BHEL as per bidder claim through various running bills.
- 1.8.2.2 The bidder shall furnish proof of service tax registration with Central Excise Department specifying the name of services covered under this contract. Registration Certificate should also bear the endorsement for the premises from where the billing shall be done by the bidder on BHEL for this project.
- 1.8.2.3 The bidder shall obtain prior consent of BHEL before billing the service tax amount and shall adopt the service tax billing methodology suggested by BHEL in case more than one method of remittance of Service Tax is available.
- 1.8.2.4 Proper cenvatable documents (ie. invoice) are to be submitted to BHEL on time. If in the event of BHEL not being able to avail credit, the service tax claim of the contractor shall not be reimbursed.
- 1.8.2.5 BHEL will reimburse the Service Tax on the first bill raised by the contractor. Subsequently, based on production of proof of previous months' Service Tax challans, the same shall be reimbursed. In case, Service Tax amount adjusted against availment of CENVAT credit, Certificate duly signed by Contractor is required to be submitted on monthly basis. Copies of Half yearly Returns are to be submitted within a week of due date of filing the Return.

### 1.8.3 Other Taxes & Levies

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

### 1.8.4 New Levies / Taxes

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

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### 1.8.5 Statutory variations

- 1.8.5.1 Statutory variations are applicable only in the cases of Value Added Tax and Service Tax, on direct transactions with BHEL. The changes implemented by the Central / State Government in the VAT Act / Service Tax during the tenure of the contract viz. increase / decrease in the rate of taxes, applicability, etc. and its impact on upward revision / downward revision are to be suitably paid/ adjusted from the date of respective variation. The bidder shall give the benefit of downward revision in favour of BHEL. No other variations shall be allowed during the tenure of the contract.
- 1.8.5.2 GST - Any new tax structure (like Goods & Services Tax) as and when implemented by the Government shall become applicable in addition to or in lieu of existing tax structure. Decision of BHEL in this regard shall be final and binding on the Contractor.

### 1.8.6 Direct Tax

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

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## VOLUME-IA PART-I CHAPTER -IX 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.)

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

### 1.9.1.1 BOCW Act & BOCW Welfare Cess Act

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

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

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

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

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

### 1.9.1.2 PROVIDENT FUND & MINIMUM WAGES

1.9.1.2.1 The contractor is required to extent the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of this letter of intent. 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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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or paid to statutory authorities by us, such amount will be recovered from payments due to you.

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

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

### 1.9.1.3 OTHER STATUTORY REQUIREMENTS

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

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

1.9.1.3.3 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 contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.

1.9.1.3.4 The Contractor shall submit copies of Final Settlement statement of disbursement 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.

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

1.9.1.3.6 In case of any dispute prolonged/pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

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### 1.9.2 GENERAL

#### 1.9.2.1 Site Visit by the Bidder

1.9.2.1.1 The bidder shall, prior to submitting his tender for the work, visit and examine the site of works and its surroundings at his own expense, and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.

1.9.2.1.2 The bidder shall satisfy themselves about the following factors:

- i) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.
- ii) Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc.
- iii) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there-from.
- iv) Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.
- v) Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.
- vi) The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.
- vii) The type of equipment and facilities needed, for and in the performance of the work;
- viii) The extent of lead and lift required for the work in complete form over the entire duration of the contract, and
- ix) All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

1.9.2.1.3 The bidder should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.

1.9.2.1.4 A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

1.9.2.1.5 The bidder and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.

- 1.9.2.2 Scope of work covered under this specification requires quality workmanship, engineering and green belt management along with the supply of all consumables, tools and tackles and testing instruments. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments 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.
- 1.9.2.3 It is not the intent to specify herein all details of all 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.
- 1.9.2.4 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.
- 1.9.2.5 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.
- 1.9.2.6 The contractor shall carryout additional tests if any, which the Engineer feels necessary because of site conditions and also to meet system specification.
- 1.9.2.7 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.
- 1.9.2.8 Wherever work sequences are furnished by BHEL, the contractor shall follow the same sequence.
- 1.9.2.9 Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for any reasons whatsoever.
- 1.9.2.10 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.
- 1.9.2.11 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.
- 1.9.2.12 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.

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- 1.9.2.13 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.
- 1.9.2.14 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 work agreed will be subject to the condition that contractor's work is not hampered by the agencies.
- 1.9.2.15 Contractor has to work in close co-ordination with other work agency 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 work 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.
- 1.9.2.16 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.
- 1.9.2.17 Contractor shall remove all scrap materials periodically generated from his working area 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.
- 1.9.2.18 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.
- 1.9.2.19 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.
- 1.9.2.20 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.

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- 1.9.2.21 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9001 – 2008 Standards.
- 1.9.2.22 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.
- 1.9.2.23 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.9.2.24 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.
- 1.9.2.25 It is the responsibility of the contractor to do the alignment, checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer.
- 1.9.2.26 If any item or equipment not covered but requires being executed, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ.
- 1.9.2.27 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.
- 1.9.2.28 **SITE INSPECTION**  
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.  
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.  
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

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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.

### 1.9.2.29 DOCUMENTATION

1.9.2.29.1 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.

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

Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by BHEL representative also.

1.9.2.30 Bidders are requested to furnish the proof of documents for the following at PSSR- HQ, after award of letter of intent.

- i Security Deposit & Additional Security Deposit as per Volume-1A Part-II Chapter-
- ii. Un Qualified Acceptance for LOI & Detailed L.O.I / Work Order.
- iii. Rs 100 /- Stamp Paper for Preparation of Contract agreement

1.9.2.31 Bidders are requested to furnish the proof of documents for the following at PSSR- Site, after award of letter of intent.

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

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### VOLUME-IA PART – I CHAPTER - X 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.)

- 1.10.1 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.
- 1.10.2 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.
- 1.10.3 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding progress of work, labour availability, equipment deployment, testing, etc.
- 1.10.4 Contractor is required to draw mutually agreed monthly work 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.
- 1.10.5 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.
- 1.10.6 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.
- 1.10.7 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.10.8 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

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- 1.10.9 The monthly report shall be submitted at the end of every month as a booklet and shall contain the following details :-
- a) Work progress in terms of percentage of work completion as relevant to the respective work areas against planned.
  - b) Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan
  - c) 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 drilling, testing etc.
  - d) Consumables report giving consumption of all types of gases, electrodes etc during the previous month.
  - e) Safety implementation report in the format
  - f) Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

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### VOLUME-IA PART – I CHAPTER - XI Bill Of Quantity (BOQ)

SI No	Description	Unit	Qty
A	<b>Erection , testing &amp; commissioning of LT Switchgear Package, For scope of work refer clause no : 6.3.2</b>		
A.1	415VST,TB&BOP MCC- 19000 Kg , size: 27000 x1400x2375	No	1
A.2	415VSTValveMCC; 23000 Kg, size:32000X1400X2375	No	1
A.3	415VPDB ; 8500 Kg, size:11000X1200X2375	No	1
A.4	415VMLDB;2400 Kg, size:3200X500X2375	No	1
A.5	415VACELDB; 1200 kg, size : 1600X500X2375	No	1
A.6	220VDCDB :4500kg, size: 5400X600X2375	No	1
A.7	220VDCELDB;1200kg, size: 1600X500X2375	No	1
A.8	230VUPSDB;3000 kg, size:3200X500X2375	No	1
A.9	Insulating Rubber Mats; 3Kg each ,size:10000x1000x2.5	No	15
B	<b>Erection, testing &amp; commissioning of 220V DC battery/Charger, Clause No: 6.3.5</b>		
B.1	Erection, testing & Commissioning of 220V DC System; 2x100% charger & 2x100% Lead-Acid(Plante) battery . Batterywt5300kg/set; size7000 x 7000 x1000 Battery (1 Set) with Charger-wt1800kg; size2400x800x2000- Charger (1 set) along with following accessories a) Isolation Box (Wall mounted) 100kg; 600x800x1000 (1 No.) b) Discharge Resistor Bank 100kgs ; 600x800x1000 (1 No.) c) Cell Booster 75Kgs ; 600x800x1000 (1 No.) d) Auto Fill System 100Kgs; 7000 x 7000 x 1000 (1 No.) e) Battery Health Monitoring System 300Kg, size: 700x600x2200-Charger (1 No.)	Sets	2
B.2	230V UPS System with 2x100% VRLA battery (Inverter& charger panel, Input isolation transformer, SVR) ;2700Kgeach,size:2400x800x2110 with battery banks and isolation box as detailed below. Battery Banks (VRLA);5000Kgs each, size: 4200X460X1500 - 2sets UPS Battery Isolation box; 100 Kg each, size: 650X300X550- 2nos	Set	1
C	<b>Erection of Junction boxes/ Push button stations. For scope of work refer relevant clause in Part-II Chapter-III</b>		
C.1	Local Control Stations; 3Kg each , size:300 x 200 x 400	No	110
C.2	MotorJunctionBox; 100kg,size : 500X300X750( Each)	No	8
C.3	WallMounted DB300kg size: 800X300X1200	No	5
C.4	Junction Box	No	10

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
D	<b>Laying and termination of LT power/Control, Instrumentation cables, For scope of work refer relevant clause in Part-II Chapter-III</b>		
D.1	<b>Laying of LT power cables</b>		
D.1.1	AL XLPE/FRLS PVC CABLE ; AI 1CX630 Sq.mm arm	Mtrs	4950
D.1.2	AL XLPE/FRLS PVC CABLE; AI 3.5Cx120 Sq.mm arm	Mtrs	550
D.1.3	AL XLPE/FRLS PVC CABLE; 4Cx70 Sq.mm A1 arm	Mtrs	1760
D.1.4	AL XLPE/FRLS PVC CABLE; AI 3Cx10 XLPE arm	Mtrs	2750
D.1.5	AL XLPE/FRLS PVC CABLE; AI 3Cx16 Sq.mm arm	Mtrs	3850
D.1.6	AL XLPE/FRLS PVC CABLE; AI 3Cx300 XLPE arm	Mtrs	1100
D.1.7	CU UNAR XLPE/FRLS PVC CABLE; Cu 1Cx150 XLPE UNARM	Mtrs	880
D.1.8	CU UNAR XLPE/FRLS PVC CABLE; Cu 1Cx35 XLPE UNARM	Mtrs	880
D.1.9	AL XLPE/FRLS PVC CABLE; 4Cx16 AI XLPE arm	Mtrs	3300
D.1.10	AL XLPE/FRLS PVC CABLE; 4Cx10 AI XLPE arm	Mtrs	550
D.1.11	AL XLPE/FRLS PVC CABLE; 3Cx50 AI XLPE arm	Mtrs	550
D.1.12	AL XLPE/FRLS PVC CABLE; 3Cx150 AI XLPE arm	Mtrs	1100
D.1.13	AL XLPE/FRLS PVC CABLE; 4Cx25 AI XLPE arm	Mtrs	1650
D.1.14	AL XLPE/FRLS PVC CABLE; 4Cx50 AI XLPE arm	Mtrs	4400
D.1.15	CU XLPE/FRLS PVC FLEX CABLE: Cu 1Cx25 XLPE UNARM	Mtrs	165
D.1.16	CU XLPE/FRLS PVC FLEX CABLE: Cu 1Cx95 XLPE UNARM	Mtrs	275
D.1.17	CU XLPE/FRLS PVC FLEX CABLE:Cu 1Cx120 XLPE UNARM	Mtrs	275
D.2	<b>Termination of LT power cables</b>		
D.2.1	AL XLPE/FRLS PVC CABLE ; AI 1CX630 Sq.mm arm	No	50
D.2.2	AL XLPE/FRLS PVC CABLE; AI 3.5Cx120 Sq.mm arm	No	6
D.2.3	AL XLPE/FRLS PVC CABLE; 4Cx70 Sq.mm AI arm	No	20
D.2.4	AL XLPE/FRLS PVC CABLE; AI 3Cx10 XLPE arm	No	28
D.2.5	AL XLPE/FRLS PVC CABLE; AI 3Cx16 Sq.mm arm	No	39
D.2.6	AL XLPE/FRLS PVC CABLE; AI 3Cx300 XLPE arm	No	12
D.2.7	CU UNAR XLPE/FRLS PVC CABLE; Cu 1Cx150 XLPE UNARM	No	12
D.2.8	CU UNAR XLPE/FRLS PVC CABLE; Cu 1Cx35 XLPE UNARM	No	12
D.2.9	AL XLPE/FRLS PVC CABLE; 4Cx16 AI XLPE arm	No	34
D.2.10	AL XLPE/FRLS PVC CABLE; 4Cx10 AI XLPE arm	No	6
D.2.11	AL XLPE/FRLS PVC CABLE; 3Cx50 AI XLPE arm	No	6
D.2.12	AL XLPE/FRLS PVC CABLE; 3Cx150 AI XLPE arm	No	12
D.2.13	AL XLPE/FRLS PVC CABLE; 4Cx25 AI XLPE arm	No	17
D.2.14	AL XLPE/FRLS PVC CABLE; 4Cx50 AI XLPE arm	No	44
D.2.15	CU XLPE/FRLS PVC FLEX CABLE; Cu 1Cx25 XLPE UNARM	No	6
D.2.16	CU XLPE/FRLS PVC FLEX CABLE; Cu 1Cx95 XLPE UNARM	No	6
D.2.17	CU XLPE/FRLS PVC FLEX CABLE; Cu 1Cx120 XLPE UNARM	No	6
D.3	<b>Laying &amp; termination of LT Power &amp; Control cables</b>		
D.3.1	AL XLPE/FRLS PVC CABLE ; AI 3Cx6 Sq.mm arm	Mtrs	17600

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
D.3.2	CU PVC/FRLS PVC CABLE; 3Cx2.5 Sq.mm Cu	Mtrs	23650
D.3.3	CU PVC/FRLS PVC CABLE; 5Cx2.5 Sq.mm Cu	Mtrs	2750
D.3.4	CU PVC/FRLS PVC CABLE; 7Cx2.5 Sq.mm Cu	Mtrs	4950
D.3.5	CU PVC/FRLS PVC CABLE; 10Cx2.5 Sq.mm Cu	Mtrs	10450
D.3.6	CU PVC/FRLS PVC CABLE; 14Cx2.5 Sq.mm Cu	Mtrs	2750
D.3.7	CU PVC/FRLS PVC CABLE; 19Cx2.5 Sq.mm Cu	Mtrs	17600
D.3.8	MUTI STRAND CU PVC/FRLS PVC CABLE; 4Cx0.5 Sq.mm Cu	Mtrs	6000
D.3.9	MUTI STRAND CU PVC/FRLS PVC CABLE; 30PAIRx0.5 Sq.mm	Mtrs	2000
D.3.10	CU XLPE/FRLS PVC CABLE ; 3Cx4 Sq.mm Cu arm	Mtrs	6050
D.3.11	CU UNAR XLPE/FRLS PVC CABLE; Cu 1Cx6 XLPE UNARM	Mtrs	550
D.3.12	AL XLPE/FRLS PVC CABLE; 4Cx6 Al XLPE arm	Mtrs	1100
D.4	<b>Laying &amp; termination of instrumentation cables</b>		
D.4.1	2PairX0.5 Sqmm, 7/0.3, PVC insulated armoured cable	Mtrs	6500
D.4.2	4PairX0.5 Sqmm, 7/0.3, PVC insulated armoured cable	Mtrs	3000
D.4.3	8PairX0.5 Sqmm, 7/0.3, PVC insulated armoured cable	Mtrs	5000
D.4.4	12PairX0.5 Sqmm, 7/0.3, PVC insulated armoured cable	Mtrs	750
D.4.5	2PairX1.5 Sqmm, 7/0.3, PVC insulated armoured cable	Mtrs	5000
D.4.6	4PairX1.5 Sqmm, 7/0.3, PVC insulated armoured cable	Mtrs	5000
D.4.7	Fibre optic cable	Mtrs	3300
D.4.8	Thermocouple extension cable 2 PairX0.5 Sqmm cable	Mtrs	1000
D.4.9	Ethernet cable 2 pairX0.5 Sqmm cable	Mtrs	1500
D.4.10	Master Clock Interface Cable(RG-58 cable)	Mtrs	749
D.4.11	2coreX2.5Sqmm cable	Mtrs	3000
D.4.12	Cable 1 x 2 x 1.3mm <sup>2</sup>	Mtrs	180
D.4.13	Cable 1 x 3 x 1.3mm <sup>2</sup>	Mtrs	30
D.4.14	Cable 2 x 2 x 1.3mm <sup>2</sup>	Mtrs	70
E	<b>Erection of Pre fabricated Cable tray with accessories like tee , bend, cross, elbow &amp; reducers etc , for scope of work refer relevant clause in Part-II Chapter-III</b>		
E.1	600MM STRAIGHT RUN (ANGULAR) CABLE TRAY WITH ACCESSORIES	Mtrs	875
E.2	600MM STRAIGHT RUN (PERFORATED) CABLE TRAY WITH ACCESSORIES	Mtrs	750
E.3	300MM LADDER (ANGULAR) STRAIGHT RUN CABLE TRAY WITH ACCESSORIES	Mtrs	875
E.4	300MM STRAIGHT RUN (PERFORATED) CABLE TRAY WITH ACCESSORIES	Mtrs	1500
E.5	50MM STRAIGHT RUN (PERFORATED) CABLE TRAY WITH ACCESSORIES	Mtrs	875
E.6	50MM STRAIGHT RUN (PERFORATED) CABLE TRAY COVER WITH ACCESSORIES	Mtrs	875

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
F	<b>Erection of Plant earthing &amp; lighting Protection System , For scope of work , please refer relevant clause in Part-II Chapter-III</b>		
F.1	GI STRIP 75x10; For below ground earthing.	Mtrs	900
F.2	GI STRIP 75x10; For above ground earthing.	Mtrs	600
F.3	GI STRIP 50x6; For above ground earthing and other purpose.	Mtrs	2200
F.4	GI STRIP 25x6; For above ground earthing.	Mtrs	200
F.5	16 SWG GI WIRE-STRANDED; For above ground earthing.	Mtrs	1200
F.6	8 SWG GI WIRE-SOLID; For above ground earthing.	Mtrs	3500
F.7	100mm CI Pipe electrode; Treated earth pits for Machine Neutral Earthing& Untreated earth pits for Machine Body Earthing.	Mtrs	25
F.8	Cu Pipe Electrode; Treated Earth pits for Electronic earthing	Mtrs	12
F.9	Vertical Air Termination Rod; For Lightening protection	Mtrs	8
G	<b>Lighting transformers , For scope of work please refer relevant clause in Part-II Chapter-III</b>		
G.1	75KVA415/415,ANDry type lighting transformer; 690 kg , size: 1375X935X1305 ;	No	2
G.2	25KVA415/415,AN Dry type emergency lighting transformer; 400 Kgs; size: 1275X825X985	No	1
H	<b>illumination Package ,For scope of work please refer relevant clause in Part-II Chapter-III</b>		
H.1	Industrial type Bulk head luminaire with die-cast aluminium LM6 body having stove enameled finish, with prismatic front glass, wire guard, tropicalised gasket, BC lamp holder suitable for 100W GLS Lamp and 220V DC supply along with accessories.	No	70
H.2	Industrial type general purpose luminaire with high efficiency electronic ballast, MS sheet steel housing (CRCA) with vitreous enameled/Epoxy powder coated AND external reflector suitable for 2x28W T5 Fluorescent lamp-Surface/suspension mounted through down conduit.	No	120
H.3	Industrial type Corrosion proof luminaire with high efficiency electronic ballast, FRP housing and clear acrylic cover suitable for 2x28W T5 Fluorescent lamps – Surface/suspension mounted through down conduit.	No	6
H.4	Industrial type high performance narrow distribution Non integral High Bay luminaire with die cast aluminium housing & specular anodized aluminium reflector suitable for 400W HPSV tubular lamp. Fixture should be totally enclosed type & complete with suitable CG Box, eye bolt and shall be suitable for roof truss/Purlin/ceiling mounting.	No	25

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
H.5	Industrial type dust proof & vapour proof Non-Integral Well glass luminaire made of die cast aluminium housing with stove enameled, white inside and grey outside reflector, heat resistant clear toughened glass and galvanized wire guard. Fixture shall be suitable for 150W HPSV lamp in complete with control gear box, eyebolt, bracket and pole reducer for suitability of suspension/ceiling/pole mounting.	No	130
H.6	Industrial type Integral Well glass luminaire with cast aluminium alloy mounting piece and sheet steel Al. canopy with stove enamel white inside and grey outside, reflector with heat resistant glass and wire guard suitable for 70W HPSV lamp in complete with Eyebolt and bracket for suitability of suspension/ceiling/pole mounting.	No	50
H.7	Street Light luminaire with single piece die cast aluminium body, electrochemically brightened and anodized/Glaskote finish aluminium reflector, heat resistant clear toughened flat front glass cover & Gasket etc. Fitting shall be fully wired complete with copper wound ballast, power factor improvement capacitor, igniter etc. and shall be suitable for 150W HPSV tubular lamp	No	20
H.8	Industrial weather proof heavy duty type narrow beam Non-Integral Flood Light luminaire made of cast aluminium housing having brightened anodized aluminium reflector with heat resistant toughened front glass cover, neoprene gasket etc. Suitable for 1x250W HPSV lamp. Fitting shall have provision for rotating in both horizontal & vertical plane and supplied with necessary control gear box etc.	No	8
H.9	6 way AC Indoor type Lighting Panel (Safe area)	No	2
H.10	12 way AC Indoor type Lighting Panel (Safe area)	No	4
H.11	18 way AC Indoor type Lighting Panel (Safe area)	No	2
H.12	6 way DC Indoor type Lighting Panel (Safe area)	No	4
H.13	6 way AC Indoor type Lighting Panel (Safe area)	No	1
H.14	12 way AC Indoor type Lighting Panel (Safe area)	No	3
H.15	3000 mm long 25mm GI conduit	No	450
H.16	3000 mm long 25mm PVC Conduit	No	150
H.17	3000 mm long 50 mm GI conduit	No	5
H.18	3000 mm long 50mm PVC conduit	No	5
H.19	3000mm long 20mm GI conduit	No	400
H.20	FSB-3 Flush mounted switchboard with 3 nos 5A piano type switches(modular type)	No	10
H.21	FSB-2 Flush mounted switchboard with 3 Nos 5A piano type switches (modular type)	No	6
H.22	20A DP MCB Box outlet (Indoor type)	No	14

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
H.23	Push button type switch box outlet consist of two no.ON/OFF Push button switch,terminal block and other accessories (indoor type)	No	8
H.24	Industrial metal clad type 5/15A, 240 V receptacle with 15A MCB switch (Indoor Type)	No	20
H.25	Industrial metal clad type 5/15A,240V receptacle with interlocked Rotary switch (Indoor Type)	No	20
H.26	Industrial metal clad type 24 V Socket with 10A MCB switch (Indoor Type) with hand lamp,15m cable and other accessories	No	8
H.27	63A TPN welding receptacles (Safe area)	No	12
H.28	240/24V Transformer module (Indoor type)with all accessories	No	1
H.29	1Cx2.5sq.mm 1.1KV PVC insulated Cu flexible wire	Mtrs	19500
H.30	CU PVC/FRLS PVC CABLE; 3Cx2.5 Sq.mm Cu along with supply of spacers and hardware, laying, termination for lighting purpose	Mtrs	2000
H.31	200X150X80MM 4 Way indoor rectangular 16 swg sheet steel JB with 6 nos. 2 pin TB suitable for 6 sqmm wire. JB shall have minimum IP-55 protection and cable entries suitable for 3CX2.5 Sqmm Cu. Cable along with its DC cable glands.	Nos	120
H.32	200X150X80MM 4 Way outdoor rectangular 16 swg sheet steel JB with 4 nos. 2 pin TB suitable for 6 sqmm wire. JB shall have minimum IP-55 protection and cable entries suitable for 3CX2.5 Sqmm Cu. Cable along with its DC cable glands.	Nos	10
H.33	200X200X100MM 4 Way outdoor rectangular sheet steel JB outdoor type (IP 55) with two 1.5" and two 3/4" cable entries along with DC glands and TB suitable for 4 nos. 50sqmm AL cable & 4 Nos. 4sqmm Cu cable.	Nos	25
H.34	88 mm dia GI 4 way Round JB with 3nos. TB suitable for 6 sq.mm wire & Flat cover. JB should have cable entries suitable for fitting with 25mm GI conduit.	Nos	150
I	<b>Fabrication &amp; erection of Structural Steel , For scope of work please refer relevant clause in Part-II Chapter-III</b>		
I.1	ISMC 100X50X6mm Channels(9.2 Kg/meter)	kgs	18000
I.2	ISA 65X65X6mm Runner angles(5.4 Kg/meter)	kgs	8000
I.3	ISA 50X50X6 mm Runner angles(4.5 Kg/meter)	kgs	7000
J	<b>Fire Proof Sealing system Package, For scope of work please refer relevant clause in Part-II Chapter-III</b>		
J.1	Fire proof sealing materials for cable opening sealing	Sq.Mt	150
J.2	Fire Break Coatings for HT/LT Power Cables	Sq.Mt	400
K	<b>Erection, commissioning of DCS system, For scope of work please refer relevant clause in Part-II Chapter-III</b>		
K.1	EHTC & TP Panel(CJJ21-24),Siute of four cubicle, Dimensions: 3500(L)X1000(B)X2500(H) WT-1600 KGS	No	1

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
K.2	ATRS Panel(CCA01-03) Siute of threecubicle, Dimensions: 2500(L)X1000(B)X2500(H) Total WT-1200 KGS	No	1
K.3	Relay panel(CCA04) Siute of one cubicle, Dimensions: 1000(L)X1000(B)X2500(H) Total WT-400 KGS	No	1
K.4	AC Power Distr. Panel(CCA08) Siute of threecubicle, Dimensions: 1000(L)X1000(B)X2500(H) Total WT-400 KGS	No	1
K.5	BOP Panel(CRE01-03) Siute of three cubicle, Dimensions: 2500(L)X1000(B)X2500(H) , Total WT-1200 KGS	No	1
K.6	Network Panel(NWPC01) Dimensions: 1000(L)X1000(B)X2500(H) WT- 400 KGS	No	1
K.7	Network Enclosure Dimensions: 1000(L)X1000(B)X2500(H) WT- 400 KGS	No	2
K.8	Hardwired Backup Control Panel size; 1050 LX 925 B X 1571 H , Weight-300 kgs	No	1
K.9	Anti-Surge control/Turbolog panel 1600(W)X2000(H)X800(D)	No	1
K.10	<b>HMI Accessories</b>		
K.11	Engineer Work Station ( Intel xeon processor, Min 3 Ghz; 4GB RAM; 500GB hard drive; DVD-ROM Drive; DVD Writer; Graphics I/F; 10/100/1000 Base T Ethernt I/F (2 Nos); ASCII keyboard & Optical Mouse; 4 Nos USB port; min 2 GB USB pen drive; Windows 7 operating system (Lincensed)	No	1
K.12	Max Storion ( Intel xeon processor, Min 3 Ghz; 4GB RAM; 500GB hard drive; DVD-ROM Drive; DVD Writer; Graphics I/F; 10/100/1000 Base T Ethernt I/F (2 Nos); ASCII keyboard & Optical Mouse; 4 Nos USB port; min 2 GB USB pen drive; Windows 7 operating system (Lincensed)	No	1
K.13	Max Operator Station ( Intel xeon processor, Min 3 Ghz; 4GB RAM; 500GB hard drive; DVD-ROM Drive; DVD Writer; Graphics I/F; 10/100/1000 Base T Ethernt I/F (2 Nos); ASCII keyboard & Optical Mouse; 4 Nos USB port; min 2 GB USB pen drive; Windows 7 operating system (Lincensed)	No	4
K.14	Max LVS Operator Station ( Intel xeon processor, Min 3 Ghz; 4GB RAM; 500GB hard drive; DVD-ROM Drive; DVD Writer; Graphics I/F; 10/100/1000 Base T Ethernt I/F (2 Nos); ASCII keyboard & Optical Mouse; 4 Nos USB port; min 2 GB USB pen drive; Windows 7 operating system (Lincensed)	No	1
K.15	Max Link Station ( Intel xeon processor, Min 3 Ghz; 4GB RAM; 500GB hard drive; DVD-ROM Drive; DVD Writer; Graphics I/F; 10/100/1000 Base T Ethernt I/F (2 Nos); ASCII keyboard & Optical Mouse; 4 Nos USB port; min 2 GB USB pen drive; Windows 7 operating system (Lincensed)	No	1
K.16	A4 B/W Laser Printer	No	1
K.17	A4 Color Laser Printer	No	1
K.18	A3 Scanner	No	1
K.19	Dot Matrix Printer	No	1

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
K.20	TSI Configuration computer Work station	No	1
K.21	70" Large Video screen - includes stand fabrication, controller, associated cabling, vendor support for E&C	No	1
K.22	Modular Operator Desk - size suitable for 5 sets of work station.	Set	1
<b>L</b>	<b>Erection/Commissioning of local/Field Instruments. For scope of work please refer relevant clause in Part-II Chapter-III</b>		
L.1	Pressure gauges.	No	47
L.2	Differential Pressure gauges.	No	2
L.3	Electronic pressure transmitters/ Temperature transmitters	No	61
L.4	Pressure switches	No	8
L.5	Electronic diff. Pressure transmitters	No	13
L.6	Temperature Gauges (Bimetallic)	No	10
L.7	Temperature Gauges (GAS FILLED)	No	5
L.8	Thermo couples	No	15
L.9	Thermo wells	No	31
L.10	Level gauges	No	3
L.11	Level transmitters	No	2
L.12	Speed measuring loop	No	6
L.13	RTDs	No	12
L.14	Control valves	No	13
L.15	Vibration Probes	No	10
L.16	Axial Displacement Probe	No	5
L.17	LVDT Casing Expansion Probe	No	1
L.18	Differential Expansion Probe	No	2
L.19	Proximitors	No	15
L.20	Proximitor housing	No	8
L.21	Solenoid valves	No	11
L.22	Velocity Probes(Velomitor)	No	4
L.23	Vibration, Axial displacement monitoring system. (Mounted on EDN panel)	No	1
L.24	Portable Vibration Analyzer	No	1
L.25	1 GB Small form factor pluggable transceiver	No	1
L.26	HART Management System Dimensions: 1000(L)X1000(B)X2500(H) WT- 400 KGS, HART Management system consisting of 1 No. HMS Panel, PC, printer and other accessories like RS485/RS232 Convertor, monitor, keyboard, mouse, interconnecting cables for above, etc. The scope of work covers installation, integration of system and commissioning	Set	1

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI No	Description	Unit	Qty
L.27	SWAS Analyser for TurboBlower, consisting of:Wet Panel : 1 No., Dry Panel: 1 No., Sensors/ Analysers and other accessories,The scope of work covers installation, integration of system and commissioning	Set	1
M	<b>Process Impulse Pipes/tube fittings, For scope of work please refer relevant clause in Part-II Chapter-III</b>		
M.1	PIPE 21.3 x 3.73 SA335 GRP22	Mtrs	500
M.2	PIPE 21.3 x 3.73 CS SA106 GR B	Mtrs	265
M.3	TUBE SS 12.7 X 2.1	Mtrs	250
M.4	TUBE SS 12.7 x 1.24mm	Mtrs	54
M.5	CHANNEL 75 X 40mm	Mtrs	50
M.6	ANGLE 50 X 50 X 6mm	Mtrs	50
M.7	FLAT 40X8mm	Mtrs	25
M.8	FLAT 50X6mm	Mtrs	50
N	<b>Erection /testing of local instrument enclosures/racks/Guage boards(LIE/LIR/LGB), For scope of work please refer relevant clause in Part-II Chapter-III</b>		
N.1	INSTRUMENT RACK(1600X1800)	Nos	2
N.2	Local gauge board	No	3
O	<b>Checking and commissioning of following erceted by other agency, For scope of work please refer relevant clause in Part-II Chapter-III</b>		
O.1	LT motors	Nos	16
O.2	Electrical actuators	Nos	60
O.3	Solenoid valves	Nos	113
O.4	Pnuematic Control valves	Nos	20
P	<b>PA System - material receipt from stores to work spot, erection/ commission supervision, coordination with vendor and misc fabrication work. (E&amp;C by PA system vendor)</b>		
P.1	Civil work, earth excavation for preparing cable trenches, Road crossings and refilling of soil, etc. inside the package battery limit.	Mtrs	20
Q	<b>MISCELLANEOUS ITEMS REQUIRED FOR THE SUBSTATION SUPPLY, ERECTION, TESTING, COMMISSIONING</b>		
Q.1	GI conduits of 100 mm diameter. Shall be medium duty, Class "B" Type Galvanizing thickness shall by minimum 75 microns	Mtrs	80
Q.2	GI Conduits of 150mm diameter Shall be medium duty, Class "B" Type.Galvanizing thickness shall be minimum 75 microns	Mtrs	80
Q.3	PVC Conduits of 200 mm diameter	Mtrs	30

**VOLUME-IA PART – I CHAPTER - XII**  
**Foundation & Grouting**

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.)

- 1.12.1 Foundation for the equipments/panels/JBs/PBs 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.
- 1.12.2 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.
- 1.12.3 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 25 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.
- 1.12.4 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
- 1.12.5 Foundation pockets are to be cleaned thoroughly before placing the columns/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.
- 1.12.6 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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.

- 1.12.7 The certificates of the grout is 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.
- 1.12.8 All the materials required for grouting including special cements like Conbextra GPI,GP2, ACC- Shrinkkomb-N20, Sika Anckor, NSG/ NSG -1, CICO Excem GP, or its equivalent as approved by BHEL and other materials like Portland cement, sand and supply of nuts, bolts, anchor fasteners etc., are to 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.
- 1.12.9 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.
- 1.12.10 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.
- 1.12.11 PROCEDURE FOR GROUTING:
- Contractor has to carry out the grouting as per the work instructions for grouting available at site or the grouting is to be carried out as per the supplier's recommendation/ IS standard. Copy of those recommendations is to be submitted to BHEL for records.

**VOLUME-IA PART – I CHAPTER - XIII**  
**Material Handling, Transportation and Site Storage**

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.)

**1.13.1 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS**

1.13.1.1 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.

1.13.1.2 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.

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

1.13.1.4 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.

1.13.1.5 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.

1.13.1.6 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.

**1.13.2 STORAGE**

1.13.2.1 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.

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- 1.13.2.2 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.
- 1.13.2.3 The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damp, sinking into ground and to circulate air under the stored equipment. This will also help in lifting the packing with fork lift truck.
- 1.13.2.4 Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when discoloration takes place or regenerated. BHEL shall supply the material and contractor shall replace.
- 1.13.2.5 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.
- 1.13.2.6 The storage room and the equipment should be checked at regular interval of 3 months to ensure protection from termites, mould growth, condensation of water etc. which can damage the equipment. Contractor shall keep BHEL informed about such problem and try to rectify the problem at his risk and cost.
- 1.13.2.7 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.
- 1.13.2.8 Packing material shall be retained if the cubicle to be repacked after inspection.
- 1.13.2.9 **Sub- Assemblies**
  - 1.13.2.9.1 All sub-assemblies should be kept in a separate place where it is easily accessible.
  - 1.13.2.9.2 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.
- 1.13.2.10 **Loose Items (wherever applicable)**
  - 1.13.2.10.1 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.
- 1.13.2.11 Contractor has to arrange required fire retardant covering material (tarpaulins) to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

VOLUME-IA PART – I CHAPTER – XIV

Painting

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

1.14.0 FINAL PAINTING

- 1.14.1 The scope of work shall also include supply and application of final painting of all the erected equipments as required and specified for the components as per the painting specifications of customer / BHEL.
- 1.14.2 The scope of painting generally includes for all the steel works such as supports, racks, frames, canopy, impulse pipes, Transformer, Bus ducts, as detailed in Scope of work of respective equipment besides touch up paints wherever required.
- 1.14.3 The scope also includes supply of paints, primers, tools/consumables like brushes, rollers, emery papers, thinner etc.,
- 1.14.4 Touch up painting only is generally required for trays, control panels, junction boxes and full painting shall be required only for specific equipments as per the scope of erection.
- 1.14.5 For any bare copper material requirement, painting as desired by the site shall be carried out by the contractor at free of cost.
- 1.14.6 All the exposed metal parts of the equipments including bus ducts, 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 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.
- 1.14.7 Paint shall be applied by brushing or by spray painting as per the instruction of BHEL Engineer. Spray painting gun and compressed air arrangement has to be made by the contractor himself. It shall be ensured that brush marks are minimum.
- 1.14.8 If needed and insisted either by BHEL / Customer, spray painting has to be carried out within the Quoted rates.
- 1.14.9 Before applying the subsequent coats the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.14.10 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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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manufacturer. No thinners shall be permitted. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,

- 1.14.11 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.
- 1.14.12 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.
- 1.14.13 Finish coat paint, No. of coat and DFT shall be as indicated in the painting specification will be issued during execution / relevant BHEL document/ customer's specifications.
- 1.14.14 The actual colour to be applied shall be approved by the customer before starting of actual painting work.
- 1.14.15 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.
- 1.14.16 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.
- 1.14.17 If needed and insisted either by BHEL/ Customer in certain cases, spray painting has to be carried out within the quoted rates.
- 1.14.18 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
- 1.14.19 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL/ Customer.
  
- 1.14.20 **PRESERVATION / TOUCH UP PAINTING**
  - 1.14.20.1 Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipment's under this tender specification right from pre- assembly stage to till the equipment is cleared for final painting.
  - 1.14.20.2 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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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oxide primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.

- 1.14.20.3 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.
- 1.14.20.4 Touch up painting only is generally required for control panels, and full painting shall be required only for specific equipment such as Busducts, Transformer etc. as per the scope of erection.
- 1.14.20.5 All damaged painted surfaces shall be cleaned and coated with two (2) coats of primer followed by a finishing coat of approved colour.
- 1.14.20.6 All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.

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### VOLUME-IA PART – II CHAPTER –I CORRECTIONS / REVISIONS IN GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

SI No: 1

The following clauses published in General Conditions of Contract (Volume I Book-II) are not applicable to this contract.

2.3 Price Variation Compensation

1.12 Over Run Compensation

This is a firm price contract. PVC and ORC are not applicable.

SI No:2

Earnest Money Deposit clause 1.9 in GCC is revised as under subsequent to release of Works Policy 2016 effective from 14/9/2016:

2.1 Every tenderer must furnish the prescribed Earnest Money Deposit (EMD) in the manner described herein.

2.2 Modes of deposit of EMD

- i) Cash deposit as permissible under Income Tax Act (before tender opening),
- ii) Electronic Fund Transfer credited in BHEL account (before tender opening),
- iii) Banker's cheque or Pay order or Demand Draft in favour of 'Bharat Heavy Electricals Limited' (along with offer) and payable at Regional HQ issuing the tender.
- iv) In case total EMD amount is more than Rs.20 Lakh, the amount in excess of Rs. 20 Lakh may be accepted in the form of Bank Guarantee from Scheduled bank. The Bank Guarantee in such cases shall be valid for atleast six months from the latest due date of tender submission.
- v) No other form of EMD remittance shall be acceptable to BHEL.

2.3 EMD shall not carry any interest.

- 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.

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 2.5 EMD given by all unsuccessful tenderers will be refunded normally within 15 days of award of work.
- 2.6 EMD of successful tenderer will be retained as part of Security Deposit.
- 2.7 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.
- 2.8 Bank details for Electronic fund transfer is as follows.  
BHEL-PSSR-Chennai,  
Bank Account No:10610819499,  
IFSC code :SBIN0000912,  
State Bank of India,  
690, EVR Periyar Building, Nandanam, Anna Salai, Chennai-600035,  
Email:sbi00912@sbi.co.in

### SI No:3

#### Security Deposit clause 1.10 in GCC is revised as under:

- 3.1 Upon acceptance of Tender, the successful Tenderer should deposit the required amount of Security Deposit for satisfactory completion of work, as given below:
- 3.2 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.
- 3.3 The security Deposit should be furnished before start of the work by the contractor.
- 3.4 Modes of deposit: 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
  - i. Cash (as permissible under the extant Income Tax Act)
  - ii. Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL
  - iii. 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.
  - iv. 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.
  - v. Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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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)

- 3.5 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.
- 3.6 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.
- 3.7 The Security Deposit shall not carry any interest.
- 3.8 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.
- 3.9 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
- 3.10 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.

### SI No:4

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

- 4.1 Clause 2.13.1 is revised as "Normally no advance payment shall be payable to the contractor. Mobilisation 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".

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 4.2 Clause 2.13.6 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”.
- 4.3 Clause 2.13.7 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.”

### SI No:7 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 as chapter-7 in part II of Technical Conditions of Contract (Volume-I Book-I).

Chapter IX Clause 9.1.1 to 9.1.25 stands deleted.

Chapter IX Clause 9.2 to 9.62 stands deleted.

### SI No: 08

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

#### REVERSE AUCTION

##### RA 1 REVERSE AUCTION

- RA 1.1 BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA (Refer Annexure 7 to Notice Inviting Tender). Non-acceptance to participate in RA may result in non-consideration of their bids in RA.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- RA 1.2 BHEL may opt for Reverse auction depending on situation as per company policy. In case BHEL opts for RA, then the price bids of bidders who fulfil all the following conditions only shall be opened.
- RA 1.2.1 The bidders should have qualified techno-commercially
- RA 1.2.2 The bidders should have submitted their acceptance to participate in the RA vide enclosed format.
- RA 1.3 In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue."
- RA 1.4 The start price intimated by BHEL may be displayed to the bidders during reverse auction bidding process as 'L1 price' or 'start / base price'. In cases where the start price mentioned by BHEL is not displayed as L1 price and no bidder accepts that price, RA is to be treated as failed and sealed envelope price bids of all the techno-commercially qualified bidders shall be opened and the tender processed accordingly. Wherever the techno-commercially acceptable bidder(s) had agreed to participate in the RA and had failed to submit the online sealed bid, the envelope sealed bids of such bidder(s) shall not be entertained.
- In such cases, no cognizance of online sealed bids shall be taken. In case the L1 bidder of "sealed envelope price bid" has quoted a lesser price in the "on-line sealed bid", cognizance of the same shall be taken for price negotiations.
- RA 1.5 In case BHEL decides not to conduct RA, the envelope sealed price bids of all techno commercially qualified bidders, along with price impact, if any, shall be opened and processed as per company Policy.
- RA 2 TERMS & CONDITIONS OF REVERSE AUCTION**
- Against this enquiry for the subject item / system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).
- RA 2.1 For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

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- RA 2.2 Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder for any of the eligible items for which techno-commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.
- RA 2.3 BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.
- RA 2.4 In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.
- RA 2.5 Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.
- RA 2.6 Bidders have to fax the Compliance form (annexure- RA IV) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.
- RA 2.7 In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.
- RA 2.8 Reverse auction will be conducted on scheduled date & time.
- RA 2.9 At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.
- RA 2.10 The lowest bidder has to fax / e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure- RA VII) as provided on case-to-case basis to Service provider within twentyfour hours of Auction without fail.
- RA 2.11 In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL's standard practice.
- RA 2.12 Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the 'Business Rules of Reverse Auction', which will be communicated before the Reverse Auction.

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- RA 2.13 If the Bidder or any of his representatives are found to be involved in Price manipulation / cartel formation of any kind, directly or indirectly by communicating with other bidders, action as per extant BHEL guidelines, shall be initiated by BHEL and the results of the RA scrapped / aborted.
- RA 2.14 The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.
- RA 2.15 In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) shall not be allowed to participate in further RA process.
- RA 2.16 If any BOQ amendments issued to this NIT by BHEL should be incorporated by the bidders in the on line opening sealed price bid.
- RA 2.17 BHEL reserves the right to cancel Reverse Auction (RA) without assigning any reasons and resort to considering the sealed bids submitted by vendor for processing and finalizing the tender.
- RA 2.18 Any variation between the on-line bid value and signed document (annexure-RA VII) will be considered as sabotaging the tender process and will invite disqualification of vender to conduct business with BHEL as per prevailing procedure.
- RA 2.19 Only those vendors, who participate in the Online Initial Sealed Bid, will be eligible to participate in the subsequent Online English Reverse Auction.
- RA 3 **BUSINESS RULES FOR REVERSE AUCTION - TENTATIVE**  
(The business rules given here are only for information and the authorized rules shall be intimated before reverse auction by service provider)
- RA 3.1 This has reference to tender no {tender number....date...}. BHEL shall finalise the Rates for the supply of {item name} through Reverse Auction mode. BHEL has made arrangement with M/s. {Service provider}, who shall be BHEL's authorized service provider for the same. Bidders should please go through the guidelines given below and submit acceptance of the same.
- The technical & commercial terms are as per  
(a) BHEL Tender Enq. No. {...} dated {...},  
(b) Bidders "technical & commercial bid (in case of two part bid) and  
(c) Subsequent correspondences between BHEL and the bidders, if any.
- RA 3.2 **Schedule for reverse auction:**  
The Reverse Auction is tentatively scheduled on {date}:  
- Online Sealed Bid:-  
    □ {Start Time:  
    □ Close Time: }  
- Online Reverse Auction:-

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□ {Start Time:  
□ Close Time:}

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

The above process will continue till completion of Reverse Auction.

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

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

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

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

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

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

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

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

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- RA 3.9 Procedure of Reverse Auctioning
- RA 3.9.1 Online Sealed Bid: This duration of online sealed bid will be {...} minutes. All bidders to submit their online sealed bids during this period.
- RA 3.9.2 Online Reverse Auction: The “opening price” i.e. start price for RA and “bid decrement” will be decided by BHEL.
- RA 3.9.3 If BHEL decides the lowest online sealed bid as the starting price, then the lowest bidder in online sealed bid shall be shown as current L1 automatically by the system and no acceptance of that price is required. System shall have the provision to indicate this bid as current L1.
- RA 3.9.4 Bidders by offering a minimum bid decrement or the multiples thereof can displace a standing lowest bid and become “L1” and this continues as an iterative process.
- RA 3.9.5 After the completion of the online reverse auction, the Closing Price (CP) shall be available for further processing.
- RA 3.9.6 If no bid is received in the auction system / website within the specified time duration of the online RA, then BHEL will scrap the online reverse auction process and proceed with the conventional mode of tendering (opening of the envelope sealed bids earlier submitted by the bidders).
- In cases where no bidder accepts the start price, the RA may be treated as failed and sealed envelope price bids of all the techno-commercially qualified bidders shall be opened and the tender processed accordingly. Wherever the techno-commercially acceptable bidder(s) had agreed to participate in the RA and had failed to submit the online sealed bid, the envelope sealed bids of such bidder(s) shall not be entertained.
- Wherever, the evaluation is done for individual items of the package, and no bid is received for some of the item(s), RA will be considered as failed for these item(s), re-reverse auction/ retendering will be conducted for these items.
- RA 3.9.7 Only those bidders who have submitted the “online sealed bid” within the scheduled time shall be eligible to participate further in RA process. However, the H1 bidder (whose quote is highest in online sealed bid) shall not be allowed to participate in further RA process.
- RA 3.9.8 Any commercial / technical loading shall be intimated to bidders prior to RA. The excel sheet provided in this regard shall cover all these aspects. Commercial / technical loading if any, shall be added by the respective bidder in its price during online sealed bid & Online Reverse Auction. Modalities of loading & de-loading shall be separately intimated to the bidders.
- RA 3.9.9 Computerized reverse auction shall be conducted by BHEL (through M/s {Service Provider}), on pre-specified date, while the bidders shall be quoting from their own

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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offices / place of their choice. Internet connectivity shall have to be ensured by bidders themselves.

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

Despite this extension if bidder fails to upload his prices due to extreme case of failure of Internet connectivity, (due to any reason whatsoever may be) it is the bidders' responsibility / decision to send fax communication immediately to M/s. {*Service provider*}, furnishing the price the bidder wants to bid online with a request to the service provider to upload the faxed price on line so that the service provider will up load that price on line on behalf of the Bidder. It shall be noted clearly that the concerned bidder communicating this price to service provider has to solely ensure that the fax message is received by the service provider in a readable / legible form and also the Bidder should simultaneously check up with service provider about the clear receipt of the price faxed. It shall also be clearly understood that the bidder shall be at liberty to send such fax communications of prices to be up loaded by the service provider only within the closure of Bid time and under no circumstance it shall be allowed beyond the closure of Bid time / reverse auction. It shall also be noted that the service provider should be given a reasonable required time by the bidders, to upload such prices online and if such required time is not available at the disposal of the Service provider at the time of receipt of the fax message from the bidders, the service provider will not be uploading the prices and either BHEL or the service provider are not responsible for this unforeseen circumstances. In order to ward-off such contingent situation bidders are requested to make all the necessary arrangements / alternatives whatever required so that they are able to circumvent such situation and still be able to participate in the reverse auction successfully. Failure of power or loss of connectivity at the premises of bidders during the Reverse auction cannot be the cause for not participating in the reverse auction. On account of this, the time for the auction cannot be extended and neither BHEL nor M/s. {*Service provider*} is responsible for such eventualities.

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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bidder (who has submitted the proxy bid) has an option to start participating in the bidding process.

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

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

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

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

- RA 3.9.12 Bidders are advised to get fully trained and clear all their doubts such as refreshing of Screen, quantity being auctioned, tender value being auctioned etc.
- RA 3.9.13 M/s. {Service provider}, shall arrange to demonstrate/ train the bidder or bidder's nominated person(s), without any cost to bidders. M/s. {Service provider}, shall also explain the bidders, all the rules related to the Reverse Auction / Business Rules Document to be adopted along with bid manual. Bidders are required to give their compliance on it before start of bid process.
- RA 3.9.14 Successful bidder shall be required to submit the final prices, quoted during the Online Reverse Auction in Annexure - RA VII after the completion of auction to M/s. Service provider besides BHEL, duly signed and stamped as token of acceptance without any new condition other than those already agreed to before start of auction.
- RA 3.9.15 Any variation between the final bid value and that in the confirmatory signed price breakup document will be considered as tampering the tender process and will invite action by BHEL as per extant guidelines in vogue.
- RA 3.9.16 Bidders bid will be taken as an offer to execute the work / supplies the item as per enquiry no. {...} dt. {...}. Bids once made by the bidder, cannot be cancelled/ withdrawn and bidder shall be bound to execute the work as mentioned above at bidder's final bid price. Should bidder back out and not execute the contract as per the rates quoted, BHEL shall take action as per extant guidelines in vogue.

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- RA 3.9.17 Bidders shall be assigned a Unique User Name & Password by BHEL or M/s. {Service provider}. Bidders are advised to change the Password and edit the information in the Registration Page after the receipt of initial Password from BHEL / M/s. {Service provider} to ensure confidentiality. All bids made from the Login ID given to the bidders will be deemed to have been made by the bidders / bidders' company.
- RA 3.9.18 Bidders shall be able to view the following on their screen along with the necessary fields during Online Reverse Auction:
- a. Leading (Running Lowest) Bid in the Auction (only total price of package)
  - b. Bid Placed by the bidder
  - c. Start Price
  - d. Decrement value
- RA 3.9.19 After receipt of the system report from the Service Provider after completion of the Online Reverse Auction, BHEL will decide upon the winner. BHEL's decision on award of contract shall be final and binding on all the Bidders.
- RA 3.9.20 BHEL reserves the right to cancel the Reverse Auction process / tender at any time, before ordering, without assigning any reason.
- RA 3.9.21 BHEL shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause. In such cases, the decision of BHEL shall be binding on the bidders.
- RA 3.9.22 Other terms and conditions shall be as per bidder's techno-commercial offers and other correspondences, if any, till date.
- RA 3.9.23 Bidders are required to submit their acceptance to the terms / conditions / modalities before participating in the Reverse Auction in the process compliance Form as per Annexure- RA IV.
- RA 3.9.24 BHEL can decide to extend, reschedule or cancel any Auction with prior intimation to all bidders.
- RA 3.9.25 If there is any clash between this business document and the FAQ available, if any, in the web site of M/s. {Service provider} the terms& conditions given in this business document will supercede the information contained in the FAQs. Any changes made by BHEL / service provider (due to unforeseen contingencies) after the first posting shall be deemed to have been accepted if the bidder continues to access the portal after that time.

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Annexure – RA IV

## Process Compliance Form

(The bidders are required to print this on their company's letterhead and sign, stamp before faxing)

To

- M/s. {Service provider}
- Postal address}

**Sub: Agreement to the Process related Terms and Conditions**

Dear Sir,

This has reference to the Terms & Conditions for the Reverse Auction mentioned in the RFQ document for {Items} against BHEL enquiry / RFQ no.{.....} dt. {.....}

This letter is to confirm that:

- 1) The undersigned is authorized official/ representative of the company to participate in RA and to sign the related documents.
- 2) We have studied the Reverse Auction Terms & Conditions and the Business rules governing the Reverse Auction as mentioned in your letter and confirm our agreement to them.
- 3) We also confirm that we have taken the training on the auction tool and have understood the functionality of the same thoroughly.
- 4) We also confirm that, in case we become L1 bidder, we will email / fax the price confirmation & break up of our quoted price (including that of line items) as per *Annexure – RA VIII* within two working days (of BHEL) after completion of RA event, besides sending the same by registered post/ courier both to M/s. BHEL and M/s. {Service provider.}

We, hereby confirm that we will honour the Bids placed by us during the auction process.

With regards

Signature with company seal

Name –

Company / Organization

Designation within Company / Organization

Address of Company / Organization

- Sign this document and Fax it to M/s {Service provider} at {.....} prior to start of the Event.
- Attach a signed copy of the RFQ document along with the Agreement Form/ Process Compliance form and send to M/s. {Service provider}

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Annexure – RA VII

### RA price confirmation and breakup

To

- M/s. Service provider
- Postal address

CC: M/s BHEL

{Unit-  
-Address-}

Sub: Final price quoted during Reverse Auction and price breakup

Dear Sir,

We confirm that we have quoted.

Rs.{\_\_\_\_\_} for item covered under tender enquiry No. {...} dt.{...}

Total price of the items covered under above cited enquiries is inclusive of {Packing & forwarding, E.D., C.S.T., freight and insurance charges upto {.....} District, {.....} State and Type Test Charges etc., (exclusive of service tax), other as per NIT} as our final landed prices as quoted during the Reverse Auction conducted today {date} which will be valid for a period of {\_\_\_\_\_} days.

The price break-up including that of line items is as given below.

=====

Total - Rs.

=====

Thanking you and looking forward to the valuable order from BHEL.

Yours sincerely,

For \_\_\_\_\_

Name:

Company:

Date:

Seal:

### VOLUME-IA PART – II CHAPTER – II TECHNICAL INSTRUCTIONS

- 2.2.1 The successful bidder on receipt of letter of intent from BHEL shall prepare a detailed work programme including items of work within the overall time period allowed and shall submit the same to the Engineer for approval.
- 2.2.2 The work has to be carried out according to priority as may be fixed up by site Engineer of BHEL at site.
- 2.2.3 The materials and workmanship must be of good quality and accepted standards and specifications.
- 2.2.4 All material for construction required, to be procured by the contractor and should conform to relevant IS specifications.
- 2.2.5 The site Engineer reserves the right to reject any material not found to be in conformance to the specification. All taxes, levies and duties on construction materials will be on contractor's account.
- 2.2.6 After completion of work, the building and areas around them should be cleared of all rubbish, debris etc. and handed over in fit condition for occupation.
- 2.2.7 All quantities under schedule of rates and quantities are approximate and are subject to change.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## VOLUME-IA PART – II CHAPTER – III TECHNICAL SPECIFICATION

### RINL VSP 6.3 MTPA EXPANSION PROJECT TURBO BLOWER (#5) ELECTRICAL / C&I / ILLUMINATION PACKAGES SCOPE OF WORK AND SPECIAL CONDITIONS

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#### 2.3.0 GENERAL

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

Identification of equipments at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard/ stores and calibration, erection, aligning, fastening, supporting, cleaning, checking, testing, commissioning, troubleshooting and carrying out statutory tests as required, trial operation, up to the time of completion of commissioning activities and commercial operation of the unit and handing over to customer or till completion of contract period whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.

- 2.3.0.1 It is not the intent to specify herein all details of material. Any item related to this work not covered, but necessary to complete the system will be deemed to have been included in the scope of the work.
- 2.3.0.2 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
- 2.3.0.3 Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc will decide the sequence of erection/commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection /commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.
- 2.3.0.4 Site testing wherever required shall be carried out for all items/materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.
- 2.3.0.5 The contractor shall co-ordinate and provide assistance for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation. Testing shall also include any additional tests, which the Engineer feels necessary because of site conditions and also to meet system specification.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 2.3.0.6 During the course of erection, testing and commissioning Electrical/ C&I work certain rework / modification / rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and/ or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously and the same shall be deemed to be part of the scope of work.
- 2.3.0.7 The work shall be executed under the usual conditions without affecting power plant construction and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 2.3.0.8 All necessary certificates and licenses required to carry out this work are to be arranged by the contractor expeditiously at his cost.
- 2.3.0.9 The contractor shall take delivery of item, materials, from the storage yard / stores/ sheds of BHEL / customer which is within a radius of 5 km. He shall also make arrangements for, safe custody, watch and ward of equipment after it has been handed over to him till they are fully erected, tested and commissioned till the contract period. The contractor shall note that items/materials shall be transported to erection site / assembly yard etc. by the prescribed route without disturbing and causing damage to other works in the most professional manner. All items, Hardware, etc. shall be stored in appropriate manner as per BHEL's instructions.
- 2.3.0.10 The contractor shall take delivery of items/materials, and consumables from the stores/ storage area / sheds of BHEL / customer after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer.
- 2.3.0.11 After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in packed condition to BHEL stores. In case of any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.
- 2.3.0.12 Contractor shall, transport all materials to site and unload at site / working area, or pre-assembly yard for inspection and checking. All material handling equipment required shall be arranged by the contractor.
- 2.3.0.13 Contractor shall retain all T&P/Testing instrument/Material handling instrument etc at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.
- 2.3.0.14 Contractor shall remove all scrap materials periodically generated from his working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor.

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- 2.3.0.15 If any item or equipment not covered but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ.
- 2.3.0.16 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
- 2.3.0.17 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.
- 2.3.0.18 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances.
- 2.3.0.19 Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc. in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployed by contractor shall match with above scope of works.
- 2.3.0.20 All the surplus, damaged, unused materials, package materials, containers, special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor.
- 2.3.0.21 Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
- 2.3.0.22 The scope of specification covers the installation, testing and commissioning of the instrument, hardware along with accessories as detailed in Bill of Materials.

**Note:**

- 1. Bill of Materials (BOM) contains detailed specification of various instruments and items, system-wise along with relevant clause for scope of works.**
- 2. The Rate Schedule contains the consolidated list of BOM with brief description of items.**
- 3. Before filling the Rate, the bidder shall go through the detailed specification of all items of BOM as well as Scope of Work as specified in relevant Clause of this document.**
- 4. The quantity indicated in the BOM/ Rate Schedule is tentative only and is liable for variation. Payment will be made as per actual quantum of job executed at the unit rate accepted by BHEL.**
- 5. Part-II Chapter-V contains general guidelines for Erection and Commissioning of Electrical / C&I systems.**

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### 2.3.1 SCOPE OF WORK

The Erection, Testing and commissioning of Electrical, C&I, Illumination works covered for the Turbine, Turbo blower, and all its associated auxiliaries.

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

- 2.3.1.01 Erection and commissioning of Transformers
- 2.3.1.02 Erection and commissioning of LT MCC, AC/DC Distribution Boards Starter Panels, Electrical/ Instrumentation control panels etc.
- 2.3.1.03 Erection and commissioning of Battery & Battery Charger/ UPS system.
- 2.3.1.04 Erection and commissioning of all Types of Field Instruments like Temperature, Pressure and Flow instruments (local & remote) and special instruments like EWLI, Vibration Monitoring System, Acoustic Pyrometer System, Steam Leak Detection System,
- 2.3.1.05 Erection and commissioning of all types of Control room mounted instruments like Indicators, Microprocessor based panels, DCS system and its accessories like system panels, PC's, printers, furniture etc.
- 2.3.1.06 Erection and commissioning of all Types of Pneumatic Power Cylinders, Controllers etc.
- 2.3.1.07 Commissioning of all Types of Pneumatic operated Valves / Actuators / Power Cylinders / Controllers and Relief Valves.
- 2.3.1.08 Erection of all types of Hardware like impulse pipes, trays & tray supports, instrument air line, etc.
- 2.3.1.09 Laying & Termination of all types of LT power/ control/ instrumentation cables etc.
- 2.3.1.010 Installation of local Push Button stations, Junction Boxes etc.
- 2.3.1.011 Installation of below ground and above ground earthing grid, equipment earthing of all equipment, cable racks, trays etc. as applicable.
- 2.3.1.012 Installation of Lightning protection as applicable
- 2.3.1.013 Fabrication and installation of steel supports wherever required.
- 2.3.1.014 Installation of Illumination Package for Turbo blower Area
- 2.3.1.015 Supply and installation of cable sealing material for sealing of unused openings in panels/ JB's etc.
- 2.3.1.016 Supply of all consumables required for installation as detailed elsewhere in the contract.
- 2.3.1.017 Supply of paints and painting of items covered in the scope of works.
- 2.3.1.018 Commissioning of LT drives, and electrically operated equipment erected by Mechanical contractor.

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2.3.1.019 Nomenclature of all equipment covered under the scope of contract which include feeders of electrical panels, control panels, batteries, chargers, UPS, Lighting panels, Junction boxes, local control stations, Field instruments, earth pits etc with painting as per instructions of BHEL engineer.

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

Note:

BHEL will provide vendor's technical support for commissioning of various proprietary type special instruments/systems like Analysers, SWAS, Vibration Monitoring System, Master Clock System, Hart Management System, Communication System, Battery/ Battery Charger, UPS, Microprocessor based relays, etc. The contractor shall carry out the works as per instructions of BHEL/ Vendor Engineer.

### **2.3.2 DETAILED SCOPE OF WORK:**

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

#### **2.3.2.01 SCOPE OF WORK OF TRANSFORMER**

- a. Receipt of Transformer and associated loose supplied accessories from stores/ yard, inspection, transporting the above to the respective erection location, erection of Transformer and all the accessories, cabling from transformer accessories to marshalling box, pre-commissioning test, commissioning of equipment and handing over.
- b. Calibration of all Testing equipment (IMTE) before putting into service at site. A copy of calibration certificate to this effect shall be furnished to BHEL-Engineer by the contractor for his verification and approval.
- c. Preparing log sheets, test certificates, protocols etc. as per field quality plan, getting it signed by concerned BHEL/Customer Engineer and submitting to the concerned BHEL Engineer.
- d. The contractor shall carry out all the above as per instructions of BHEL Engineer.
- e. The contractor shall carry out all tests with their own testing equipments and testing team.
- f. The contractor has to ascertain the quantum of work involved and quote lump sum rate for erection, testing and commissioning of each transformer

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### **2.3.2.02 SCOPE OF WORK FOR LT SWITCHGEARS, POWER DISTRIBUTION BOARDS OTHER CONTROL PANELS.**

- a. LT MCCs are simple module type with isolators and fuses. However, some of the MCCs are Double Front draw out type consisting of circuit breakers unit, contactors/starter fuse switch units, MCB etc. These MCCs and ACDBs are mainly supplied to cater the requirement of drives, valves, etc.
- b. The base frames shall normally be supplied along with the boards. These shall be aligned, levelled and grouted in position as per approved drawings. All minor concrete chipping and finishing works are included in the scope of the job. If any grouting bolts are required for the panel, the same shall be supplied at no extra cost.
- c. Wherever the base channels are not available, the same shall be fabricated, erected and painted at site. The material for this shall be supplied by BHEL. For fabrication & erection of base frame, separate rate shall be paid on Tonnage basis.
- d. For the panels to be mounted on the trenches, channel supports have to be provided across the cable trenches over which the base frames of the panels shall be mounted. The contractor shall carry out fabrication and erection of these support structures. Separate rate shall be paid on Tonnage basis for fabrication and erection of support structures.
- e. The contractor shall take the panels to the desired locations either through floor openings or temporary openings. No claims will be entertained for taking the panels to the location owing to change of route or non-availability of openings as per nearest route.
- f. Panels will be delivered in different shipping sections. The contractor shall set each section of equipment on its foundation or supporting structures and assemble the panels as required. Necessary interconnection of bus bar, inter panel wiring, etc. will have to be done by the contractor.
- g. Normally the panels shall be supplied with complete instrument mounting and wiring. However, if necessary, dismantling of the existing components, making minor modifications in the wiring to suit operating conditions, mounting and rewiring of new components shall be carried out without any extra cost. Mounting and wiring of any instruments, meters, relays, push buttons, indicating lamps, contactors etc. if supplied loose for safety in transit, shall also be included in the scope of the job. However, if any major wiring modification is involved inside the panel, the same shall be carried out at extra cost. The decision of BHEL Engineer shall be final in respect of above extra works.
- h. The contractor shall carryout touch up painting for panels wherever required and this includes supply of paints also.
- i. The contractor shall calibrate and commission all switchgear/panel mounted instruments, protection relays, transducers, Recorders, Indicators, energy meters etc with well-experienced Engineers/ Technicians.
- j. MCC/PCC incomer bus shall be connected to main source/PCC of customer. The contractor shall co-ordinate for proper connection at both ends.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

**Note: BHEL shall provide vendors' support for commissioning of proprietary**

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type of microprocessor based instruments, protection relays which requires software loading and programmer etc. However overall responsibility lies with contractor and the contractor shall provide all support like manpower, standard T&P, instruments etc. for calibration and commissioning of above proprietary type instruments.

The contractor shall carry out testing and commissioning works with their own testing equipments and testing teams. Testing shall be done under the supervision of BHEL/Customer Engineers.

### 2.3.2.03 SCOPE OF WORK FOR C&I PANELS

- a. Different types of Microprocessor based panels like PLC Panels, Instrument Panels, etc. are covered in the scope of work for erection and commissioning.
- b. The unit rate for Installation of control panels, shall include fixing of anti-vibration pads, levelling and alignment, welding, grouting, drilling of bottom gland plates for cable entry as required, closing control panel bottom with suitable flame proof compounds wherever required and checking of internal wiring, instruments, components etc. Unit rate shall also include Testing, Calibration and adjustment of relays, electronic cards and instruments mounted on the panels except the Instruments identified in the BOQ.
- c. Panels are normally supplied in suite of one / two / three/ four cubicles with bottom base frame and these panels are to be mounted on separate site fabricated base frames as per site condition. The base frames to be properly grouted to the concrete floor or to be TIG welded to the embedded insert plates. The structural steel material for the above will be supplied by BHEL. For fabrication and erection of frame, unit rate shall be paid on tonnage basis.
- d. 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.
- e. 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.
- f. Minor concrete chipping and grouting works, including supply of grouting material is included in the scope of works.
- g. 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.
- h. 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.

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- i. Painting of fabricated parts and earthing conductors of panels shall be part of the work. Touch up painting for panels, including supply of points shall be carried out by the contractor within the quoted rate.
- j. Closing the Panel openings and unused drilled holes with non-flammable sealant materials, including supply of above material, shall be part of erection work.
- k. For panels/ equipment erected by other agencies, commissioning work and troubleshooting are to be carried out by the contractor as per the rate in the schedule.
- l. Normally the panels shall be supplied with instruments / modules mounted and wired. No separate payment shall be made for commissioning of any instrument/ cards/ components. If dismantling of the above such instruments and rewiring are needed at site, the same shall be carried out at no extra cost. If any instruments/ cards/ components supplied as loose items for safe transit, the same shall be mounted and wired at no extra cost unless specified otherwise in the BOM. Similarly, if any loose supplied instruments /modules are to be mounted and wired on customer panels or any other panels not erected by contractor, the same shall be carried out at no extra cost unless otherwise specified in the BOM. However, if any major installation/modification/wiring are involved, the same may be carried out as extra work. The decision of BHEL Engineer shall be final in respect of above extra works.
- m. Dimensions & weights indicated in the BOQ against various panels are approximate only. There may be variations in the weight and dimensions. Variations in depth, height or weight of the panel shall not be considered for payment. Any variation within  $\pm 20\%$  of length shall not be considered for payment. However, for variations beyond  $\pm 20\%$  in length, price adjustment shall be considered proportional to the length of the panel.

### **2.3.2.04 SCOPE OF WORK OF DCS PACKAGE:**

- a. BHEL will supply sophisticated MAX-DNA DCS system. The tentative details of DCS System are furnished in the BOM.
- b. The scope of DCS system includes erection of microprocessor based systems max DNA control panels, I/O panels, Ethernet switching panels, Network Enclosure cabinets, CPU, Engineer workstations, operator workstations, CRTs, server, printers, portable UPS power supply, furniture and interconnecting cables like Ethernet/Fibre-optic etc.
- c. The scope of work for DCS Panels will generally be in line with that for C&I Panels as detailed in Clause 2.3.2.03
- d. Unit rate for DCS equipment shall cover installation & integration of all the above equipment and providing necessary commissioning assistance. No separate unit rate is applicable for installation of all loose items/ modules/ components or accessories including furniture etc, which is not explicitly mentioned in the BOQ, but comes as part of the system.
- e. Separate rate shall be applicable for laying and termination of cables including fibre optic/ Ethernet as detailed in the scope of work for cabling.

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### **2.3.2.05 SCOPE OF WORK FOR BATTERY / BATTERY CHARGER AND UPS**

The charger and batteries are of heavy duty type. Charger batteries are capable of providing DC supply for DCS/ electrical systems. The cells will be mounted on insulators carried on suitable wooden/ fibre stands. Tentative details are given in the BOM.

BHEL will provide vendor's technical support for commissioning of Battery and Battery charger/ UPS. 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 DC system. No additional payment shall be made for any variation in the number of cells. The unit rate for erection of Chargers, UPS and batteries will include the following works.

#### **SCOPE OF WORK FOR BATTERY**

- a. Collecting the batteries and all the accessories like cable connectors, inter lock connectors, equalizing connectors, rack insulators, fuse box, etc from stores and assembling on the racks and fixing all loose supplied items as per drawings.
- b. Filling the individual cells with Acid/alkali – if applicable.
- c. Installation of auto water fill system and health monitoring system for battery sets as per drawings under the supervision of BHEL/Vendor's Engineer.
- d. Arranging suitable resistive load banks for charging and discharging during charging and discharging cycles.
- e. 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.
- f. Modifications or changes if any for the loose supplied items or any minor changes in wiring.
- g. Arranging necessary tools, T&P, Testing equipments required for erection and commissioning of the battery.
- h. For laying and termination of cables of battery/ battery charger system, separate rate shall be applicable as per rates in Rate Schedule.
- i. Periodic maintenance of batteries such as top up of DM water/alkali, cleaning the batteries surfaces free of dust, as required, for proper functioning of the batteries shall be done by the contractor till handing over to customer at no extra cost,. Alkali/DM water shall be supplied by BHEL.

#### **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 2.3.2.03.

### **2.3.2.06 SCOPE OF WORK FOR LOCAL/FIELD INSTRUMENTS:**

- a. The type of instruments to be erected and commissioned shall be as detailed below:
  - i) All types of transmitters like temperature, pressure, flow, level and position feed back transmitters etc.

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- ii) Local mounted pressure gauges, DP gauges, thermocouples, RTDs, temperature gauges, temperature switches, pressure switches, DP switches, flow switches and limit switches etc.
  - iii) Air filter regulator sets, Air lock off valve, Power cylinders etc.
  - iv) Panels / Control desk mounted Instruments like indicators, recorder, electronic modules etc.
  - v) I/P converters and local controllers.
  - vi) Special instruments like vibration sensors, proximity sensors, electronic water level indicator, Acoustic Pyrometer System, Steam Leak Detection System, Furnace Flame Viewing System etc.
  - vii) Pneumatic operated control valves, trip valves, solenoid valves, and electrically operated valves. (commissioning only)
- b. Prior to installation, all the Instruments (local & remote), thermocouples and RTDs, I/P converters, etc. shall be calibrated. Similarly, limit switches, flow switches, level switches, solenoid valves, air filter regulator, purge meters, etc. shall be checked for proper operation.
  - c. Unit rates shall include calibration, installation, loop checking, commissioning and troubleshooting of all instruments 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 recalibration 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.
  - d. 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.
  - e. Unit rate 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.
  - f. Unit rate for Temperature transmitters, I/P converters, Air filter/ Air lock off valves, Purge meters, Rota meters, position transmitter, probes etc shall include fixing the instruments on the racks / supports along with associated fittings and clamps.
  - g. The unit rate 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.
  - h. The unit rate for erection of Casing temperature thermocouple of turbine/ metal temperature thermocouple (MTM) shall cover laying, dressing and clamping, supply and fixing of tag plates, etc. Welding of MTM pads shall be carried out by mechanical contractor. Necessary tray supports for routing of MTM thermocouples shall be erected as part of tray erection covered in the tender. Proper care to be taken during cleaning the crevices where the MTM t/c are inserted.

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- i. Unit rate for erection and checking of temperature switches, gauges, thermocouple, RTD etc. shall include cleaning of thermo well stubs threads using tap sets, fixing of thermo wells, seal welding of thermo well, wherever required as per BHEL specification and directive of site engineers.
- j. Unit rate for erection and commissioning of float type Level switches includes fixing of switches on float chambers and fixing of float chambers on stand pipe, providing supports wherever required, any minor modification required to match Float chamber with tapping point etc.
- k. The unit rate 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.
- l. Unit rate for erection/commissioning of special instruments like, Vibration monitoring System, Electronic water level indicator, PC based instruments, etc. shall include installation of all loose items which are not explicitly mentioned, but comes as part of the system, integration of total system and commissioning. Lump sum rate shall be quoted as indicated in Rate Schedule. No separate rate shall be payable for loose items including furniture. The quantity of loose supplied items are approximate only. No proportional rate will be applicable for any variation in quantity or for any additional items supplied as part of equipments.
- m. 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.
- n. All instruments are generally covered in rate schedule. However, if any instruments not covered, but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent unit rate for those instruments shall be considered wherever possible from the BOQ.
- o. 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.
- p. Temporary protection by thermocol, polythene sheet, and 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.
- q. TSI proximate and probes erection shall include proximate housing erection, support tube erection and protective flexible conduit erection
- r. Erection of instruments shall include fabrication of instrument stands and hardware like nuts & bolts for mounting instruments on to stands.

### **2.3.2.07 SCOPE OF WORK FOR IMPULSE PIPES:**

- a. 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, syphon, tees, bends, nut and tail piece.

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- b. Unit rate 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, identification ferrules, tags, 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
- c. 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, and Tungsten rods etc., filler wire shall be arranged by the contractor within the quoted rate.
- d. For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer.
- e. Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work.
- f. The contractor shall obtain necessary approval for welding electrodes, filler wire from BHEL welding engineer at site.
- g. Impulse pipes Welder shall undergo test and get approval from BHEL welding engineer according to the nature of welding.

### **2.3.2.08 SCOPE OF WORK FOR PRE-FABRICATED/ SEMI-FABRICATED LIR/ LIE/ GAUGE BOARDS**

- a. 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
- b. 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.
- c. Unit rate 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.

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- d. Wherever LIR/LGB/LIE are supplied with instruments mounted on them, the rate 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 erection/ commissioning charges shall be applicable in line with other instruments.

### **2.3.2.09 SCOPE OF WORK FOR COPPER/SS TUBES:**

- a. Different sizes of copper tubes of different thickness with or without PVC coating shall be supplied in standard lengths of 15 Mt Coils and SS tube shall be supplied in standard length of 6 meter. The connectors and tees will be of brass/SS of different sizes as per site requirement.
- b. The unit rate on meter basis includes site routing, bending, providing supports, fixing of connectors, unions, valves, tees, etc. and connecting to the instrument airline instruments. The unit rate also includes providing tag plates on instruments / power cylinders.
- c. If copper/SS tube length is more than ½ mtr, suitable support shall be provided either by angle or trays. Protective angles to be used for copper tube routing. The support materials shall be supplied by BHEL. Separate Rate shall be paid for fabrication and erection of supports as per tonnage rate in the BOQ.
- d. Copper/SS tubes shall be clamped with suitable clamping materials. Supply of suitable Aluminium clamps and tag plates are under contractor's scope. The unit rate for laying of copper tube shall cover the supply of clamping materials also. For SADC system copper tube Tag plate shall be provided near instruments, TEES and Power cylinders. Leak test shall be carried out after completion of tubing works as per guidelines.

### **2.3.2.010 SCOPE OF WORK FOR INSTRUMENT AIR LINES (GI PIPES):**

- a. 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
- b. 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.
- c. 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.
- d. After installation of instrument airlines, the line shall be blown and leak test shall be conducted for all the joints as per the guidelines given in section VII.

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### 2.3.2.011 SCOPE OF WORK OF ELECTRIC & PNEUMATIC ACTUATORS:

- a. 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.
- b. The unit rate 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.
- c. 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.
- d. For calibration of any Pneumatic Actuator at field, temporary air supply if required shall be arranged by the contractor.
- e. 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 for commissioning of pneumatic power cylinder of similar type.
- f. 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 for Erection and Commissioning of power cylinder of similar type.
- g. During commissioning of the Electrical Actuators the Contractor shall ensure that all feedback and command signals (loop checking) and settings are made available. The list of such actuators is indicated separately in the BOM under commissioning scope. The work for loop checking of actuators shall be deemed to be completed only after satisfactory operation of actuator from DCS. The Unit Rate for checking of motors from DCS shall cover all the activities mentioned above.

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### 2.3.2.012 SCOPE OF WORK FOR CABLES:

- a. BHEL will supply LT cables (1.1 KV, armoured/ unarmoured, Aluminium/ Copper PVC FRLS insulation) and Instrumentation cables of different sizes. The special cables supplied shall be of Compensating cable, Ethernet cables and Fibre-optic cable of different sizes and types..
- b. 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.
- c. The unit rate for laying of LT cables shall also include fixing of Trefoil clamps and clamping as per BHEL specification.
- d. Cable Termination
  - Separate rate shall be paid for termination of LT Power cables of various sizes. Such cables will be indicated in the BOM/ Rate Schedule.
  - For all other cables, a composite rate covering laying and termination shall be applicable.
- e. Unit rate for cable shall cover laying, drilling of holes on the gland plates of the panels/JB or Enlargement of cable entry holes by tapping or any modification required fixing of cable glands, fixing of glands, ferrules termination, and providing tag plates and dressing.
- f. Unit rates for cabling shall also include supply of clamping/ dressing materials such as Aluminium/GI strips or PVC/nylon ties, ferrules, tag plates, lugs upto 2.5 sq. mm. apart from the work mentioned above:
  - i) Cable Tags 2mm thick, 75mm long, 15mm width Aluminium Strips {At entry, exit & at every 30 mtrs of cable run length}
  - ii) Trefoil clamps for single core cables- 8 SWG thick, 25mm wide Aluminium Strips {@ Every 3 mtrs of cable length}
  - iii) Clamps for multicore cables- 25x3mm Aluminium flats {@ Every 3 metres of cable length}
  - iv) 3mm dia Nylon Cord {Required for tying cables to trays, at every 5 metres.}
- g. Uniform unit rate is applicable for the cables whether laid on cable trays or routed through duct bank, conduits, cable shafts etc.
- h. Ethernet cables shall be isolated from other cables and laid in a separate cable tray as directed by site Engineer.
- i. The contractor shall provide Tools/ equipment required for the connections and termination of cable wherever necessary. For cable joining, if any, separate rate shall be considered on extra works basis.

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- j. 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.
- k. Wherever cable entry holes have not been provided for equipment installed by another agency, the contractor shall co-operate to get the same done.
- l. During testing and commissioning, if the equipment on which the cables are terminated not functioning, it is the responsibility of the contractor to check and establish in coordination with the commissioning agencies that there is no defect in the cabling, The contractor shall promptly depute his supervisor or technicians to assist the commissioning agencies to check the interconnecting cables.
- m. 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.
- n. The Cable glands are double compression type made of Nickel plated brass
- o. Cable lugs are of tinned copper suitable for termination of different cross sections of LT/control cables.
- p. Individual termination up to wire level shall be considered
- q. Cable glands and cable lugs are supplied along with respective package/equipment's
- r. Contractor shall intimate/record the availability of cable glands/lugs while drawing the respective package/equipment's from Stores.
- s. SCOPE OF CABLE TERMINATION
  1. The scope of termination shall include termination of cables on various equipment installed by others.
  2. Re-termination if required during testing/ commissioning, shall be carried out without additional cost.
  3. Scope of termination shall include supply of insulating sleeves. The sleeves shall be fire resistant and long enough to over pass conductor insulation.
  4. Contractor shall arrange all type of termination and crimping Tools/ equipments required for the connections/terminations.
  5. Only printed ferrules should be used and contractor shall arrange necessary ferrules printer.
  6. After cable terminations, the debris shall be removed then & there
  7. The termination and connection of cables shall be done strictly in accordance with the manufacturer's instruction, drawings and/or directed by BHEL / RINL Site Engineer.

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8. The work shall include all clamping, fitting, fixing, soldering, tapping, compound filling, cable jointing, crimping, shorting and grounding as required for the complete job. All equipment shall be of contractor's procurement under this specification.
9. Control cable cores entering control panel/switchgear etc. shall be neatly bunched and served with PVC perforated tape to keep it in position at the terminal block.
10. The contractor shall put ferrules on all control cable cores in all junction boxes and at all terminations. The ferruling shall be Cross-Ferruling. The ferrules shall carry terminal numbers as per drawings. All ferrules shall be coloured, plastic & interlocked type.
11. Spare cores shall also be similarly ferruled, crimped with lug and taped on the ends. Spare cores shall be ferruled with individual cable number.
12. Termination & Connection shall be carried out in such a manner as to avoid strain on the terminals. Cables shall be marked with cable numbers as per applicable drawing.
13. All cable entry points shall be properly sealed and made vermin and dustproof. Unusual opening, if any, shall be effectively closed. Sealing work shall be carried out with motor sealing having fire withstand capability for 3 hours & fire break coating of 30 min.

### **2.3.2.013 SCOPE OF WORK FOR CABLE TRAYS:**

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

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

- a. The unit rate for erection of trays shall be on meter basis. The unit rate for erection of tray shall also include erection of all tray accessories such as elbow, cross, TEEs, bends such as vertical and Horizontal, reducers, coupler plates/fixing plates, anchor bolts, fasteners etc.
- b. For routing of trays standard tray accessories supplied by BHEL shall be used. However if above standard tray accessories are not supplied, the same shall be fabricated and installed at no extra cost.
- c. If standard tray accessories like TEEs, Reducers, Bends, cross etc requires any modification to suit the tray routing, the same shall be carried out at no extra cost.
- d. The unit rate for trays shall also cover making of offsets by means of cutting standard tray sections and inserting suitable trays to match with the existing arrangement
- e. No separate rate shall be paid for any such site fabrication/ modification on trays or on tray accessories.

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- f. The uniform rate on meter basis is applicable for erection of trays and Tray accessories like TEES, Reducers, Bends, cross etc.
- g. Tray covers are to be erected after completion of cable lying and no separate payment will be made for fixing these covers. GI strip clamps are to be used for fixing the tray covers.
- h. Welded Joints of trays shall be painted with red lead and aluminium paint in turn with bitumen as per IS 3043. The unit rate shall also include supply of paints, thinner, other consumables and brush etc.
- i. All the Pre-fabricated Ladder & Perforated type Cable Trays & accessories like Tees, Bends, Elbows, Cross etc. are made out of GI sheets.
- j. Cable trays shall be angular type.
- k. The contractor shall consider supply of Red Oxide Zink Chromate Primer for site painting of all Structural Steels (required for cable Tray Supports) in the Contractor's scope.
- l. Cable Trays shall be numbered as per layout drawing before laying of cable.
- m. All cables shall be provided with minimum of- 2 mm thick aluminium sheets as cable identification tags indicating cable designation in accordance with the cable schedule. The cable tags shall be provided at the ends, every 30 metres and when the cable changes and when the cable changes its direction/elevation. The tags shall be aluminium with the number punched on it and securely attached to the cable by not less than two turns of 16 SWG GI wire.
- n. The cable trays shall be supported in general at a span of 1.5m horizontally and at a distance of 1m vertically.
- o. Cable Tray on the top tier shall be covered whenever running below pipes.
- p. For buried cable, the marker shall project at least 150mm above ground and shall be spaced at an interval of 30m and at every change of direction.
- q. All the cables shall be clamped to the cable trays/support structure with the help of clamps. All power cables shall be clamped individually and control cables shall be clamped in groups of 3 or 4 cables. Clamps for multicore cables shall be fabricated out of 25x3 mm aluminium flats. Single core power cables shall be laid in trefoil formation and suitably clamped with 8 SWG thick, 25mm wide aluminium strips. All sharp edges and Burr shall be removed.
- r. Cables to be strapped to tray at interval not greater than 300mm.
- s. The contractor shall carry out the plant cabling works in line with customer/consultant's Technical specifications.

### **2.3.2.014 SCOPE OF WORK FOR JUNCTION BOXES/CJCBs /PUSH BUTTON BOXES:**

- a. Different Junction Boxes/ CJCBs/ Push Button boxes with gland plates shall be supplied by BHEL.
- b. The unit rate 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

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- Painting the tag Nos. or fixing a separate tag plate on junction boxes/push button boxes
  - Minor chipping, grouting as required for mounting the JB/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.
- c. All bolts and nuts (Fasteners) required for mounting the junction box shall be arranged by the contractor.
- d. For CJCBs/ RJCBs, the rate for Junction Boxes of similar size, as per Rate Schedule, will be applicable.
- e. For fabrication and fixing of supports/Frame, separate rate shall be paid on tonnage basis.

### **2.3.2.015 SCOPE OF WORKS FOR ILLUMINATION PACKAGE**

The scope of works of illumination covers mainly in Turbo blower area. The scope of items to be supplied by the contractor is indicated in the BOQ.

- a. The following shall be part of the illumination work.
- Installation of lighting panels, light Fixtures, Receptacles etc.
  - Installation of GI conduits with conduit accessories
  - Wiring and earthing
  - Supply of complete erection hardware for installation of lighting system like bolts, nuts, anchor fasteners, grouting bolts, connectors, flexible GI conduits, ferrules etc.
  - Laying of 3CX2.5 Armored cable including supply of clamps, screws, ferrules etc.
- b. If any conduit accessories other than those supplied by BHEL are required for completion of illumination system, the same shall be arranged by the contractor within the quoted rate.
- c. The rate for laying of conduits shall include fixing of all the related conduit accessories, Conduit branching JBs, earthing wires etc.
- d. The rate for installation of fixtures shall include fixing of all the related accessories, including JB - fixture supports.
- e. Scope of work for lighting panels shall be in line with erection of MCC.
- f. If any supports is required for installation of Lighting panels and Lighting Fixtures, the same shall be fabricated and installed. Rate for steel fabrication shall be paid on tonnage basis
- g. The contractor shall carry out the plant illumination works in line with Customer/BHEL's approved document/drawing

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- h. Erection activities like shaping,/ cutting/threading/welding etc. of conduit/pipe/ISMC/ISA shall be carried out by the contractor as per requirement.
- i. Consumables like Rawl plug, Screws, Check nuts, Nuts, Nuts & Bolts, Cu Lugs of different sizes locking wire, insulation tape, sealing compound/plugs, washers etc. which are not covered in the above list but required for successful completion of erection activity of plant illumination shall be considered in the contractor's scope
- j. Pipes & accessories of poles will be supplied to in loose. Assembling of poles and erection of the same along with civil work/foundation etc. shall be considered by the contractor.
- k. For Non-integral fixtures control gear box for these fixtures are to be separately mounted which also act as JB's for looping in and looping out. Hence separate JB's are not required. If the Fixtures are of Integral type, JB shall be considered for loop in and loop out.
- l. Accessories of lighting panel/JB like cable glands, gland plate may be supplied in loose. The contractor shall consider assembling of the same at site.

### **2.3.2.016 SCOPE OF WORK FOR FABRICATION & ERECTION OF STEEL MATERIALS:**

- a. 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.
- b. 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.
- c. 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.
- d. All fabricated steel materials shall be painted as detailed in the scope of painting.
- e. Rate includes fabrication and installation of steel, on tonnage basis. The above rate shall include supply of paints and painting, grouting and grouting material as required.
- f. These materials are supplied by BHEL to contractor to make supports for cable trays (Overhead tray arrangement on pipe racks and Cable Tray arrangement in Cellars & other arrangements as applicable for the project). Also these are required for making of frames for PB stations and junction boxes as per the project requirements.
- g. The contractor shall ensure that all steel structure used for electrical installation shall be painted with one coat of Red Oxide Zine Chromate Primer of approved shade for indoor installations.

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- h. The contractor shall ensure that after welding and drilling (if any) of the steels bracket shall be applied with above mentioned paints of approved shade.
- i. The contractor shall carry out the structural steel works in line with the cable tray layout as well as no. of frames as required for PB Stations and JB's.

### 2.3.2.017 SCOPE OF EARTHING & LIGHTNING PROTECTION INSTALLATION

#### A) Earthing

- a. The scope of earthing covered in this contract is below ground and above ground earthing. Scope of earthing covers earthing of field Instruments, JB's, Branch trays, LIR/LIE/ , JB, push Button boxes etc. shall be electrically earthed. All DCS and its accessories PLC/Instrumentation panels/systems etc, shall be earthed to a separate Electronic earth grid.
- b. Different type of earthing materials shall be supplied and same shall be erected as per site requirement.
- c. The scope of work shall include supply of fasteners, lugs, minor civil works etc.
- d. All connections from the equipment to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the contractor at site.
- e. Specifications related underground earthing may be included
- f. The contractor shall carry out the plant below and above ground earthing works in line with customer / consultant's technical specifications.

#### B) Lightning protection system installation

- a. The scope of works for Lightning Protection system includes installation of vertical air terminals, Horizontal conductors, vertical down conductors, test links, earth electrodes, supply of saddles, clamps, minor civil works etc..
- b. HORIZONTAL AND VERTICAL DOWN CONDUCTORS: The horizontal conductors shall be installed on the top of the building with suitable clamps/saddles arrangements. This horizontal conductor shall be connected with down conductors which in turn will be connected to risers through test links. Both horizontal and down conductors shall be supported on the clamps/saddles and spacers which will be fixed on the walls/columns or on top of the parapet walls. The clamping arrangements shall be provided at a span as specified in the drawing.
- c. The unit rate for horizontal and vertical conductor on meter basis shall include supply of support clamps, saddles, spacers, Anchor fasteners etc.
- d. TEST LINKS: The unit rate for the test link on sets (Nos.) basis shall cover supply of GI fasteners like washer/bolt/nut required for fixing Test Link and connecting the Test Link to earth electrodes by welding.

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- e. EARTH ELECTRODES: (if applicable) the earth electrodes shall be driven into the earth with suitable tools as per drawing. The unit rate for earth electrode shall also covers driving of earth, installation and welding with lightning down conductors and Test link, refilling of the excavated earth, consolidation etc.
- f. VERTICAL AIR TERMINATIONS: The vertical air terminations shall be located in different locations of the buildings as shown in the drawings. The vertical terminal shall mostly be fixed on the top of peripheral wall using a GI base plate of size 150x150x6 mm. The vertical air terminal shall be grouted on the wall and minor civil works required for grouting the air terminals as shown in drawing including supply of grouting materials are in the scope of Contractor.
- g. The unit rate on sets (No's) basis for vertical air terminal includes supply of base plates, bolt with nuts & washer, chipping and minor civil works, grouting and supply of grouting materials.

### **2.3.2.018 SCOPE OF PAINTING:**

- a. The scope of painting generally covers all the steel fabrication works such as supports, racks, frames, canopy, LIE/LIR/LGB, impulse pipes etc. carried out by the contractor. Painting shall be carried out for any bare copper tube also.
- b. Touch up painting only is generally required for trays, control panels, junction boxes and full painting shall be required only for specific equipments as per the scope of erection.
- c. The painting shall include two coats of Red oxide primer and two coats of final painting of synthetic enamel paint of colour approved by BHEL.
- d. All damaged painted surfaces shall be cleaned and coated with two (2) coats of primer followed by a finishing coat of approved colour.
- e. All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
- f. Unless otherwise instructed, final painting shall be carried out in the field, only after mechanical completion and completion of cable laying.
- g. The scope of work includes supply of paints, primers, consumables like brushes, emery papers, thinner etc.
- h. Paints shall be arranged from standard reputed suppliers in consultation with BHEL.
- i. All painting materials brought to site by contractor for application shall be procured directly from manufacturer as per specifications and shall be accompanied by manufacturer's test certificates. The paint manufacturer's instructions shall be followed at all times.
- j. No separate rate shall be paid for painting and supply of paints, and other consumables. Painting shall be accommodated in the unit rate for items which calls for painting as per scope of work.

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### 2.3.2.019 SCOPE OF CIVIL WORKS

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

### 2.3.2.020 SCOPE OF CALIBRATION:

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

### 2.3.2.021 SCOPE OF COMMISSIONING OF EQUIPMENT ERECTED BY THE MECHANICAL CONTRACTOR.

- a. ALL TYPES OF LT DRIVES AND ELECTRICAL ACTUATORS.
  - a) Cable identification, checking and meggering.
  - b) IR value of motor, measurement of winding resistance etc.
  - c) Dry out all the motors if required to improve IR value.
  - d) Limit switch and torque switch setting.
  - e) Calibration of Electronic cards, modules etc. and fixing the same if supplied as loose item.
  - f) Checking direction of rotation of motors and testing and commissioning from local as well as remote.
  - g) Attending to any defects till the handing over of the unit to customer by BHEL
  - h) Replacing defective components like limit switches, electronic cards etc.
- b. Electrical & control equipment and field instruments of suction air filter, Air compressor system.
- c. PANELS.

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The panels shall be mostly skid mounted and the skid will be erected by mechanical contractor. The scope of commissioning of Panels covers checking of internal wiring and associated loop cables from panels to field instruments, Push Buttons, JBs, drives, replacing defective components/instruments/electronic cards etc. as detailed in the Bill of Materials.

d. 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.

e. FLOW METERS/ SWITCHES

a) Checking the calibration and servicing if required.

b) Setting the alarm value

c) Replacement of defective components if any

f. LIMIT SWITCHES & LEVEL SWITCHES

a) Checking the operation

b) Replacing defective components if required

g. SOLENOID VALVES

a) Checking the healthiness of coil

b) Checking the operation

c) Replacement of defective components if required.

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

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- a) Checking the healthiness
- b) Replacement of defective element (only for bearing)
- i. DIRECT WATER LEVEL GAUGES (REMOTE & LOCAL)

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

- j. INSTRUMENTS MOUNTED ON THE EQUIPMENTS/ SKIDS/ PANELS

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

**NOTE:**

The scope of work covered in 2.3.2.21 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.

**2.3.2.022 SCOPE OF PRE-COMMISSIONING/ COMMISSIONING AND POST COMMISSIONING WORKS:**

- a. 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.
- b. Scope of commissioning starts with the commissioning of various equipment/ instruments/ systems erected by the contractor and making them available, as required, for the various commissioning activities of the main plants. The commissioning activities of Turboblower shall be as below:
  - a) Barring Gear of Turbine
  - b) Trial Run of Turbo blower
  - c) Full Load Operation.
- c. The above activities, tests, trial runs may have to be repeated till satisfactory results are obtained to the satisfaction of customer / consultant / statutory authorities like boiler inspector, electrical inspector etc.
- d. The contractor shall co-ordinate with other contractor's during the above main plant commissioning activities to ensure successful commissioning of total plant.

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- e. Contractor shall arrange experienced commissioning engineers, supervisors including electricians/instrument mechanics in each area to be associated with BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted. It shall be specifically noted that above employees of the contractor may have to work round the clock along with BHEL commissioning engineers involving considerable payment of overtime, which forms part of Contractors Scope
- f. 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.
- g. After erection of various equipment prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers.
- h. 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.
- i. 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.
- j. 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.
- k. 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.
- l. 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.
- m. The scope of commissioning shall also cover the commissioning of the equipment/drives erected by the mechanical contractors. (as detailed in the BOQ).

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### 2.3.2.023 FIRE PROOF SEALING SYSTEM PACKAGE:

a) The contractor shall carry out the installation of fire proof sealing barrier materials & fire break coating

b) **Typical Installation Guidelines:**

**1) Preparation & application procedure for Mortar Seal (Fire Barrier) given below.**

i) **Preparation:** 25 Kgs/ of Mortar Seal when mixed with 16 litres of water will result in about 36 litres of ready to apply Mortar. No special surface preparation is necessary. However dusting /removal of any oil substance is recommended.

- In case of wall openings, normally only one side of the opening is to be shuttered by using plywood or any other suitable material. However in the case of larger openings, shuttering on the application side will facilitate a more rapid pace of work. The shuttering on the application side shall be moved up with the level of the mortar. In the case of floor openings, only the underside needs to be shuttered. Mortar is filed from the top and leveled out, with a trowel.

- The mixed mortar is then applied like normal cement concrete, taking care to fill all the crevices and spaces between the cables. The exposed surface can be trowelled to form a very smooth surface.

- The mortar thus installed shall be cured for 5 to 6 days with water.

ii) **Application:**

- Sealing of bottom of all panels ( as visible in cellar, if you stand and look up)

- Sealing of wall/floor cut-outs, after cables are laid/passed through

- Sealing of cable entry into cellar/any other building, normally when cable passes through the conduits into a building from outdoor trench, both ends of conduits are required to be sealed by using this material

- Sealing of all sides of future floor cut-outs covered with chequered plates.

**2) Preparation & application procedure Cable Coating Compound given below:**

i) **Preparation**

- Stir the paint drum for about 5 minutes with wooden or steel rod to make it uniform, Transfer the required quantity of paint into small bucket.

- Clean the dirt on cables with dry cloth which are to be coated

- Define application area by applying removable tape on both ends of the cable.

- Start applying the paint on cables with paint brush. After completion, let it dry

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- Every coat has to be dried for 3-4 hrs. In case of indoor application and 2-3 hrs. In case of outdoor application. After complete drying of each coat, next coat must be applied.
- Repeat the step 4 till you get the thickness 1.5mm to 2mm. To achieve this thickness total coats required are 4.
- Remove all the tapes on cable ends after applying 4th coat & leave it for drying.
- After complete drying of 4th coat, measure the thickness by Vernier caliper
- Apply additional 5th coat if desired thickness is not achieved after applying 4th coat.
- Please note that 1.5 to 2mm thickness has to be achieved in complete four coats applied by trained/skilled labors. We recommend minimum this thickness has to be achieved for best performance of the product. Additional coat is advised if this thickness is not achieved.

### ii) Application

- Normally applied on both ends of power cables( 3 meters at load end & 3 meters at source i.e. HT/LT switch board end)

\*\* Above notes about preparation of mortar seal & fire break coating are typical only, same may vary from manufacturer to manufacturer. Site to refer vendor's instruction/installation details before carrying out the installation works at site.

### 2.3.2.024 EXCLUSIONS

The following are specific exclusions from this work

- a. Erection of dampers, valves, electrical actuators, LT drives
- b. Attachment welding of thermocouple pads, flow nozzle, orifice plates and control valves
- c. Root valves on the instruments tapping points

#### NOTE:

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

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### **2.3.2 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS**

- 2.3.2.1 BHEL shall issue materials covered in BHEL scope from their stores at site. The contractor shall collect such materials from BHEL stores and transport to his worksite at the contractor's cost.
- 2.3.2.2 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.
- 2.3.2.3 Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.
- 2.3.2.4 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.
- 2.3.2.5 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.
- 2.3.2.6 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.

### **2.3.3 STORAGE**

- 2.3.3.1 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.
- 2.3.3.2 The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damp, sinking into ground and to circulate air under the stored equipment. This will also help in lifting the packing with forklift truck.
- 2.3.3.3 Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when de-colorization takes place or regenerated. BHEL shall supply the material and contractor shall replace.
- 2.3.3.4 Due care should be taken to ensure that the equipment is not exposed to fumes gases etc. which can affect electrical contacts of relays and terminal boards.
- 2.3.3.5 The storage room and the equipment should be checked at regular interval of 3 months to ensure protection from termites, mould growth, condensation of water etc. which can damage the equipment.
- 2.3.3.6 Contractor shall keep BHEL informed about such problem and try to rectify the problem at his risk and cost.
- 2.3.3.7 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.

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- 2.3.3.8 Packing material shall be retained if the cubicle to be repacked after inspection.
- 2.3.3.9 All sub-assemblies should be kept in a separate place where it is easily accessible.
- 2.3.3.10 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.
- 2.3.3.11 The loose items supplied for the main equipment falls into various categories like tools, modules, prefabricated cables, console inserts, recorders, modules and display units, printers, sensors and transducers, PCs, monitors, cable glands, cable ducts, frames etc. are to be categorised and stored separately.

### **2.3.5 T&P TO BE PROVIDED BY BHEL FREE OF CHARGE**

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

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

#### **a) TOOLS AND PLANTS TO BE ARRANGED BY THE CONTRACTOR**

- a) 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.
- b) 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.
- c) No material or equipment or tools etc. shall be taken out of the work-site without the written consent of BHEL.
- d) 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.
- e) 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.

#### **b) MATERIALS/CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR WITHIN THE RATE QUOTED FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENT/ ITEMS.**

- a. Welding electrodes and gas

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- b. Provision for Temporary Scaffoldings.
- c. "U" Clamps with nuts and washers for impulse pipes and GI pipe clamping.
- d. Tags- Plates. Al/Fiberglass/ Stainless Steel
- e. Insulation tape.
- f. Teflon tape for instrument air system piping.
- g. Paints required for primer coating and final coating of synthetic enamel paint of approved colour, Consumables like thinner, brushes, emery paper etc.
- h. Solder wire ( Lead) -(60/40)
- i. Protocol/Calibration report sheets as per BHEL Format.
- j. Fastener for mounting JB and local PB Boxes.
- k. Panel/ JB Sealing compound material (for cable entry from bottom/Top of Panel).
- l. PVC cable tie, Aluminium or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing, grommet
- m. Printed Ferrules, sleeves for cables Yellow/White
- n. Lugs up to 2.5 sq. mm Solder less crimping type

### c) MANPOWER REQUIREMENT

- a. Manpower requirement per unit for Erection shall as follows: There shall be separate Erection In-charge for Turbo blower. They shall work independently with required manpower, T&P etc., including storage facilities. Each Erection In-charge shall have minimum 1 erection engineer with adequate supervisors and Technicians.
- b. Similarly commissioning Engineers also shall be identified separately for each package and the minimum requirement shall be as indicated below.

	<b>Turbo-blower</b>	<b>TOTAL</b>
<b>Engineer (Elect)</b>	2 No.	<b>2 Nos.</b>
<b>Engineer (C&amp;I)</b>	2 No.	<b>2 Nos.</b>
<b>Supervisor (Elect)</b>	2 No.	<b>2 Nos.</b>
<b>Supervisor (C&amp;I)</b>	2 No.	<b>2 Nos.</b>

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<b>Technician (C&amp;I/ Elect)</b>	4 Nos.	<b>4 Nos.</b>
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- c. The commissioning group shall be identified at the Pre-commissioning and commissioning time. The commissioning group shall have the knowledge of various systems referred in the tender and also should have adequate experience.
- d. In addition to the above, the contractor shall provide three data entry operators for documentation works such as preparation of calibration records, protocols, progress reports etc.
- e. 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.
- f. 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.

### **d) DOCUMENTATION**

- a) The following information shall be furnished after commencement of works.
  - a. Calibration certificates for the Instruments calibrated at site.
  - b. Test certificates of various tests conducted at site.
  - c. Erection and commissioning protocols signed by customer & BHEL
- b) As built drawings :

After successful completion, testing and commissioning of installation work, the above listed Purchaser's drawings/documents shall be updated in line with the actual work carried out and as built drawings/documents shall be submitted by the contractor as agreed for the project.

### **e) PROGRESS AND MONITORING OF WORK**

- a) It shall be the responsibility of the contractor to provide all the relevant information on a regular basis regarding erection progress, welding progress, labour availability, equipment deployment, consumption of electrodes, gases, etc.
- b) The contractor shall submit daily, weekly and monthly progress reports, manpower reports, material reports, and equipment reports etc. as per formats specified by BHEL. The progress reports shall indicate the progress achieved against planned with reasons indicating the delays, if any. The report shall also give the remedial actions which the contractor

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intends to make good the slippage or lost time so that further works can proceed as per the original programme and the slippage do not accumulate and affect the overall programme.

### **f) ELECTRICAL INSPECTORATE'S APPROVAL: (if applicable)**

- a) All electrical installation covered in contractors scope are to be inspected/approved by the electrical inspector/statutory authority. Contractor is responsible for getting the Electrical inspector approval. For getting electrical inspector approval, contractor shall co ordinate with Electrical contractor. Necessary completion/test certificate for the Electrical equipments like DC systems, UPS etc covered in the contractor scope shall be arranged by the contractor.
- b) Contractor shall carry out the modifications/rectifications if any as suggested by the authority at his cost.
- c) BHEL shall pay all fees (Fees for visits, Inspection fees, registration fees, etc)
- d) However any expenditure related to documentation shall be borne by contractor.

### **g) DETAILS TO BE FURNISHED BY THE TENDERERS**

- a) Apart from other details called for in the tender document under the various other provisions, the tenderers along with their offers shall submit the following details. Please also refer the checklist.
- b) Tenderers shall go through very carefully all the provisions under section VI and shall submit manpower deployment plan as per appendix VI A. The contractor along with his offer shall, also submit the list of T&P and instruments that are available with him for mobilisation for the work as specified in Appendix VI B. Tenderers shall indicate the present location and submit a schedule of tools and plants for this site to meet the schedules of erection and commissioning.
- c) Apart from other details called for in the tender document under the various other provisions, the tenderers along with technical bid shall submit the following details.
  - a. HQ Organisation chart
  - b. Site Organisation Chart Covering various function
  - c. Month wise Manpower deployment plan
  - d. T&P deployment plan
  - e. The following information shall be furnished within two weeks of award of contract for approval:
    - f. Final field quality plan
    - g. Detailed organization chart
    - h. Erection Schedule.
    - i. Experience details of site staff
    - j. Details of calibration instruments

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### h) MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

- a) 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.
- b) The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.
- c) 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.
- d) 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.
- e) 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. 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.
- f) 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.
- g) Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard pro forma prescribed for this purpose by the site in charge.
- h) The erection contractor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed the following limits;

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

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

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

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## ANNEXURE VI- B

### RECOMMENDED LIST OF TOOLS AND TACKLES / INSTRUMENTS

#### A) FOR ELECT WORKS

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

a) Insulation tester:

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

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

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

c) Torque wrench

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

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

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

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

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

i) Secondary injection kit - 0-5A.

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

k) Oscilloscope

l) Phase sequence meter - 110V - 450V - 25 to 65Hz.

m) Frequency meter - 0 - 115 - 230 - 4500 - 45 - 601/s.

n) Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A.

o) Tachometer etc.

p) Micro ohm meters for measuring contact resistance

q) Event recorders with micro second accuracy

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

S. NO	DESCRIPTION	QUANTITY
01	Dead Weight tester rated 400 Kg/Sq.cm with weights & test gauges facility	02 No.
02	Oil temperature bath suitable to calibrate upto 300 Deg C	02 No.
03	Furnace range 600 Deg C	01 No.
04	Standard Pressure Gauges as below :	
	0 to 1 Kg/Sq.cm	02 No.
	0 to 5/6 Kg/Sq.cm	02 No.
	0 to 10 Kg/Sq.cm	02 No.
	0 to 16 Kg/Sq.cm	02 No.
	0 to 25 Kg/Sq.cm	02 No.
	0 to 60 Kg/Sq.cm	02 No.
	0 to 100 Kg/Sq.cm	02 No.
	0 to 250 Kg/Sq.cm	02 No.
05	Standard Temperature Gauges as below :	
	0 to 100 Deg C	02 No.
	0 to 200 Deg C	02 No.
	0 to 600 Deg C	02 No.
06	Standard compound pressure gauge -1 to +3 kg/Sq.cm	01 No.
07	Standard Vacuum Gauge -760 mm Hg to 0 Kg/Sq.cm	01 No.
08	Manometer 0 to 1000 mm WC with hand bulb	04 Nos.
09	Portable air compressor with drier and regulator rated for 10 Kg/Sq.cm	02 No.
10	Vacuum pump with standard vacuum gauge	02 No.
11	Standard Milliamps Source (Digital)	10 Nos.
12	Standard Millivolts Source (Digital)	05 Nos.
13	Mercury Manometer different range	04 Nos.

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

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

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## ANNEXURE VI- C

### ACCURACY REQUIREMENT OF TESTING INSTRUMENTS

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

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

### OTHER REQUIREMENTS OF CONTRACTOR'S INSTRUMENTS & T&P

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

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- i. Contractors shall arrange experienced/qualified persons for using these calibration instruments at laboratory and also at work spot.
- j. Wherever frequent calibration is required, contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments.

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## APPENDIX - VI D

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

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### NOTE

01. Minimum Number of persons to be indicated month wise.
02. Above deployment plan shall be discussed with BHEL Site Engineer and necessary changes shall have to be made by the contractor as per discussion. If required, any additional deployment during execution of the work shall have to be arranged by the contractor for meeting various schedules/targets set by BHEL without any additional compensation.
03. Resident Engineer should have a minimum qualification of Engineering Degree or Diploma in Engineering with 15 years of experience in Thermal Power Station.
04. Supervisor should have a minimum qualification of Diploma in Engineering or a graduate with 10 to 15 years of experience in Thermal Power Station.
05. Lab Technicians should have experience in Thermal Power Stations.
06. Contractor should have one Store Keeper and one Transport Supervisor for the safe transportation of materials.

# TECHNICAL CONDITIONS OF CONTRACT (TCC)

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## APPENDIX - VI E

### DEPLOYMENT PLAN FOR MAJOR TOOLS AND PLANTS / INSTRUMENTS

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

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

### NOTE

- 01. The list of Tools and other plants to be deployed for this project may be indicated by the tenderers separately.**
- 02. Above deployment plan shall be discussed with the site engineer and necessary changes shall have to be made by the contractor as per discussions. If required, an additional deployment during execution of work shall have to be made by the contractor for meeting various schedules/targets set by BHEL without any additional compensation.**

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BHEL PS:SR

Format No. CP: FEX

CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS

Name of Site :

Name of Sub-contractor :

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

SIGN OF SITE CIC

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

### VOLUME-IA PART – II CHAPTER –IV

#### DATA SHEET

##### 2.4.1 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.	<b>CLAMP SPACING:</b>			
	a	<b>Trefoil Clamps</b>		
		i	Horizontal run spacing	1000 mm (max)
		ii	Vertical run spacing	1000 mm (max)
		iii	Axial spacing between adjacent trefoils	Double the diameter of larger cable or 150mm Whichever is less
	b	<b>Other Clamps</b>		
		<b>A.Power Cables:</b>		
		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			

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

		i) Horizontal runs	Collectively clamped at 3000 mm intervals (max)
		ii) Vertical runs	Collectively clamped at 2000 mm interval (max)
		<b>B.Control Cables:</b>	
		i) Horizontal runs	Collectively clamped at 3000 mm interval (max)
		ii) Vertical runs	Collectively clamped at 3000 mm interval (max)
		<b>C.Spacing for cables supported along structure / ceiling</b>	
		<b>Clamping Spacing:</b>	
		i) In horizontal runs	750mm (max)
		ii) In vertical runs	750mm (max)
		Spacing between cables	30 mm (min)
		<b>Note:</b> a. Supports shall also be provided at each bend. b. For any change in above spacing, prior approval of Engineer shall be taken.	
6		<b>Cable termination:</b>	
		<b>Type of Lugs:</b>	
	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.
		<b>Wastage Allowances</b>	
a.	b.	LT cables	1%
c.	d.	Control cables	2%
e.	f.	Instrumentation cables	2%
g.	h.	Impulse Pipe lines	1%
i.	j.	Steel materials (for cable trays / tray support installation)	2% by weight

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## VOLUME-IA PART – II CHAPTER –V

### GENERAL TECHNICAL REQUIREMENTS AND GUIDELINES FOR INSTALLATION, TESTING, COMMISSIONING OF SUPPLY ITEMS

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#### 2.5.1 INSTALLATION, TESTING & COMMISSIONING IN GENERAL:

The stages of completion of various works shall be as follows

- Equipment shall be considered to be completely erected when the following activities have been completed.
- Moving of all equipment to the respective foundations.
- Fixing of anchor bolts or tack welding as required.
- Leveling and alignment of equipment.
- Assembling of all accessories such as relays, CTs, PTs, meters, instruments etc. as described in the job specification.
- Drying of equipment as required and testing of oil for di-electric strength.
- Filtration and filling of oil as required.
- Cable laying, termination with continuity check.
- Applying of finishing coat of paint.
- Mounting of lighting fixtures and connections.
- Completion of earthing system.

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

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

#### 2.5.2 SITE TESTS AND CHECKS

##### 2.5.2.1 General

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

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

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

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

### 2.5.2.2 Trial Run Test

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

### 2.5.2.3 Acceptance Test

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

## 2.5.3 TRANSFORMER

### 2.5.3.1 INSTALLATION

To ensure that a Transformer will function satisfactorily, it is important that handling, lifting, storing and assembling are carried out with great care and cleanliness by experienced personnel who know the various working operations very well.

### 2.5.3.2 INSPECTION

In connection with receiving and unloading at site, and at the final storing place before assembling, the transformers shall be inspected carefully. External visible damages as dents, paint damage etc. may imply that the transformer has been subjected to careless handling during transport and/or re-loading, and a careful investigation is therefore justified.

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After the arrival of the material at receiving points, before unloading, the condition of packing and of the visible parts should be checked and possible traces of leaks verified (condenser bushing). If necessary, appropriate statements and claims should be made.

Drums containing oil which have separately despatched should be examined carefully for leaks or any sign of tampering. All despatched drums are filled upto their capacity and any shortage should be reported.

Check immediately the gas pressure at the arrival. A positive indicates that the tank and the transformer components respectively are tight, and that the active part including the insulation materials is dry.

If there is no positive gas-pressure, transformer should be immediately filled with dry Nitrogen gas at a pressure of 0.17 kg/cm<sup>2</sup> (2.5 psi) without loss of time.

Otherwise, it should be checked if the core isolation is satisfactory and that accessories packed separately have not been damaged during transportation.

### 2.5.3.3 UNLOADING

Whenever rollers/trolleys are supplied with transformer, movement of transformer at site is carried out by mounting these rollers / trolleys.

Alternatively for movement of transformer from loading bay to actual site of the equipment, skidding on greased rails etc can also be resorted to.

### 2.5.3.4 STORING

Dismantled equipment and components are packed to the protected against normal handling and transport stresses. The instructions for lifting given on the packages must be complied with to avoid damages.

Goods stored outdoors must not be placed directly on the ground, and should be covered carefully with tarpaulin or similar materials.

Oil drum should be stored in horizontal (lying) position with both the bungs also in horizontal position.

### 2.5.3.5 LIFTING

Lifting devices on the transformer tank are dimensioned of lifting of the complete transformer filled with oil. The positioning of the lifting devices, permissible lifting angles, minimum height to crane hook and transformer weight, appear from the OGA drawings. Check at lifting of complete transformer that the lifting wires/ropes are not in contact with bushing or other components on the cover.

For lifting with hydraulic jacks, the transformer is provided with jacking pads

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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dimensioned for lifting of complete transformer filled with oil. The position of the pads appear on the OGA drawings.

### 2.5.3.6 CHECK POINTS BEFORE STARTING AND DURING ERECTION

#### a. Check points before starting erection.

1. Conditions of leads
2. Bracing, clamping of leads
3. Connections
4. Tap changer checks
5. General conditions of insulation
6. Core check that it has not moved in transit.
7. Core-ground; this is checked with the megger after removing earth connection
8. CTs, including the secondary leads and their passage through metal parts
9. Check that shipping frame for bushings have been removed.
10. Check that coil position has not moved in transit
11. Check for dirt, metal swarf, moisture
12. Check that the bushing leads set without being too close to ground or other points of different potential.

#### b. Check-points during erection:

By means of the part list and the transformer/reactor OGA, the assembling of a fully completed transformer is carried out according to the following instructions. The following precautions are to be taken:

- i. Fire-fighting equipment shall be available at the oil-treatment equipment as well as at work on and adjacent to the transformer.
- ii. Welding work on or adjacent to the transformer shall be avoided, but if this is not possible, the work shall be supervised by fire-protection personnel.
- iii. Smoking on or near the transformer shall not be allowed.
- iv. Transformer tank, control cabinet etc, as well as assembling and oil-treatment equipment shall be connected with the permanent earthing system of the station
- v. Check that there is no overpressure in the transformer when blanking plates or connection lids are to be opened.
- vi. All loose objects, tools, screws, nuts etc. shall be removed from the transformer cover before opening the connection and blanking lids.
- vii. All loose objects (tools, pencils, spectacles etc.) shall be removed from the boiler- suit pockets etc. before starting the work through man-holes.

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- viii. Tools to be used inside the transformer e.g. for tightening of screws-joint- shall be fastened to the wrist or another fixed point by means of cotton tape or string.
- ix. Tools with loose sleeves and tools with catches must not be used at work inside the transformer.
- x. Greatest possible cleanliness shall be observed at work inside the transformer, and at handling of part to be mounted inside the transformer.
- xi. Fibrous cleaning materials should not be used as it can deteriorate oil when mixed with it.
- xii. All components despatched separately should be cleaned inside and outside before being fitted.
- xiii. A Transformer is best protected from damp hazard by circulating warm, dry, de-aerated oil through it until its temperature is 5 C to 10 C above ambient. This should be done before allowing external oil to the interior of the tank. The warm oil should be circulated all the time transformer is open to atmosphere.
- xiv. Oil pump & all joints in the oil pipe work should be air tight to avoid entrance of air through leakage joints.
- xv. The active part (core and winding) should be exposed to the surrounding air as short time as possible. Open therefore only one blanking plate or connection lid at a time for remounting of bushing, valves etc.
- xvi. Objects which-despite all precaution are dropped inside transformer, must absolutely be brought out from the equipment.
- xvii. Check that the oxygen content inside the transformer tank is minimum 20% if a person is to enter the tank.

### 2.5.3.7 ASSEMBLY

Assembly of wheels Bushing Valves, cooling device, Oil conservator, Pipe Flanges, Blanking plates and accessories like cooling fans, pumps, OLTC and components for supervision and control oil level indicator, flow indicators, gauges, Buchholz relay, PRV, thermometers etc. are assembled according to leaflet / description valid for the components.

### 2.5.3.8 OIL FILLING

The following procedure is recommended.

- i. Close and blank the valve to isolate the conservator from main tank. Fill the oil in transformer under vacuum up to Buchholz level as per instructions given elsewhere.
- ii. After filling the oil in transformer and breaking the vacuum, oil can be filled in

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the conservator either through reactor or by drain valve.

- iii. Remove the inspection cover (ii) provided on the side of the conservator and check the air cell assuring that it is inflated. The air must remain in fully inflated condition during oil filling operation. If the air cell is found deflated fit the inspection cover and inflate the air cell with dry air / nitrogen gas to 0.035kg/sq.cm max. A gauge may be put by removing plug. After filling close these connections.
- iv. Remove air release plugs provided on top of the conservator.
- v. Slowly pump the oil through main reactor / drain valve. Temporarily stop filling operation when oil starts coming from opening after ensuring that no air bubbles come out through these air release holes. Fit the two air release plugs.
- vi. Continue oil filling till oil start coming from air release plug stop oil after ensuring that no air bubbles come out. Fit the plug.
- vii. Now release the air pressure held inside the air cell from point and continue oil filling until magnetic oil gauge indicates 35 deg. C level.
- viii. Remove oil pump and connect air cell to breather from point. Also remove pressure gauge and put plug.
- ix. The system is now properly filled. Air release plugs are fitted in normal operation.

### 2.5.3.9 EQUIPMENT FOR OIL-FILLING UNDER VACUUM

- (i) High-vacuum 2 storage oil filtration plant provided with thermostat-controlled oil heaters and vacuum-proof hoses with dependent vacuum pumping system for tank evacuation. Capacity: 6 kl/hr
- (ii) Oil-storage tanks provided with silica-gel breathers and inlet / outlet valves for oil circulation. Recommended capacity 20kl
- (iii) Vacuum gauges provided in filtration plant.
- (iv) Equipment for measurement of electric strength (BDV) of oil - 100 kv set.
- (v) Equipment for moisture content of oil.
- (vi) Equipment for measurement of Resistivity and Tan delta at 90 C.
- (vii) Transparent vacuum-proof tubes for checking of oil-level during oil filling.
- (ix) Valves, fitting, gaskets etc.
- (x) Dry nitrogen cylinders.

### 2.5.3.10 COMMISSIONING

Testing after Assembly of the Transformer.

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

### 2.5.3.11 COMMISSIONING CHECKS

<u>Sl. No</u>	<u>DESCRIPTION</u>
1.	Breather Silica gel (Blue when dry)
2.	Oil in the Breather housing cup.
3.	All valves for their correct opening and closing sequence.
4.	Oil level in conservator tank.
5.	Oil in cooling system.
6.	Oil level in bushings.
7.	Release air, wherever necessary.
8.	Cooling accessories (Pump motors, Fan motors etc.) for direction and O/L setting.
9.	Buchholz, oil level indicator, pressure gauges, thermometer, Temp. indicators etc.
10.	Neutral earthing.
11.	Earth Resistance of Electrodes.
12.	Earthing of bushing test tap.
13.	Check oil leakage for 24 hrs.
14.	Check Auxiliary circuit voltage (415 V)
15.	Calibration of OTI / WTI with hot oil.
16.	Check Working of WTI / RTD repeaters at control room.
17.	IR of core to earth.
18.	Die electric strength of oil PPM & Chemical analysis, specific gravity test
19.	IR tests on windings to earth and between winding
20.	Phase sequence test & vector group check
21.	Continuity test
22.	No load voltage ratio on all tap position
23.	Winding resistance in all taps
24.	Tap changing at 415v 3 50 Hz supply in all three phases

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25. TAN-DELTA test if quality check list calls for.
26. Dew point check for N<sub>2</sub> Gas at the time of oil filling.

### INSULATION RESISTANCE TEST

Sl.No	Description	Date	Time Hrs	in Megger	IR Value	Temp	Remarks
1	Control wiring			500 V			
2.	Tap Changer						
	a) Motor						
	b) Control						
3.	Cooling system						
	a) Motor Fan						
	b) Motor pump						
	c) Control Wiring						
4.	Main Winding						
	a) HV/E+LV						
	b) LV/E+HV						
	c) HV/IV						
	d) IV/LV						
	e) HV/LV						

#### Note :-

- (1) While checking these values no external, lightning arrestors etc should be in circuit.
- (2) Special care should always be taken while meggering the transformer winding to ensure that there is no leakage in the leads.
- (3) Megger voltage to be decided based on the voltage rating of equipment under test.

#### Oil Characteristics.

Take necessary precaution (regarding rinsing the bottle, cleaning hand, air bubble etc) while withdrawing the samples, Each sample should be free of air

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bubbles and should not be tested when it is hot. The sample should satisfy IS:1866.

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

### Tests on CT

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

### Potential Transformer Tests

1. IR test of primary winding by HV megger between windings
2. IR test of secondary winding by LV megger between winding and winding to earth
3. Checking of voltage ratio
4. Verification of terminal markings and polarity
5. Checking of oil level if applicable
6. Checking of continuity and IR values for cables from PT to M
7. Checking tightness of earthing connection.
8. Checking of insulator for cracks
9. Checking output on charging of the system with connected meter

### On Load Tap changer

S/No	Description	Date	Observation	Remarks
1)	Visual inspection of equipment			
2)	While operating the mechanism on Electrical Control, check once			
3)	Hand operation on all taps			
3	Complete wiring of the circuits			
4	Limit Switch			
5	Over running device			
6	Remote Panel Wiring.			
7	Overload Device of Driving Motor.			
8	Local Operation (Electrical)			
9	Remote Operation (Electrical)			
10	Tap Position Indicator.			
11	Step by step contractor			
12	Out of Step Relay.			

again limit swit

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### 2.5.4 BUSDUCTS –SEGREGATED PHASE

#### 2.5.4.1 HANDLING AND STORAGE

##### General

Busduct form the main electrical connections between the Generator and associated Generator Transformer and tap-off to PTSP cubicle. The ducts are made of aluminium sheet which house the busbar conductors supported on post insulators. The duct assembled are suitably supported on the structures in the station. The bus enclosure assembled are despatched with the insulators assembled and the conductor are sent either loose or assembled inside the duct, keeping in view the erection necessities and transport limitations.

#### 2.5.4.2 INSPECTION AT SITE :

When the packages are received at site, these must be checked for the following:

- a. Completeness and correctness of the consignment. (Compare with delivery documents)
- b. Physical damage if any during transit.

#### 2.5.4.3 HANDLING DURING ERECTION :

The bus ducts are in unpacked conditions, therefore, great care is necessary in handling. Ensure that:

- a. While lifting enclosure assemblies manila ropes are passed round the bus duct enclosure near the support channels.
- b. All shipping steel clamps are to be tightened and bus bars do not slip out while handling, if the bus bar is assembled in the enclosure.
- c. While inserting and mounting the bus bar in the enclosure care is taken that the bus bar does not hit and damage the insulators.
- d. Eye bolts are used while lifting the cubicles.

##### Caution:

1. When inspecting the enclosures assemblies etc. the wooden packings, braces and polythene covers should be replaced, if removed, to prevent damage and ingress of dust and moisture.
2. Aluminium being softer material, great care must be taken in handling enclosures and other aluminum items.
3. If the site conditions make it impossible to return the items to the cases for storage:
  - a. Nothing must be laid direct on the ground.

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b. All items must be protected against weather and damages.

### 2.5.4.4 HANDLING OF BUS DUCT.

Handling from delivery station to power station stores:

1. Use suitable slings to lift the packages
2. No impact should come on the packings while loading. Do not drop from height.
3. Do not stack busduct packings one above the other; also avoid stacking of heavier items on busduct packings.

### 2.5.4.5 DURING UNPACKING, HANDLING AND STORAGE

#### DO's

1. Check all the packings for any damage during transit.
2. Open the packings carefully.
3. Verify material as per shipping list and report any shortage/damage immediately.
4. Keep material in original packings unless required for erection.
5. Ensure that Manila ropes are used for lifting the busduct.
6. Check the tightness of shipping steel clamps while lifting busduct assembly with busbar in position.
7. Ensure that CTs, LAs, capacitors, N.G. transformer, grounding resistor, fuses, insulators, wall bushings, moulded and rubber items and flexibles are stored in well ventilated area.

#### DON'Ts

1. Don't destroy any markings.
2. Don't drop packings from height.
3. Don't stack heavier items on busduct packings.
4. Don't keep door of cubicle open during storage.
5. Don't lay down unpacked material directly on the ground.
6. Don't cause damage or scratches by dropping, dragging etc. on fragile items such as CTs, PTs, Insulators, rubber items etc.

### 2.5.4.6 DURING ERECTION & COMMISSIONING :

#### DO's

1. Carry out pre-lay survey to verify the position of various equipment to be connected, levels of floors and positions of cutouts.

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2. Keep the layout drawing etc. ready for reference.
3. Draw the material from stores as per erection sequence.
4. Ensure alignment and proper matching of various enclosures and busbars.
5. Ensure proper alignments of epoxy cast CTs and seal-off bushings before final tightening of hardware.
6. Make the busbar joints as per the instructions.
7. Ensure aluminium welding by qualified welder only.
8. Take care for proper sealing while joining the enclosure.
9. Ensure proper earthing of enclosure and structure as specified.
10. Check wiring as per relevant wiring diagram.

### DON'Ts

1. Don't allow accumulation of dirt or foreign material inside the enclosure during erection.
2. Don't overtight the bolts.
3. Don't hammer the bolts etc. while joining the busbars if holes are not matching.
4. Don't forget any foreign material inside the enclosure.
5. Don't allow aluminium welding by unqualified welder.
6. Don't subject IAS, capacitors, and PTs to HT test as these are pre-tested and test at site is not required.
7. Don't subject NG transformers to over voltage as these are pre-tested.
8. Don't apply rated voltage to full bus duct unless pre commissioning checks are completed.
9. Don't apply any voltage to bus ducts when the ends are connected to equipments like transformer and generator.
10. Don't apply high voltage with surge arrestor and lightning arrestors in circuit.

### 2.5.4.7 ERECTION INSTRUCTIONS

#### A. Packing and Shipping

Layout drawing and main bill of material (M.B.O.M) or shipping list should be referred to for identification of various items. All the drawings necessary for assembly and erection are furnished separately.

Busducts are usually despatched as single phase assemblies generally assembled with busbars. The busbars are braced with steel clamps to avoid any damage to insulators and displacement of busbars during transport. Structures, hardwares, flexibles, and other miscellaneous items are packed

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separately.

### B. Marking :

Following markings are done with paint on busduct assemblies and cubicles for identification :

- a. Project name and unit number
- b. Item no of main BOM this is encircled
- c. Phase marking R, Y or B
- d. Work order number
- e. Drawing number and item/variant number
- f. Arrow indicating direction towards transformers end. Direction of arrow shall be decided from lay out.

C. Similarly loose items are also identified by suitable marking on tags.

### 2.5.4.8 PRE LAYOUT SURVEY

Before starting the erection work the centre lines of the complete busduct installation, location of connected equipment such as switchgear, unit auxiliary transformer, LA & VT cubicle, NG Cubicle etc. with respect to generator central line should be established and marked clearly. The various levels of floor, ceiling, terminal position of main transformer, unit auxiliary transformer etc. should also be verified. Any deviations in this regard should be recorded and necessary remedial measures should be taken. In case of any substantial deviation which may effect the erection of busduct installation, the same should be referred to the design engineer. The remedial measures should be planned in advance, which may consist of levelling by suitable packers chipping of the concrete floor or wall etc. or rectification of the components with the concurrence of engineers.

### 2.5.4.9 PROVISION OF FOUNDATION BOLTS & EMBEDDED ITEM

In the power station, busduct is supported on various floors, halls, ceiling, etc. and support structure is suitably attached to the building. For this foundation bolts, embedded items are grouted at number of locations as per foundation drawing.

### 2.5.4.10 SEQUENCE OF ERECTION

Normally the following sequence of erection is recommended.

#### A. Erection of steel work:

First, all the vertical structures are to be installed, leveled and foundation bolts grouted.

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Next, place all the longitudinal cross channels in position, adjust the level and bolt / weld them.

Check up the correctness of levels and positions of various installed structures. For installation of foundation bolts refer foundation details drawing of the project.

### B. Erection of Enclosures :

Before the installation of enclosures in position each assembly of enclosure and conductor complete with insulator supports is to be checked for correctness and cleaned on the working floor.

The various enclosures assembled are to be erected as per layout drawing. After placing the assemblies in position the packing braces/steel clamps inside the ducts are to be removed.

Some of the busduct assemblies will be self supporting only when they are welded to adjacent enclosures, as such some temporary scaffolding is necessary to support these enclosures during erection, leveling and welding.

### C. Handling of Busducts :

For handling of busducts specified instructions should be followed.

### D. Sequence of erection-enclosure assemblies:

In positioning the various enclosures assemblies the following sequence is recommended:

### E. Indoor Portion:

#### (a) Neutral Side

Complete the assembly of top chamber/neutral shorting chamber at the working floor as per the drawing. Connect copper flexible on the generator neutral terminals, and fix it with the generator plate. Provide temporary support as necessary. Complete the assembly of bottom chamber (if applicable) along with CTs and wiring as per drawing at the working floor and match with the top chamber (if applicable). Now fix the supporting structure. Assemble N.G. Transformer and N.G. Reactor and complete the terminal connections.

Note: Before fixing top chamber / bottom chamber, care should be taken that shunts are welded on line side busduct as shown in lay out drawing :

#### (b) Line Side

Assemble copper flexibles and connections with generator line terminals. Match each phase generator enclosure with generator plate and fix to the support structure. Complete the generator terminal bolted connections.

Place P.T cubicle in position match and connect with the respective tap off.

### F. Busbar Joints :

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Busbar joints may be bolted type or welded type as specified for the installation. For making the busbar joints, it is essential that specified procedures and precautions are followed.

### G. Cleaning of Busduct

Before putting the split covers, enclosures make up pieces (welded to enclosure) & covers of inspection windows, all the insulator should be cleaned again. The busduct should also be cleaned and dried up for any moisture/condensates. Thoroughly check the interior of every enclosures and ensure that these are free from any foreign matter.

### H. Inspection of windows, covers, etc.

Finally, the split covers, inspection windows and make-up piece may be assembled. The assembly of split cover, inspection windows and make-up pieces should be done as per recommended procedures and if should be ensured that proper sealing is achieved.

## 2.5.4.11 BUSBAR BOLTED JOINTS

### A. Aluminium to Aluminium Joints (Un plated)

Wipe the contact surfaces with dry clean cloth to remove any dirt, dust and moisture and smear these with recommended jointing compound. Clean the surfaces under the compound by breading with dry coarse emery cloth or stainless steel wire brush. Wipe the surfaces with a clean dry cloth and immediately make a light application of jointing compound. Close up the joints and wipe off excess compound.

### B. Aluminium to Copper Joints :

#### Cleaning of Aluminium surface (Unplated)

Follow Instructions given under clause 2.2.3.12 A above and apply jointing compound.

#### Cleaning of copper surfaces (unplated)

Clean the copper contact surface with emery cloth and wipe the surface with clean dry cloth.

#### Cleaning of copper aluminium surfaces (unplated)

Clean the contact surface with dry cloth to remove dirt, dust and moisture. Apply a light coating of jointing compound.

### C. Aluminium to Copper Joints using bimetallic strip

For cleaning of aluminium and copper surfaces follow instructions given under 2.2.3.12 A&B above. Apply jointing compound to aluminium and copper surfaces.

The contact faces of bimetallic strip should also be cleaned as per the above

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practice and jointing compound applied.

Note : Bimetallic strip is inserted between the copper and aluminium surfaces. Care should be taken that copper faces copper surface and aluminium faces aluminium surface.

### D. Cleaning of copper surfaces (plated)

Clean the contact surface with dry cloth to remove dirt, dust and moisture.

Note: Wire, brush, emery cloth or jointing compound containing metallic particles or other abrasives should not be used on plated surfaces.

### 2.5.4.12 CONTACT PRESSURE

To obtain correct tightening pressure on contact surfaces following torques are recommended for various bolt sizes.

Bolt Size	Recommended Torque	Torque Spanner Capacity
M10	0.85 to 1.3 NM (20-30 Ft-lb)	0.85 to 1.3 NM (20-30 Ft-lb)
M12	1.3 to 1.7 NM (30-40 Ft-lb)	0.85 to 4.3 NM (20-100 Ft-lb)
M16	1.7 to 2.1 NM (40-50 Ft-lb)	0.85 to 4.3 NM (20-100 Ft-lb)
M20	2.1 to 2.5 NM (50-60 Ft-lb)	0.85 to 4.3 NM (20-100 Ft-lb)

Alternatively tighten the nut till belleville washer becomes flat. Then unscrew the nut by about 1/8 th. turn.

### 2.5.4.13 WELDED JOINTS OF SHUNTS

Various locations of shunts to be welded to the enclosures are shown in layout drawing.

### 2.5.4.14 DRAIN VALVE WELDING (IF APPLICABLE)

Mark the location as per lay out and drill 10mm dia hole at the bottom most point of enclosure. Tack weld the drain valve pad to enclosure ensuring proper alignment of pad hole with enclosure hole. Weld continuously as per jointing recommendations. Clean with wire brush and point for final finish.

### 2.5.4.15 FIXING OF NEOPRENE SEAL :

Enclosures are fitted with access covers. Each cover is fitted with four pieces of neoprene seal and held in position by bolted clamps.

(Note: Only one cover should be removed from enclosure at any time to minimise the air flow into the enclosure).

### 2.5.4.16 EARTHING OF SEGREGATED PHASE BUSDUCT AND CUBICLES

#### A. General

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One end of the electrical continuous enclosure should be earthed to station earth at the shunt location where all the three enclosures are shorted. Location of earth points are shown in the layout drawing. For this purpose two drillings are to be done on these shunt to suit at site and two separate earth strap are to be connected to the station earth thus ensuring double earthing.

In some assemblies (such as transformer hood etc) due to short length of enclosures shunts are not provided. In such cases, each phase enclosure should be separately earthed.

One point of the earth phase split cover, rubber bellow clamping strap should be electrically connected to enclosures and in turn enclosures should be earthed.

### B. Cubicle earthing :

Each cubicle is provided with two number of earthing terminals. These terminals are generally located on side face of the cubicle. Both the terminals are to be connected independently to the station earth by suitable connectors.

For earthing the top and bottom C.T. chambers, station earth can be connected to each chambers of two locations for double earthing.

### 2.5.4.17 SITE TESTS ON SEGREGATED PHASE BUSDUCT

#### A. Physical Checks:

Design survey which include dimensional checking of electrical clearances and cleanliness of the installation.

#### B. Cleanliness:

The inside of all enclosures, outside of conductors and insulators should be free from dirt, all, grease, swaft and any deposits, special attention should be paid to the insulators and seal off bushings and oil moisture is to be removed and surfaces polished with a dry soft clutch. All panels/inspection windows cover are to be replaced after cleaning operation.

#### C. Power Frequency High Voltage Test

##### Preparation:

Following equipment must be disconnected from busbars removing the bolted link and grounded suitably prior to conducting this test:

- a. Generator terminals
- b. Unit auxiliary transformer terminals
- c. Generator transformer terminals
- d. Neutral grounding transformer HV terminal
- e. Lightning arresters
- f. Capacitors

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g. Potential transformer.

It is important to ensure that secondary of all the current transformers mounted on busbars are shorted and grounded properly before conducting this test.

Ensure that all insulators seal-off bushings are cleaned free from any dust, grease and moisture etc before test.

During the test, ensure the following

- a. The generator rotor is kept stationary.
- b. H.V. Circuit breakers on system side are kept in the open position.

D. Test Voltage:

The test voltage shall be attenuating current on any frequency between 25 hertz to 100 Hz and approximately of sine-wave form. The r.m.s. value shall be as given in table-1 below:

For A.C. voltage duration of test shall be one minute.

The test with D.C. at a voltage not in excess of the values given in Table-1, Column-3 for the corresponding rated voltage may be substituted for the AC test prescribed.

Table - 1

Rated Highest System Voltage	Test Voltage (A.C.)	Test Voltage (D.C.)
Upto & Including	KV	
3.6	16.8	
7.2	21.6	
12	28	
24	44	
36	60	

E. Meggar-Checks:

Before the application of high voltage, check the insulation of each bus, conductors by means of 2.5 KV meggar. A value e. 100 mega ohms is expected under normal conditions. However, during mainly season this value may fall down considerably and drying up by hot air may be necessary before the test. Minimum acceptable value is around 20 mega ohms. After the application of high voltage the insulation value is checked gain.

F. Application of Test Voltage:

Corresponding test voltage as indicated in Table-1 shall be applied in turn between each phase conductor and its enclosure which shall be kept at ground potential. Remaining two phase conductors and their enclosure shall be properly as in consistent with its value being indicated by the measuring

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instrument. The full test voltage shall be then maintained for specified duration. Each bus including tap-off must withstand the above test voltage.

### 2.5.4.18 SITE TEST RECORDS ON SEGREGATED PHASE BUSDUCTS :

Test conducted on date..... Site .....

Power Frequency high voltage test :

Instrument .....

Phase	Meggar Reading		HV applied & duration A.C./ D.C.	Leakage current	Remarks
	before HV test	after HV test			
R					
Y					
B					

### 2.5.5 SWITCHGEAR / CONTROL PANELS:

#### 2.5.5.1 THE FOLLOWING POINTS SHALL BE CHECKED UP DURING ERECTION

1. Layout of foundation channels.
2. Floor level covered by the panel with respect to main floor level.
3. Location and serial no. of panels.
4. Positioning of panels.
5. Verticality of switchgear panels within the limit specified.
6. Freeness of Breaker Truck and modules in housing and its manual operation.
7. Earthing of panels and breaker truck to station earth.
8. Lugs for termination of HT and LT cables.
9. Mounting and fixing arrangements of Bus bars.
10. Tightening of Busbar jointing bolts as specified.
11. Clearance between :
  - i. Phase to Phase
  - ii. Phase to earth
12. Minimum clearance for:
  - i. Breaker, Truck and moduls withdrawal
  - ii. Distance required for maintenance work
13. Check the operation of:
  - i. Remote control

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- ii. Various required - closing / tripping / alarm / indications / interlocks
- 14. Installation position of insts and relays  
Operation of relays and meters by secondary injection.
- 15. AC/DC supplies for panel  
Final relay settings as per customer requirements.
- 16. Tightness of terminal connections for HT & LT connections.
- 17. Opening operation of breaker, manually and electrically.
- 18. Working of ammeters and voltmeters for their entire range and other panel mounted instruments like recorder, indicator etc.

### 2.5.6 TEST FOR GENERATOR RELAY AND CONTROL PANELS :

#### A. For generator relay panel :

- (i) Functional checks on all the relays in the panel like pickup and drop of voltage and by doing secondary injection.
- (ii) Loop checking of the relays.
- (iii) Checking of interlock and protection as per schemes by Primary injection.
- (iv) Checking of synchronising circuits.
- (v) Calibration of energy meter

#### B. For generator and transformer control panel :

- (i) Checking of the control circuits.
- (ii) Calibration of the panel meters.
- (iii) Checking of the total annunciator / indication system.
- (iv) Calibration of energy meters.

### 2.5.7 BATTERY AND BATTERY CHARGER TESTS

#### 2.5.7.1 Battery

- 1. Checking for completion of civil/ventilation requirement of battery room.
- 2. Checking of adequacy of charger output/ requirement wrt current required battery charging as per the manual.
- 3. Check availability of safety devices, water and first aid kit.
- 4. Check polarity of connections between battery and charger
- 5. Visual inspection test for level and leakage.
- 6. Checking of layout as per approved drawing.
- 7. Checking of IR value from positive to earth and negative to earth.

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8. Checking of voltage per cell and total voltage between positive negative and earth to positive/negative and also tap cell voltage (as applicable).
9. Checking of tightness of connectors on each cell.
10. Checking of capacity test and hourly measurement of specific gravity and voltage for each cell.

### 2.5.7.2 Battery Charger

1. IR test
2. HV test
3. Checking voltage ratio of boost and float mode transformers
4. Checking for charging mode of batteries, constant current and constant voltage mode.
5. Load test on chargers by running of DC drives and by liquid resistance system.
6. Checking of tightness of earthing connections.
7. Check for all alarm conditions.
8. Checking and calibration of all indicating meters.
9. Check functional operation of charger, auto/ manual changeover from float to boost and boost to float.
10. Checking and setting of all relays.
11. Check AC ripple in boost and float mode after charging.
12. Check polarity of cables connected to battery.

Apart from above following tests also to be carried out.

1. Insulation resistance and earth resistance checks.
2. Primary and secondary injection test.
3. Calibration of all instruments
4. Tests at normal voltage and when required at reduced voltage to prove satisfactory closing and tripping from local and remote points, checking of tripping from relay and protective gear, intertripping, interlocks etc. Reduced voltage test at 70% rated voltage to prove tripping of each circuit breaker.
5. Battery capacity test.

### 2.5.8 TESTS FOR EQUIPMENT ERECTED BY MECHANICAL CONTRACTOR

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

#### a) Generator :

Generator set with all auxiliaries and controls shall be assembled and tested to verify compliance with the guaranteed technical particulars and for satisfactory

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performance. Relevant standards shall be followed as guideline for testing. All the tests shall be witnessed by customer or its representative. The commissioning tests shall be carried out at site under normal service conditions.

Following tests shall be carried out on the generators:

1. Insulation resistance test and determination of polarization index value of:
  - Generator
  - Exciter
  - Resistance temperature detectors
2. Dielectric test
3. No load characteristics
4. Short circuit characteristics
5. Temperature rise at rated voltage, current, power factor and frequency.
6. Over-speed test
7. Vibration tests\*
8. Calculation of efficiency
9. Phase sequence / voltage balance / current balance checks.
10. Insulation of bearing pedestal/ housing.
11. Determination of reactance and time constants.
12. Waveform test and harmonic analysis (Type test results are acceptable).
13. Determination of moment of inertia (Type test results are acceptable).

Note :

- a) Vibration tests in the factory to be taken at 100% of synchronous speed and at 120% during over-speed test.
  - b) Vibration test at site to be taken at 100% of synchronous speed of the complete generator with its driver.
14. Instantaneous short circuit test (Optional).
  15. Noise measurement test.
  16. Response of voltage and frequency with sudden shedding of 25%, 50%, 75% and 100% of rated load respectively.
  17. Temperature detector test.
  18. Measurement of DC resistance of winding.
  19. Inter turn insulation test of stator winding with induced voltage 130% of rated value for 5 minutes (if applicable).
  20. Measurement of shaft voltage.
  21. Tan Delta test for generator bushing (If required).

b) AC Motors

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1. IR test of stator and rotor windings.
2. Heating of both windings up to the permissible temp.
3. Checking/testing of associated switchboard, cables, relays / meter interlocking as mentioned in relevant chapters are completed.
4. Tightness of cable connection.
5. Winding resistance measurement of stator and rotor.
6. Checking continuity of winding.
7. Checking tightness of earth connections.
8. Checking space heaters and carryout heating of winding (if required).
9. Checking direction of rotation in decoupled condition during kick start.
10. Measure no load current for all phases.
11. Measurement of temperature of body during no load and load conditions.
12. Check for tripping of motor from local/remote switches and from.
13. Checking of vibration (if required).
14. Checking of noise level (if required).
15. Measurement of stator and bearing temperatures during load running (if applicable) for every half an hour interval till saturation comes.
16. Checking tightness of foundation bolts.
17. Checking operation of speed switch (if there).
18. Check continuity of temperature detectors.
19. Check alignment, paralleling of shafts, level of lubricating oil etc. as per manufacturer's manual.
20. Check contact of slip ring brush and measure brush pressure (150-200 gm/sq. cm).
21. For CACW drive check cooling water and system/piping, availability of pressure, cleaning and pressure testing of pipelines etc.
22. Checking of polarisation index of stator winding, R10/R1 by motorised megger (The value should not be less than 2.0) R60/10 absorption coefficient shall not be less than 1.5.
23. Dielectric test (only for HT Motors).
24. Measurement of open circuit rotor winding voltage for slip ring motor.
25. For actuator drives, following shall be checked/ tested:
  - Visual and dimensional
  - Hydraulic pressure for valves
  - IR and operation of limit switches
  - Winding resistance

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### c) DC Motors

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

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### GENERAL TECHNICAL REQUIREMENTS AND GUIDE LINES FOR INSTALLATION, TESTING & COMMISSIONING OF C&I SYSTEMS

#### 2.5.9 Guidelines for Installation of C & I Equipments

- 2.5.9.1 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.
- 2.5.9.2 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.
- 2.5.9.3 High & Low pressure impulse lines shall not be grouped and run together. Also impulse lines for explosive & inert gases shall not run together.
- 2.5.9.4 Impulse lines of high pressure steam, harmful gases, etc. shall not be brought into the control room, as far as possible.
- 2.5.9.5 Intrinsically safe circuits shall be used for explosion hazardous areas.
- 2.5.9.6 Separate cable routing shall be followed for high and low voltage lines.
- 2.5.9.7 All electrical equipments shall meet the requirements of Indian Electricity Rules.
- 2.5.9.8 Wherever severe vibrations are expected, shock absorbers shall be provided.
- 2.5.9.9 Installation of instruments with radioactive isotopes, mercury and other toxic substances shall be as per statutory regulations provided by authorities.
- 2.5.9.10 Compensating cables should be connected directly to instruments, i.e. no junction boxes shall be used if CJCBS are not provided.
- 2.5.9.11 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.
- 2.5.9.12 Pressure gauges shall be provided with snubbers, syphons (for more than 100°C), 3 way valve manifolds wherever applicable.

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- 2.5.9.13 For pneumatic instruments, air shall be dry & free from oil. Air must be supplied from oil-free compressors specially erected for this purpose. After drying, air must be stored in receiver. Pressure gauges must be provided on each supply line and after the pressure reducer.
- 2.5.9.14 Correct level (height) between detecting element and tapping point and transmitter shall be maintained.
- 2.5.9.15 The equipment shall maintain its normal posture (level, perpendicular, front and back).
- 2.5.9.16 Connection between detecting element/tapping point and transmitter shall be maintained at short distances wherever practicable to avoid any time lag.
- 2.5.9.17 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.
- 2.5.9.18 For details of installing each measuring instruments, instruction manual issued by the respective manufacturer of instruments may be referred to, wherever necessary.
- 2.5.9.19 The drain pipes shall be terminated in a common closed header and finally the common header shall be connected to plant open drain.

### 2.5.10 Guide Line for Erection of IMPULSE LINES

- 2.5.10.1 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.
- 2.5.10.2 The routing of pipelines shall include sufficient flexibility near tappings to allow for thermal expansion of the process equipment.
- 2.5.10.3 The pipes shall be cold bent using hydraulic bending machines only.
- 2.5.10.4 The horizontal impulse lines shall be laid with proper slopes towards the tapping point.
- 2.5.10.5 Supports for piping and tubing shall be adequate and in no case exceed limits shown below:
  - a) 1/4" OD/ 3/8" OD Copper      Continuous
  - b) 1/2" NB Pipe/Tube              5'

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c) ¾" NB Pipe/Tube 5'

d) 1" NB Pipe/Tube 8'

- 2.5.10.6 All impulse line welding shall be done through welding generator/rectifier and only structural welding could be done through welding transformer.
- 2.5.10.7 Impulse pipe of Alloy Steel/SS/CS shall be TIG welded wherever required. Welding of impulse pipe shall be carried out in accordance with BHEL welding procedure. The welding electrodes shall be approved by BHEL welding Engineers. Impulse pipes welders shall undergo welding Test and approved by BHEL welding engineer at site.
- 2.5.10.8 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.
- 2.5.10.9 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.
- 2.5.10.10 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.
- 2.5.10.11 Alternatively hose assembly - S.S. flexible may be used for connection between tapping point and impulse pipe.
- 2.5.10.12 The expansion bends are to be avoided as far as possible, as these act as air/sedimentation traps hampering the system performance.
- 2.5.10.13 Impulse piping shall be arranged as short as possible with a minimum of bends.
- 2.5.10.14 Horizontal piping shall be avoided and 1/10 slope shall be maintained.
- 2.5.10.15 Pipes shall not be laid parallel to high temperature process piping.
- 2.5.10.16 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.
- 2.5.10.17 Impulse Piping for Air & Flue Gas System

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- 2.5.10.17.1 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.
- 2.5.10.17.2 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.
- 2.5.10.17.3 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.
- 2.5.10.18 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.
- 2.5.10.19 Impulse Piping for Steam and Water System**

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- 2.5.10.19.1 As a rule, instrument installation position for steam and water shall be downward from root valves.
- 2.5.10.19.2 Impulse pipes shall have a minimum slope of 1:10 and shall be supported at every 2 metres length.
- 2.5.10.19.3 At the transmitter end, the connection can be either through 2 way valve manifold or nipple with coupling.
- 2.5.10.19.4 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.
- 2.5.10.19.5 Some supplier recommends capillary type tube for transmitter connection from the impulse pipe to instrument by using S.S. tube and compression fittings.
- 2.5.10.19.6 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.
- 2.5.1.1.1 In the case of high temperature steam applications, sufficient length of siphon shall be provided to ensure certain length of condensate is formed thereby protecting breaking the measuring instrument from high temperature. Snubbers can also be provided if there is likely to be any pulsating of the medium measured.
  
- 2.5.10.20 Bending.
- 2.5.10.20.1 It is recommended for cold bend for the impulse pipes with the help of a hydraulic bending machine to achieve a particular shape. 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.
- 2.5.10.20.2 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.
- 2.5.10.20.3 Large bending shall be so made as to form smooth curve.
  
- 2.5.10.21 Cutting

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- 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.

### 2.5.10.22 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.

### 2.5.10.23 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 2 times the maximum working pressures. The fall in pressure shall not be more than 1 Kg/Cm<sup>2</sup> 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 pressure.

### 2.5.10.24 Guidelines for Installation of Pneumatic Line

- 2.5.10.24.1 Copper tubing shall be connected with Olive type of compression fittings.
- 2.5.10.24.2 When two or more lines run together, the joint in the adjacent alternate line shall be a offset.
- 2.5.10.24.3 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.
- 2.5.10.24.4 Multi-core copper tubing shall not to be bend less than 10 deg and D is the OD if the multi-core copper. All air distribution, main and branch lines shall be galvanised internally as well as externally and the galvanised pipe, never, shall be braced or welded. 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.
- 2.5.10.24.5 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.
- 2.5.10.24.6 Instrument airline should not be routed where severe vibration, high temperature exists and adequate space should be available for maintenance.

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- 2.5.10.24.7 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.
- 2.5.10.24.8 While using the pipe cutter, care shall be taken to remove burr from the cutting side.
- 2.5.10.24.9 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 meter distance.
- 2.5.10.24.10 While fixing the copper tube fittings only Teflon tapes should be used. However, no tape shall be used while tightening the ferrules.

### 2.5.10.25 Instrument Air line Testing

- 2.5.10.25.1 All instrument air lines shall be isolated from the instruments and pressurised pneumatically to maximum working pressure. It shall then be isolated from the source of pressure and fall shall be less than 1 psi in 20 minutes.
- 2.5.10.25.2 All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurised pneumatically 20 psi, and checked with soap solution for leak.

### 2.5.10.26 General Guidelines on Installation of Flexible Hoses

- 2.5.10.26.1 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).
- 2.5.10.26.2 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).
- 2.5.10.26.3 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.
- 2.5.10.26.4 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.

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- 2.5.10.26.5 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.
- 2.5.10.26.6 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.
- 2.5.10.26.7 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.
- 2.5.10.27 **General Notes on Installation of Local Instrument Racks and JB Frames.**
- 2.5.10.28 In cases where the local instrument stands are to be installed on a concrete foundation, it shall be fixed by anchor bolts.
- 2.5.10.29 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.
- 2.5.10.30 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.
- 2.5.10.31 Local Instrumentation rack, which shall be installed utilizing the Beam and Structure, shall be fixed by welding. Care shall be taken while deciding the location in order to ensure that no hindrance is caused to the maintenance personnel in their moving space within the work area. Further as a standard practice, it should be ensured that no instrument stands/ racks/ JBs shall be supported by/ welded on to any of the working equipments, or even hand gridded or floor gridded, as per safety norms.
- 2.5.10.32 Proper care should be taken to ensure that welding of the stand on any structure or beam is fully welded.
- 2.5.11 **General Guideline on Flow Instruments Installation**
- 2.5.11.1 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.
- 2.5.11.2 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 behavior of reading periodically.
- 2.5.11.3 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.

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- 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.
- 2.5.11.4 Always  $\frac{3}{4}$ " 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.
- 2.5.11.5 The Measuring instrument shall be located close to the flow-sensing element. The speed of response is reduced if there is a long run,
- 2.5.11.6 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.
- 2.5.11.7 Location of Flow element should have clear straight run of 10D in upstream and 5D in downstream.
- 2.5.11.8 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.
- 2.5.11.9 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.
- 2.5.11.10 If the flow of any dry gases are to be measured, the location of instrument can be kept above or below the tapping points.
- 2.5.11.11 The condenser pot should be located nearer to the tapping point and both condenser chamber should be at the level of upper tapping.
- 2.5.11.12 For air flow measurements, it is always preferable to install the instruments above the pipeline. In case if the instrument must be installed
- 2.5.11.13 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.
- 2.5.11.14 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 startup of the boiler in order to remove Air and Vapor which might have got entrapped.
- 2.5.11.15 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.

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- 2.5.11.16 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.
- 2.5.11.17 The commonly used sealing liquid includes water, light oil, glycerol, ethylene glycol and mixtures of the last two with water.
- 2.5.11.18 The sealing chambers, in each pressure pipe, should be installed at the same level and as close as possible to the pressure tapings.
- 2.5.11.19 The general arrangement for pressure tapings from the Sealing Chamber to the instrument is shown in the sketch.
- 2.5.11.20 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.

### 2.5.12 General Guideline on Installation of Valves

- 2.5.12.1 Primary isolating valves (root valves) must be located at the tapping which can be of globe valves.
- 2.5.12.2 These valves shall be installed where access is possible.
- 2.5.12.3 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.
- 2.5.12.4 For pressure more than exceeding 40 kg, 2 isolating valves shall be provided.
- 2.5.12.5 In the case of heavy duty isolating valves, suitable support shall be provided to avoid any loading on the stubs.
- 2.5.12.6 In viscous fluids, suitable steam tracing shall be provided.
- 2.5.12.7 These valves are always located as nearer to the measuring device as possible.
- 2.5.12.8 **Blowdown Valves or Drain Valves**
  - a) These valves are fixed at the lowest end of impulse pipe.
  - b) In the case of high-pressure line always 2 valves shall be fitted in series. Normally, these valves will be of globe type.
  - c) For low-pressure application, single valve is used.
  - d) In case of air and flue gas measurements, either a plug or a suitable gate valve of 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.

### 2.5.13 PAINTING

All the supporting steelworks impulse pipe shall have protective painting. The surface shall be free from rust, foreign adhering matters, grease etc. Two

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coats of rust preventing red-oxide primer and final painting of two coats as per the colour DECIDED by the site engineer. (More details please refer Part 1 scope of works). After cleaning the surface is painted with one coat of Red oxide zinc chromate primer conforming 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.

### 2.5.14 GUIDELINES FOR CABLE LAYING

- 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) In case of multi-core cables of diameter up to 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.
- 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.
- 4) GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends
- 5) In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy duty PVC pipes shall be provided.
- 6) Entry of cables through trenches/tunnels into buildings shall be by means of one of the methods indicated in drawing as applicable for different buildings.
- 7) 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.
- 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 2000 mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be of enclosed type.
- 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.

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- 10) Cable trays shall be supported on ISA 50x50x6mm MS/GI brackets. Brackets shall be welded to steel plate inserts in the trenches / tunnels or supporting channel angle / inserts in other areas.
- 11) Wherever direct heat radiation exists, heat isolating barriers (subject to customers approval), for cabling system shall be adopted.
- 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.
- 13) If required, a few numbers of cables in exceptional areas may be directly buried into the earth.
- 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.
- 15) At certain places where hazardous fumes / gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.
- 16) In corrosive atmosphere, PVC conduits shall be used for cables.
- 17) Single core cables, when pulled individually shall be taken through PVC pipes only.
- 18) Laying and installation of power, control and special cables shall generally conform to IS : 1255
- 19) The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
- 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.
- 21) Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.
- 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.
- 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

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crossings, every 25m spacing for straight runs or as specified by Engineer for easy identification of cable.

- 24) When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.
- 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.
- 26) Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacing not less than one cable diameter of bigger diameter cable.
- 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.
- 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.
- 29) Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formation:
  - 29.1 HT cables shall be laid in the top tier(s)
  - 29.2 LT power cables to be laid in the tray(s) below the HT cable trays.
  - 29.3 LT control cables to be laid in the Tray(s) next below to the LT power cable (trays)
  - 29.4 Special control cables including screened control cables to be laid in the bottom most tray(s).
- 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.
- 31) When it may not be possible to accommodate the cables as per the criteria indicated in the two clauses 29 & 30 indicated above, the following rules shall override the criteria. However, prior approval of the Engineer will be required. In hierarchical order:
  - 31.1 Control cables are mixed up with the special control cables with clear minimum gap of 100 mm between them.
  - 31.2 LT power cables are mixed up with control cable with clear minimum gap of 150 mm between them.
  - 31.3 LT power cables are mixed up with HT power cables with clear minimum gap of 200 mm between them.

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- 31.4 LT power cables are mixed up with special control cables with clear minimum gap of 200 mm between them.
- 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.
- 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.
- 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 6 mm thickness.
- 35) To facilitate pulling of cables in GI conduits, powdered soft stone, plastic scoop or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.
- 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.
- 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.
- 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.
- 39) Wherever specific cable routes are not shown in cable schedules cables shall be laid as directed by Engineer.
- 40) **Support Spacings & Clampings**  
Support spacing and clamping suitably provided and as required
- 41) **Laying of cables directly buried in ground**  
Laying and installation of directly buried cables in ground shall conform to the requirements of IS 1255.
- 2.5.15 **CODES AND STANDARDS**  
Installation of cabling work shall comply with the following Indian Standards (Latest editions):

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- 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 and CEA.
- d) Regulations laid down by the Factory Inspector of State.
- e) Any other regulations laid down by the authorities.

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

### 2.5.16 GUIDELINES FOR ERECTION OF Cable Trays, GI PIPES, Supports & Accessories.

- 2.5.16.1 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.
- 2.5.16.2 Wherever specified or directed by Engineer, the contractor shall install galvanised MS sheets covers over cable trays. The width of the covers shall be

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- same as that of cable trays. Bolting shall be done to fasten covers to the cable trays, elbows, reducers, tees, crosses etc.
- 2.5.16.3 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.
- 2.5.16.4 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.
- 2.5.16.5 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.
- 2.5.16.6 Cable trays/racks shall be so arranged that they do not obstruct or impair clearances of passage way or maintenance of adjacent equipment.
- 2.5.16.7 For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.
- 2.5.16.8 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.
- 2.5.16.9 GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.
- 2.5.16.10 The entire GI conduit system shall be firmly fastened in position. All boxes and fittings shall generally be secured independently from the GI pipes entering them.
- 2.5.16.11 Bends of GI pipes/conduits shall be made without causing damage to the pipes/conduits.
- 2.5.16.12 Occupancy of conduits shall not be greater than 40%.
- 2.5.16.13 The adopter for coupling rigid GI pipe/conduits and flexible conduit shall be of aluminium or galvanised steel.
- 2.5.16.14 Transportation and storage of cable drums
- 2.5.16.15 Transportation and storage of cable drums shall generally conform to the requirements of IS : 1255
- 2.5.16.16 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.
- 2.5.16.17 The cable drums shall be transported on wheels to the place of work.
- 2.5.17 **GUIDELINES FOR Cable Termination and Jointing**
- 2.5.17.1 Contractor shall carry out cable terminations at various electrical and electronic equipment terminals.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 2.5.17.2 When the equipment are provided with undrilled gland plates for cable/conduit entry into the equipment, drilling and cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site and drawings shall be prepared and take engineer's approval before drilling holes. cutting shall not be allowed.
- 2.5.17.3 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.
- 2.5.17.4 All cable entries in the equipment shall be sealed after glanding the cables..
- 2.5.17.5 Adequate length of cables shall be pulled inside the switch boards, control panels, terminal boxes etc. as per near termination of each core/conductor.
- 2.5.17.6 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.
- 2.5.17.7 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.
- 2.5.17.8 Screened control cables of 0.5 sq. mm cross-sectional area shall be terminated by means of wire rapping system.
- 2.5.17.9 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.
- 2.5.17.10 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.
- 2.5.17.11 Termination and jointing of aluminium/copper conductor power cables shall be done by means of compression method using compression type aluminium / tinned copper lugs.
- 2.5.17.12 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.
- 2.5.17.13 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.
- 2.5.17.14 Junction boxes shall be used, wherever required, for jointing of control cables.
- 2.5.17.15 Termination and jointing shall generally conform to the requirements of IS : 1255

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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and shall strictly conform to the recommendations of termination and jointing kit supplier.

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

#### 2.5.18.1 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.

#### 2.5.18.2 Self-Locking Clamps

- a) Clamps shall be of nylon material/fibre glass.
- b) Clamps shall have self-locking feature when the cord is looped.
- c) Clamps shall be provided with manual lock release.
- d) Clamp cord shall not move in the backward position once it has been locked, unless the lock release is applied.
- e) Type test certificates to ascertain the strength of clamps shall be submitted for purchaser's approval.
- f) Nylon self-locking clamps shall be of BHEL approved make only.

#### 2.5.18.3 Ferrules

- a) Ferrules shall be required for individual core of cable hence they shall be suitable for the insulated conductor diameter.
- b) Ferrules shall be of plastic material.
- c) Numbering on the ferrules shall be engraved type with contrast colour to the base. Engrave colouring shall be of durable quality to match the entire life of the plant. Engraving shall be legible from a distance of 600 mm.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 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.

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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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### 2.5.19 GUIDELINES FOR EARTHING Installation

- 2.5.19.1 All equipments shall be earthed by two separate and distinct connections. Earthing terminals will be available in all the equipment supplied by BHEL.
- 2.5.19.2 The earthing conductors shall be mild steel/G.I. strips/wires. All connections from the equipments to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the successful tenderer.
- 2.5.19.3 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.
- 2.5.19.4 All joints in the earthing system shall be welded type. Earthing connections to all equipment including motors shall be bolted type.
- 2.5.19.5 Earthing connections shall be free from tinning scale, paint, grease, rust or dirt at the time of making joint.
- 2.5.19.6 Metallic sheaths, screens/shields and armour of all multicore cables shall be bonded and earthed.
- 2.5.19.7 Earthing conductors along with their run on columns, beams, walls etc., shall be supported by suitable cleats at intervals of 750 mm.
- 2.5.19.8 Conduits shall be bonded together and grounded at all switchgear and control centres.
- 2.5.19.9 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.
- 2.5.19.10 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.

### 2.5.20 Guidelines for Erection of Control Panels and Distribution Boards Erection

- 2.5.20.1 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 be grouted. Suitable concrete drilling machine shall be used for making hole on the concrete floor.
- 2.5.20.2 For the panels which are to be mounted on the trenches, channel supports have to be provided across the cable trenches over which the base frames of the panels shall be mounted. Fabrication and erection of these support structures shall be carried out as per drawings.

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- 2.5.20.3 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.
- 2.5.20.4 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.
- 2.5.20.5 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:
    - i. Remote control
    - ii. 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.
- 2.5.21 415 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

## TECHNICAL CONDITIONS OF CONTRACT (TCC)

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- m) Phase rotation checks
- n) High voltage test on 7C.1.3KV switchboard

### 2.5.22 Cutting & Wastage Allowance

The following scrap allowances are permissible:

	non- salvageable	unaccountable
1. Length below 0.5 M steel pipes, SS/Cu tubes, Single pair cables	2%	0.5%
2. Length below 20m multi cable, multitubes	2%	0.5%

### 2.5.23 Guidelines for handling of solid state modules:

- All the solid-state modules shall be handled by qualified person.
- Electronic modules should only be touched when it is absolutely essential.
- Before touching any electronic modules, the operator should discharge the static electricity by earthing himself or better still, ensure constant discharge by wearing an earthed wrist strip.
- The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing 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.

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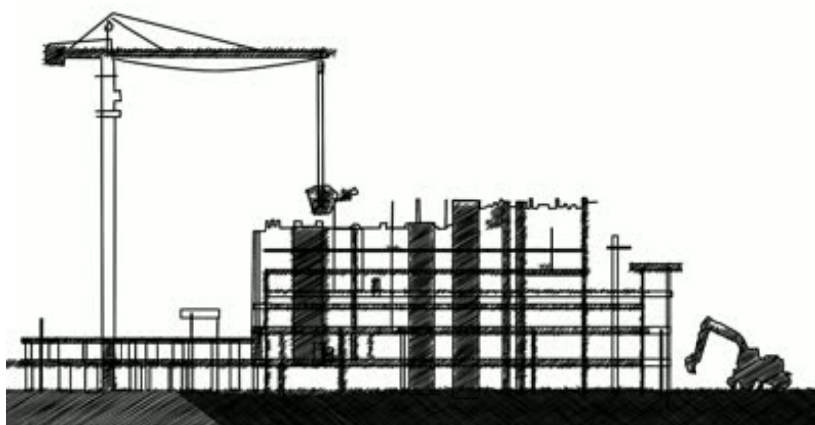
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- 2.5.24 Guidelines for landing and storage of Electronic Cubicles/sub-assemblies / loose items.
- 2.5.24.1 Immediately after unloading at site, the electronic equipment should be kept in the covered area. Handling and lifting of the package should 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.
- 2.5.24.2 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.
- 2.5.24.3 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.
- 2.5.24.4 After opening the case, all supports provided for transport are to be removed with due care.
- 2.5.24.5 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-IA PART – II CHAPTER –VI

HSE PLAN FOR SITE OPERATIONS BY  
SUB-CONTRACTORS

- Next 72 pages



**HEALTH,  
SAFETY and  
ENVIRONMENT  
PLAN**

for

**SITE  
OPERATIONS**

by

**SUB-  
CONTRACTORS**

**POWER SECTOR**



HEALTH, SAFETY AND ENVIRONMENT  
PLAN FOR  
SITE OPERATION by SUBCONTRACTORS

Doc no.: HSEP: 14

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Date: 12.08.2014

POWER SECTOR

DOCUMENT ISSUE SHEET

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Signature			
Date	12/8/14	12/8/14	12/8/14

# HSE PLAN FOR SITE OPERATIONS BY BHEL'S SUBCONTRACTORS

## AT A GLANCE

BEFORE START	<b>SIGNING OF MOU</b> Agree to comply to HSE requirement- Statutory and BHEL's	
PLAN	<b>HSE ORGANISATION</b>	
	<p style="text-align: center;"><b>Manpower</b></p> <ul style="list-style-type: none"> <li>1 (one) safety officer for every 500 workers or part thereof</li> <li>1(one) safety-steward/ supervisor for every 100 workers</li> </ul> <p><b>Qualification</b> As per Cl. 7.1</p>	<p style="text-align: center;"><b>HSE Roles and responsibilities</b></p> <ul style="list-style-type: none"> <li>Site In-charge- As per clause 7.2.1</li> <li>Safety officer- As per clause 7.2.2</li> </ul>
	<b>HSE Planning</b> for Man , Machinery/Equipment/Tools & Tackles	
PROVIDE	<b>HSE INFRASTRUCTURE</b>	
	<ul style="list-style-type: none"> <li>PPEs</li> <li>Drinking Water</li> <li>Washing Facilities</li> <li>Latrines and Urinals</li> <li>Provision of shelter for rest</li> <li>Medical facilities</li> </ul>	<ul style="list-style-type: none"> <li>Canteen facilities</li> <li>Labour Colony</li> <li>Emergency Vehicle</li> <li>Pest Control</li> <li>Scrapyard</li> <li>Illumination</li> </ul>
TRAIN	<b>HSE TRAINING , AWARENESS &amp; PROMOTION</b>	
	<p style="text-align: center;"><b>Training</b></p> <ul style="list-style-type: none"> <li>Induction training</li> <li>Height work and other critical areas</li> <li>Tool Box talk &amp; Pep Talk</li> </ul>	<p style="text-align: center;"><b>Awareness &amp; Promotion</b></p> <ul style="list-style-type: none"> <li>Signage</li> <li>Poster</li> <li>Banner</li> <li>Competition</li> <li>Awards</li> </ul>
COMMUNICATE	<b>HSE COMMUNICATION</b>	
	<p style="text-align: center;"><b>Incident Reporting</b></p> <ul style="list-style-type: none"> <li>Accident- Fatal &amp; Major</li> <li>Property damage</li> <li>Near Miss</li> </ul>	<p style="text-align: center;"><b>Event Reporting</b></p> <ul style="list-style-type: none"> <li>Celebrations</li> <li>Training</li> <li>Medical camp</li> </ul>

**EXECUTE SAFELY**

**OPERATIONAL CONTROL PROCEDURES**

**PERMIT TO WORK**

Height work ( above 2 metres), Hot Work, Heavy Lifting, Confined Space, Radiography, excavation( More than 4 metres)

**SAFETY DURING WORK EXECUTION**

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Welding</li> <li>• Rigging</li> <li>• Cylinder- storage &amp; Movement</li> <li>• Demolition work</li> <li>• T&amp;Ps</li> <li>• Chemical Handling</li> <li>• Electrical works</li> </ul> | <ul style="list-style-type: none"> <li>• Fire</li> <li>• Scaffolding</li> <li>• Height work</li> <li>• Working Platform</li> <li>• Excavation</li> <li>• Ladder</li> <li>• Lifting</li> <li>• Hoisting appliance</li> </ul> |
|--|---|

**HOUSE KEEPING**

**WASTE MANGEMENT**

**TRAFFIC MANAGEMENT**

**ENVIRONMENTAL CONTROL**

**EMERGENCY PREPAREDNESS AND RESPONSE PLAN**

**CHECKS**

**HSE AUDITS & INSPECTION**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Daily Checks</li> <li>• Inspection of PPEs</li> <li>• Inspection of T&amp; Ps</li> <li>• Inspection of Cranes &amp; Winches</li> </ul> | <ul style="list-style-type: none"> <li>• Inspection of Height work</li> <li>• Inspection of Welding and Gas cutting</li> <li>• Inspection of elevators etc</li> </ul> |
|---|---|

**HSE PERFORMANCE EVALUATION PARAMETERS**

**NON CONFORMANCE**

**PENALTY for NON CONFORMANCE**

**Refer Clause 16**

**Incremental penalty**

For repeated violation by the same person, the penalty would be double of the previous penalty

For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.



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## 1.0 PURPOSE

- 1.1 The purpose of this HSE Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during installation and servicing of industrial projects and power plants.
- 1.2 This document shall be followed by BHEL's subcontractors at all installation and servicing sites. In case customer specific documents are to be implemented, this document will be followed in conjunction with customer specific documents.
- 1.3 Although every effort has been made to make the procedures and guidelines in line with statutory requirements, in case of any discrepancy relevant statutory guidelines must be followed.
- 1.4 In case the customer has any specific requirement, the same is to be fulfilled.

## 2.0 SCOPE

The document is applicable for BHEL's Subcontractors at all installation / servicing activities of BHEL Power Sector as per the relevant contractual obligations.

## 3.0 OBJECTIVES AND TARGETS

The HSE Plan reflects that BHEL places high priority upon the Occupational Health, Safety and Environment at workplaces.

- Ensure the Health and Safety of all persons at work site is not adversely affected by the work.
- Ensure protection of environment of the work site.
- Comply at all times with the relevant statutory and contractual HSE requirements.
- Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
- Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.
- Provide all personnel with adequate information, instruction, training and supervision on the safety aspect of their work.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including subcontractors in respects of HSE.
- Establish effective communication on HSE matters with all relevant parties involved in the Project works.
- Ensure that all work planning takes into account all persons that may be affected by the work.
- Ensure fitness testing of all T&Ps/Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent person.
- Ensure timely provision of resources to facilitate effective implementation of HSE requirements.
- Ensure continual improvements in HSE performance
- Ensure conservation of resources and reduction of wastage.
- Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
- Ensure timely implementation of correction, corrective action and preventive action.



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**HSE TARGETS**

EXPLOSION	ZERO
FATALITY	ZERO
LOST TIME INJURY	ZERO
FIRE	ZERO
VEHICLE INCIDENTS	ZERO
ENVIRONMENTAL INCIDENTS	ZERO

**4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY**

**Power Sector HSE Policy**

We, at BHEL Power Sector, reaffirm our belief that the Health and Safety of our stakeholders and conservation of Environment is of utmost importance and takes precedence in all our business decisions. In pursuit of this belief and commitment, we strive to:

- ✓ Ensure total compliance with applicable legislation, regulations and other requirements concerning Occupational Health, Safety and Environment.
- ✓ Ensure continual improvement in the Occupational Health, Safety and Environment Management System performance.
- ✓ Enhance Occupational Health, Safety and Environment awareness amongst employees, customers and suppliers by proactive communication and training.
- ✓ Review periodically and improve Occupational Health, Safety and Environment Management System to ensure its continuing suitability, adequacy and effectiveness in a continuously changing business environment.
- ✓ Develop a culture of safety through active leadership and provide appropriate training at all levels to enable employees to fulfill their Health, Safety and Environmental obligations.
- ✓ Incorporate appropriate Occupational Health, Safety and Environmental criteria into business decisions for selection of plant, technology and services as well as appointment of key personnel.
- ✓ Ensure availability at all times of appropriate resources to fully implement the Occupational Health, Safety and Environmental policy of the company.

This policy will be communicated to all employees and made available to interested parties.

Sd/-

Date: 01.05.2013

Director (Power)



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**5.0 MEMORANDUM OF UNDERSTANDING:**

After award of work, subcontractors are required to enter into a memorandum of understanding as given below:

**Memorandum of Understanding**

BHEL, Power Sector \_\_\_\_\_ Region is committed to Health, Safety and Environment Policy (HSE Policy).

M/s \_\_\_\_\_ do hereby also commit to comply with the same HSE Policy while executing the Contract Number \_\_\_\_\_

M/s \_\_\_\_\_ shall ensure that safe work practices as per the HSE plan. Spirit and content therein shall be reached to all workers and supervisors for compliance.

In addition to this, M/S \_\_\_\_\_ shall comply to all applicable statutory and regulatory requirements which are in force in the place of project and any special requirement specified in the contract document of the principal customer.

M/s \_\_\_\_\_ shall co-operate in HSE audits/inspections conducted by BHEL /customer/ third party and ensure to close any non-conformity observed/reported within prescribed time limit.

Signed by authorized representative of M/s -----

Name :

Place & Date:



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## 6.0 TERMS AND DEFINITIONS

### 6.1 DEFINITIONS

#### 6.1.1 INCIDENT

Work- related or natural event(s) in which an injury , or ill health (regardless of severity), damage to property or fatality occurred, or could have occurred.

#### 6.1.2 NEAR MISS

An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as "Near-Miss".

#### 6.1.3 MAN-HOUR WORKED

The total number of man hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labours. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of workdays for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

#### 6.1.4 FIRST AID CASES

First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time.

#### 6.1.5 LOST TIME INJURY

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

#### 6.1.6 MEDICAL CASES

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.

#### 6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

##### **Non-Reportable Cases:**

An incident, where the injured person is given medical help and discharged for work without counting any lost time.



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**Reportable Cases:**

In this case the injured person is disable for 48 hours or more and is not able to perform his duty.

**Injury Cases:**

These are covered under the heading of non-reportable cases. In these cases the incident caused injury to the person, but he still continues his duty.

**6.1.8 TOTAL REPORTABLE FREQUENCY RATE**

Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

$$\frac{\text{Number of Reportable LTI} \times 1,000,000}{\text{Total Man Hours Worked}}$$

**6.1.9 SEVERITY RATE**

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:

$$\frac{\text{Days lost due to LTI} \times 1,000,000}{\text{Total Man Hours Worked}}$$

**6.1.10 INCIDENCE RATE**

Incidence Rate is the Number of LTI per one thousand manpower deployed. Mathematically, the formula reads as:

$$\frac{\text{Number of LTI} \times 1000}{\text{Average number of manpower deployed}}$$

**7.0 HSE ORGANISATION**

**Number of safety officers:**

The subcontractor must deploy one safety officer for every 500 workers or part thereof in each package. In addition, there must be one safety-steward/safety-supervisor for every 100 workers.

**Deployment:** The subcontractor should deploy sufficient safety officers and safety-steward/Safety-supervisor, as per requirement given above, since initial stage and add more in proportion to the added strength in work force. Any delay in deployment will attract a penalty of Rs.30,000/- per man month for the delayed period.

**7.1 QUALIFICATION FOR HSE PERSONNEL**

Sl.no	Designation	Qualification	Experience
1	Safety officer (Construction Agency)	Degree or Diploma in Engineering with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years for degree holder and five years for diploma holder in the field of Construction of power plant/ major industries



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2	Safety-Steward/ Supervisor	Safety-	Degree or diploma in any discipline with full time diploma in Industrial Safety with construction safety as one of the subjects	Minimum two years
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## 7.2 RESPONSIBILITIES

### 7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

- Shall sign Memorandum of Understanding (MoU) for compliance to BHEL's HSE Plan for Site Operations as per clause 5.0
- Shall engage qualified safety officer(s) and steward (s) as per clause 7.0
- Shall adhere to the rules and regulations mentioned in this code, practice very strictly in his area of work in consultation with his concerned engineer and the safety coordinator.
- Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.
- Shall not engage any employee below 18 years.
- Shall arrange for all necessary PPEs like safety helmets, belts, full body harness, shoes, face shield, hand gloves etc. before starting the job. Shall ensure that no working men/women carry excessive weight more than stipulated in Factory Rule Regulation R57.
- Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent person.
- Shall ensure that provisions stipulated in contract Labour Regulation Act 1970, Chapter V C.9, canteen, rest rooms/washing facilities to contracted employees at site.
- Shall adhere to the instructions laid down in Operation Control Procedures (OCPs) available with the site management.
- Shall ensure that person working above 2.0 meter should use Safety Harness tied to a life line/stable structure.
- Shall ensure that materials are not thrown from height. Cautions to be exercised to prevent fall of material from height.
- Shall report all incidents(Fatal/Major/Minor/Near Miss)to the Site engineer /HSE officer of BHEL.
- Shall ensure that Horseplay is strictly forbidden.
- Shall ensure that adequate illumination is arranged during night work.
- Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.
- Shall ensure display of adequate signage/posters on HSE.
- Shall ensure that mobile phone is not used by workers while working.
- Shall ensure conductance of HSE audit, mockdrill, medical camps, induction training and training on HSE at site.
- Shall ensure full co-operation during HQ/External /Customer HSE audits.



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- Shall ensure submission of look-ahead plan for procurement of HSE equipment's and PPEs as per work schedule.
- Shall ensure good housekeeping.
- Shall ensure adequate valid fire extinguishers are provided at the work site.
- Shall ensure availability of sufficient number of toilets /restrooms and adequate drinking water at work site and labour colony.
- Shall ensure adequate emergency preparedness.
- Shall be member of site HSE committee and attend all meetings of the committee
- Power source for hand lamps shall be maximum of 24 v.
- Temporary fencing should be done for open edges if Hand – railings and Toe-guards are not available.

**7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR**

- Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, P&M and other tools and tackles.
- Facilitate inclusion of safety elements into Work Method Statement.
- Highlight the requirements of safety through Tool-box / other meetings.
- Help concerned HOS to prepare Job Specific instructions for critical jobs.
- Conduct investigation of all incident/dangerous occurrences & recommend appropriate safety measures.
- Advice & co-ordinate for implementation of HSE permit systems, OCPs & MPs.
- Convene HSE meeting & minute the proceeding for circulation & follow-up action.
- Plan procurement of PPE & Safety devices and inspect their healthiness.
- Report to PS Region/HQ on all matters pertaining to status of safety and promotional program at site level.
- Facilitate administration of First Aid
- Facilitate screening of workmen and safety induction.
- Conduct fire Drill and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- Apprise PS– Region on safety related problems.
- Notify site personnel non-conformance to safety norms observed during site visits / site inspections.
- Recommend to Site In charge, immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
- To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
- Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.
- Shall work as interface between various agencies such customer, package-in-charges, subcontractors on HSE matters



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## 8.0 PLANNING BY SUBCONTRACTOR

### 8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.
- The machinery and equipment to be embraced for this purpose shall include but not limited to the following:
  - Mobile cranes.
  - Side Booms.
  - Forklifts.
  - Grinding machine.
  - Drilling machine.
  - Air compressors.
  - Welding machine.
  - Generator sets.
  - Dump Trucks.
  - Excavators.
  - Dozers
  - Grit Blasting Equipment.
  - Hand tools.
- Subcontractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the subcontractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.

### 8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

- The subcontractor shall arrange induction and regular health check of their employees as per schedule VII of BOCW rules by a registered medical practitioner.
- The subcontractor shall take special care of the employees affected with occupational diseases under rule 230 and schedule II of BOCW Rules. The employees not meeting the fitness requirement should not be engaged for such job.
- Ensure that the regulatory requirements of excessive weight limit (to carry/lift/ move weights beyond prescribed limits) for male and female workers are complied with.
- Appropriate accommodation to be arranged for all workmen in hygienic condition.



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**8.3 PROVISION OF PPEs**

- Personnel Protective Equipment (PPEs), in adequate numbers, will be made available at site & their regular use by all concerned will be ensured
- The following matrix recommends usage of minimum PPEs against the respective job.

Sl. No	Type of work	PPEs
1	Concrete and asphalt mixing	Nose mask, hand glove, apron and gum boot
2	Welders/Grinders/ Gas cutters	Welding/face screen, apron, hand gloves, nose mask and ear muffs if noise level exceeds 90dB. Helmet fitted with welding shield is preferred for welders
3	Stone/ concrete breakers	Ear muffs, safety goggles, hand gloves
4	Electrical Work	Rubber hand glove, Electrical Resistance shoes
5	Insulation Work	Respiratory mask, Hand gloves, safety goggles
6	Work at height	Double lanyard full body harness, Fall arrestor (specific cases)
7	Grit/Sand blasting	Blast suit, blast helmet, respirator, leather gloves
8	Painting	Plastic gloves, Respirators (particularly for spray painting)
9	Radiography	As per BARC guidelines

- The PPEs shall conform to the relevant standards as below and bear ISI mark.

**Relevant is-codes for personal protection**

IS: 2925 – 1984	Industrial Safety Helmets.
IS: 4770 – 1968	Rubber gloves for electrical purposes.
IS: 6994 – 1973 (Part-I)	Industrial Safety Gloves (Leather & Cotton Gloves).
IS: 1989 – 1986 (Part-I-II)	Leather safety boots and shoes.
IS: 5557 – 1969	Industrial and Safety rubber knee boots.
IS: 6519 – 1971	Code of practice for selections care and repair of Safety footwear.
IS: 11226 – 1985	Leather Safety footwear having direct molding sole.
IS: 5983 – 1978	Eye protectors.
IS: 9167 – 1979	Ear protectors.
IS: 1179-1967	Eye & Face protection during welding
IS: 3521 – 1983	Industrial Safety Belts and Harness
IS:8519 -1977	Guide for selection of industrial Safety equipment for body protection
IS:9473-2002,14166-1994,14746-1999	Respiratory Protective Devices

The list is not exhaustive. The safety officer may demand additional PPEs based on specific requirement.



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- Where workers are employed in sewers and manholes, which are in use, the subcontractor shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into manhole, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent incident to the public
- Besides the PPEs mentioned above, the persons shall use helmet and safety shoe. The visitors shall use Helmet and any other PPEs as deemed appropriate for the area of work.

Colour scheme for Helmets:

1. Workmen: Yellow
  2. Safety staff: Green or white with green band
  3. Electrician: Red
  4. Others including visitors: White
- All the PPEs shall be checked for its quality before issue and the same shall be periodically checked. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be repaired/ replaced.
  - The issuing agency shall maintain register for issue and receipt of PPEs.
  - The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front.
  - The body harnesses shall be serial numbered.

## **8.4 ARRANGEMENT OF INFRASTRUCTURE**

### **8.4.1 DRINKING WATER**

- Drinking water shall be provided and maintained at suitable places at different elevations.
- Container should be labeled as " Drinking Water"
- Cleaning of the storage tank shall be ensured atleast once in 3 months indicating date of cleaning and next due date.
- Potability of water should be tested as per IS10500 at least once in a year.

### **8.4.2 WASHING FACILITIES**

- In every workplace, adequate and suitable facilities for washing shall be provided and maintained.
- Separate and adequate cleaning facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition and dully illuminated for night use.
- Overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the painters and other workers to wash during the cessation of work.

### **8.4.3 LATRINES AND URINALS**

- Latrines and urinals shall be provided in every work place.
- Urinals shall also be provided at different elevations.
- They shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times, by appointing designated person.
- Separate facilities shall be provided for the use of male and female worker if any.



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**8.4.4 PROVISION OF SHELTER DURING REST**

Proper Shed & Shelter shall be provided for rest during break

**8.4.5 MEDICAL FACILITIES**

**8.4.5.1 MEDICAL CENTRE (As per Schedule V, X and XI of BOCW central Rules, 1998)**

- A medical centre shall be ensured/identified at site with basic facilities for handling medical emergencies. The medical center can be jointly developed on proportionate sharing basis with permission from BHEL
- A qualified medical professional, not less than MBBS, shall be deployed at the medical centre
- The medical centre shall be equipped with one ambulance, with trained driver and oxygen cylinder.
- Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste –Management and Handling Rules, 1998)

**8.4.5.2 FIRST AIDER**

- Ensure availability of Qualified First-aider throughout the working hours.
- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of Qualified first aiders and their contact numbers should be displayed at conspicuous places.

**8.4.5.3 FIRST AID BOX (as per schedule III of BOCW)**

- The subcontractor shall provide necessary first aid facilities as per schedule III of BOCW. At every work place first aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact no to be displayed on the box.
- The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time.
- The first aid box shall be distinctly marked with a Green Cross on white background.
- Details of contents of first aid box is given in Annexure No. 01
- Monthly inspection of First Aid Box shall be carried out by the owner as per format no. HSEP:13-F01
- The subcontractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.

**8.4.5.4 HEALTH CHECK UP (As per schedule VII and Form XI)**

The persons engaged at the site shall undergo health checkup as per the format no. HSEP:13-F02 before induction. The persons engaged in the following works shall undergo health checkup at least once in a year:

- a. Height workers
- b. Drivers/crane operators/riggers



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- c. Confined space workers
- d. Shot/sand blaster
- e. Welding and NDE personnel

**8.4.6 PROVISION OF CANTEEN FACILITY**

- Canteen facilities shall be provided for the workmen of the project inside the project site.
- Proper cleaning and hygienic condition shall be maintained.
- Proper care should be taken to prevent biological contamination.
- Adequate drinking water should be available at canteen.
- Fire extinguisher shall be provided inside canteen.
- Regular health check-up and medication to the canteen workers shall be ensured.

**8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY**

- The subcontractor shall arrange for the accommodation of workmen at nearby localities or by making a labour colony.
- Regular housekeeping of the labour colony shall be ensured.
- Proper sanitation and hygienic conditions to be maintained.
- Drinking water and electricity to be provided at the labour colony.
- Bathing/ washing bay
- Room ventilation and electrification.

**8.4.8 PROVISION OF EMERGENCY VEHICLE**

- Dedicated emergency vehicle shall be made available at workplace by each subcontractor to handle any emergency

**8.4.9 PEST CONTROL**

Regular pest control should be carried out at all offices, mainly laboratories, canteen, labour colony and stores.

**8.4.10 SCRAPYARD**

- In consultation with customer, scrapyard shall be developed to store metal scrap, wooden scrap, waste, hazardous waste.
- Scrap/Waste shall be segregated as Bio-degradable and non-bio-degradable and stored separately.

**8.4.11 ILLUMINATION**

- The subcontractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations at dark places and during night hours at the work spot as well as at the pre-assembly area.
- Adequate and suitable light shall be provided at all work places & their approaches including passage ways as per IS: 3646 (Part-II). Some recommended values are given below:



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S. No.	Location	Illumination (Lux)
<b>A. Construction Area</b>		
1.	Outdoor areas like store yards, entrance and exit roads	20
2.	Platforms	50
3.	Entrances, corridors and stairs	100
4.	General illumination of work area	150
5.	Rough work like fabrication, assembly of major items	150
6.	Medium work like assembly of small machined parts	300
	rough measurements etc.	
7.	Fine work like precision assembly, precision measurements etc.	700
8.	Sheet metal works	200
9.	Electrical and instrument labs	450
<b>B. Office</b>		
1.	Outdoor area like entrance and exit roads	20
2.	Entrance halls	150
3.	Corridors and lift cars	70
4.	Lift landing	150
5.	Stairs	100
6.	Office rooms, conference rooms, library reading tables	300
7.	Drawing table	450
8.	Manual telephone exchange	200

- Lamp (hand held) shall not be powered by mains supply but either by 24V or dry cells.
- Lamps shall be protected by suitable guards where necessary to prevent danger, in case of breakage of lamp.
- Emergency lighting provision for night work shall be made to minimise danger in case of main supply failure.

If the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions issued by the authorized BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor

## 9.0 HSE TRAINING & AWARENESS

### 9.1 HSE INDUCTION TRAINING

All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL /subcontractor before being assigned to work.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project details.
- Safety objectives and targets.
- Site HSE rules.
- Site HSE hazards and aspects.
- First aid facility.
- Emergency Contact No.
- Incident reporting.
- Fire prevention and emergency response.
- Rules to be followed in the labour colony (if applicable)



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- Proper safety wear & gear must be issued to all the workers being registered for the induction (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.
- On completing attending subcontractor's in-house HSE induction, each employee shall sign an induction training form (format no. HSEP:13-F03) to declare that he had understood the content and shall abide to follow and comply with safe work practices. They may only then be qualified to be issued with a personal I.D. card, for access to the work site.

## 9.2 HSE TOOLBOX TALK

- HSE tool Box talk shall be conducted by frontline foreman/supervisor of subcontractor to specific work groups prior to the start of work. The agenda shall consist of the followings:
  - Details of the job being intended for immediate execution.
  - The relevant hazards and risks involved in executing the job and their control and mitigating measures.
  - Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
  - Recent non-compliances observed.
  - Appreciation of good work done by any person.
  - Any doubt clearing session at the end.
- Record of Tool box talk shall be maintained as per format no. HSEP:13-F04
- Tool box talk to be conducted at least once a week for the specific work.

## 9.3 TRAINING ON HEIGHT WORK

Training on height work shall be imparted to all workers working at height by in-house/external faculty at least twice in a year. The training shall include following topics:

- Use of PPEs
- Use of fall arrester, retractable fall arrester, life line, safety nets etc.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.
- Dos & Don'ts during height work.

## 9.4 HSE TRAINING DURING PROJECT EXECUTION

- Other HSE training shall be arranged by BHEL/ subcontractor as per the need of the project execution and recommendation of HSE committee of site.
- The topics of the HSE training shall be as follows but not limited to:
  - Hazards identification and risk analysis (HIRA)
  - Work Permit System
  - Incident investigation and reporting
  - Fire fighting
  - First aid
  - Fire-warden training
  - EMS and OHSMS
  - T & Ps fitness and operation



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- Electrical safety
- Welding, NDE & Radiological safety
- Storage, preservation & material handling.
- A matrix shall be maintained to keep an up-to-date record of attendance of training sessions carried out.

**9.5 HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC**

**9.5.1 Display of HSE posters and banners**

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/English languages at work place

**9.5.2 Display of HSE signage**

- Appropriate HSE signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed

**9.5.3 Competition on HSE and award**

- Site will arrange different competition (slogan, poster, essay etc.) on HSE time to time (Safety day, BHEL day, World Environment Day etc.) and winners will be suitably awarded.

**9.5.4 HSE awareness programme**

- Subcontractor shall arrange HSE awareness programme periodically on different topics including medical awareness for all personnel working at site

**10.0 HSE COMMUNICATION**

**10.1 INCIDENT REPORTING**

- The subcontractor shall submit report of all incidents, fires and property damage etc to the Engineer immediately after such occurrence, but in any case not later than 24 hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. ( Refer HSE procedure for incident investigation, analysis and reporting for details)
- In addition, periodic reports on safety shall also be submitted by the subcontractor to BHEL from time to time as prescribed by the Engineer. Compiled monthly reports of all kinds of incidents, fire and property damage to be submitted to BHEL safety officer as per prescribed formats.
- HSE incidents of site shall be reported to BHEL site Management as per Procedure for Incident Investigation and Reporting in format no. HSEP:14-F15. Corrective action shall be immediately implemented at the work place and compliance shall be verified by BHEL HSE officer and until then, work shall be put on hold by Construction Manager.

**10.2 HSE EVENT REPORTING**

- Important HSE events like HSE training, Medical camp etc. organized at site shall be reported to BHEL site management in detail with photographs for publication in different in-house magazines
- Celebration of important days like National Safety Day, World Environment Day etc. shall also be reported as mentioned above.



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**11.0 OPERATIONAL CONTROL**

All applicable OCPs (Operational control procedures) will be followed by subcontractor as per BHEL instructions. This will be done as part of normal scope of work. List of such OCPs is given below. In case any other OCP is found to be applicable during the execution of work at site, then subcontractor will follow this as well, within quoted rate. These OCPs (applicable ones) will be made available to subcontractor during work execution at site. However for reference purpose, these are kept with Safety Officer of BHEL at the Power Sector Regional HQ, or available in downloadable format in the website, which may be referred by subcontractor, if they so desire.

**LIST OF OCPs**

Safe handling of chemicals	Safety in use of cranes	Hydraulic test
Electrical safety	Storage and handing of gas cylinders	Spray insulation
Energy conservation	Manual arc welding	Trial run of rotary equipment
Safe welding and gas cutting operation	Safe use of helmets	Stress relieving
Fire safety	Good house keeping	Material preservation
Safety in use of hand tools	Working at height	Cable laying/tray work
First aid	Safe excavation	Transformer charging
Food safety at canteen	Safe filling of hydrogen in cylinder	Electrical maintenance
Illumination	Vehicle maintenance	Safe handling of battery system
Handling and erection of heavy metals	Safe radiography	Computer operation
Safe acid cleaning	Waste disposal	Storage in open yard
Safe alkali boil out	Working at night	For sanitary maintenance
Safe oil flushing	Blasting	Batching
Steam blowing	DG set	Piling rig operation
Safe working in confined area	Handling & storage of mineral wool	Gas distribution test
Safe operation of passenger lift, material hoists & cages	Drilling, reaming and grinding(machining)	Cleaning of hotwell / deaerator
Electro-resistance heating	Compressor operation	O&M of control of AC plant & system
Air compressor	Passivation	Safe Loading of Unit
Safe EDTA Cleaning	Safe Chemical cleaning of Pre boiler system	Safe Boiler Light up
Safe Rolling and Synchronisation		

**11.1 HSE ACTIVITIES**

HSE activities shall be conducted at site based on the HSEMSM developed by Power Sector and issued to site by Regions.

While planning for any activity the following documents shall be referred for infrastructural requirements to establish control measures:

- 1) HSE Procedure for Register of OHS Hazards and Risks
- 2) HSE Procedure for Register of Environmental Aspects and Impacts
- 3) HSE Procedure for Register of Regulations



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- 4) Operational Control Procedures
- 5) HSE Procedure for Emergency Preparedness and Response Plan
- 6) Contract documents

### 11.2 WORK PERMIT SYSTEM

- The following activities shall come under Work Permit System
  - a. Height working above 2 metres
  - b. Hot working at height
  - c. Confined space
  - d. Radiography
  - e. Excavation more than 4 meter depth
  - f. Heavy lifting above 50 tonRefer Annexure 05 for Work permit formats.
- "HSE Procedure for Work Permit System" shall be followed while implementing permit system. Where customer is having separate Work Permit System the same shall be followed.
- Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- Permit holder shall implement and maintain all control measures during the period of permit .He will close the permit after completion of the work. The closed permit shall be archived in HSE Department of site.

### 11.3 SAFETY DURING WORK EXECUTION

Respective OCPS are to be followed and adherence to the same would be contractually binding

#### 11.3.1 WELDING SAFETY

All safety precautions shall be taken for welding and cutting operations as per IS-818. All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.


#### 11.3.2 RIGGING

Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging equipment, when not in use, shall be removed from the original work area so as not to present a hazard to employees.

#### 11.3.3 CYLINDERS STORAGE AND MOVEMENT

All gas cylinders shall be stored in upright position. Suitable trolley shall be used. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced. No of cylinders shall not exceed the specified quantity as per OCP

Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.

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When cylinders are transported by powered vehicle they shall be secured in a vertical position.

#### 11.3.4 DEMOLITION WORK

Before any demolition work is commenced and also during the process of the work the following shall be ensured:

- All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.
- All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.

#### 11.3.5 T&Ps

All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test/calibration certificates bearing endorsement from competent authority of BHEL..Subcontractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.

#### 11.3.6 CHEMICAL HANDLING

Displaying safe handling procedures for all chemicals such as lube oil, acid, alkali, sealing compounds etc , at work place. Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the subcontractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The subcontractor shall be responsible for obtaining the same.

#### 11.3.7 ELECTRICAL SAFETY

- Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts.
- Fulfilling safety requirements at all power tapping points.
- High/ Low pressure welders to be identified with separate colour clothings. No welders will be deployed without passing appropriate tests and holding valid welding certificates. Approved welding procedure should be displayed at work place.
- The subcontractor shall not use any hand lamp energized by Electric power with supply voltage of more than 24 volts in confined spaces like inside water boxes, turbine casings, condensers etc.
- All portable electric tools used by the subcontractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the subcontractor to carry out all types of electrical works. Details of earth resource and their test date to be given to BHEL safety officer as per the prescribed formats of BHEL
- The subcontractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site.



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- BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the subcontractor.
- All electrical appliances used in the work shall be in good working condition and shall be properly earthed.
- No maintenance work shall be carried out on live equipment.
- The subcontractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
- Area wise Electrical safety inspection is to be carried out on monthly basis as per "Electrical Safety Inspection checklist" and the report is to be submitted to BHEL safety officer
- Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public
- The subcontractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.

**11.3.8 FIRE SAFETY**

- Providing appropriate fire fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
- Subcontractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labor colony etc. Such fire protection equipment shall be easy and kept open at all times.
- The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders.
- All other fire safety measures as laid down in the "codes for fire safety at construction site" issued by safety coordinator of BHEL shall be followed.
- Non-compliance of the above requirement under fire protection shall in no way relieve the subcontractor of any of his responsibility and liabilities to fire incident occurring either to his materials or equipment or those of others.
- Emergency contacts nos must be displayed at prominent locations
- Tarpaulin being inflammable should not be used (instead, only non infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.

**11.3.9 SCAFFOLDING**

- Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders.
- When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than ¼ horizontal and 1 vertical.
- Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the out side and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from savor, from swaying, from the building or structure.

**11.3.10 WORK AT HEIGHT:**

- Guardrails and toe-board/barricades and sound platform conforming to IS:4912-1978 should be provided.



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- Wherever necessary, life-line(pp or metallic) and fall arrestor along with Polyamide rope or Retractable lifeline should be provided.
- Safety Net as per IS:11057:1984 should be used extensively for prevention/ arrest of men and materials falling from height. The safety nets shall be fire resistant, duly tested and shall be of ISI marked and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.
- Reaching beyond barricaded area without lifeline support, moving with support of bracings, walking on beams without support, jumping from one level to another, throwing objects and taking shortcut must be discouraged.
- Use of Rebar steel for making Jhoola and monkey-ladder (Rods welded to vertical or inclined structural members), temporary platform etc. must be avoided.
- Monkey Ladder should be properly made and fitted with cages.
- Jhoola should be made with angles and flats and tested like any lifting tools before use.
- Lanyard must be anchored always and in case of double lanyard, each should be anchored separately.
- In case of pipe-rack, persons should not walk on pipes and walk on platforms only.
- In case of roof work, walking ladder/ platform should be provided along with lifeline and/ or fall arrestor.
- Empty drums must not be used.
- For chimney or structure painting, both hanging platform and men should be anchored separately to a firm structure alongwith separate fall arrestor. Rope ladder should be discouraged.

#### 11.3.11 WORKING PLATFORM

Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above. Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

#### 11.3.12 EXCAVATION

Wherever there are open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.

#### 11.3.13 LADDER SAFETY

Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least ¼" for each additional foot of length.

A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to Construction.

#### 11.3.14 LIFTING SAFETY

- It will be the responsibility of the subcontractor to ensure safe lifting of the equipment, taking due precaution to avoid any incident and damage to other equipment and personnel.



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- All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the subcontractor by engaging only the Competent Persons as per law.
- Defective equipment or uncertified shall be removed from service.
- Any equipment shall not be loaded in excess of its recommended safe working load.

**11.3.15 HOISTING APPLIANCE**

- Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards.
- Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming incidentally displaced.
- When workers employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided.
- The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.

**11.4 ENVIRONMENTAL CONTROL**

Environment protection has always been given prime importance by BHEL. Environmental damage is a major concern of the principal subcontractor and every effort shall be made, to have effective control measures in place to avoid pollution of Air, Water and Land and associated life. Chlorofluorocarbons such as carbon tetrachloride and trichloroethylene shall not be used. Waste disposal shall be done in accordance with the guidelines laid down in the project specification.

Any chemical including solvents and paints, required for construction shall be stored in designated bonded areas around the site as per Material Safety Data Sheet (MSDS).

In the event of any spillage, the principle is to recover as much material as possible before it enters drainage system and to take all possible action to prevent spilled materials from running off the site. The subcontractor shall use appropriate MSDS for clean-up technique

All subcontractors shall be responsible for the cleanliness of their own areas.

The subcontractors shall ensure that noise levels generated by plant or machinery are as low as reasonably practicable. Where the subcontractor anticipates the generation of excessive noise levels from his operations the subcontractor shall inform to Construction Manager of BHEL accordingly so that reasonable & practicable precautions can be taken to protect other persons who may be affected.

It is imperative on the part of the subcontractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.

The subcontractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.

**11.5 HOUSEKEEPING**

- Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the subcontractor. Such cleanings has to be done by



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subcontractor within quoted rate, on daily basis by an identified group. If such activity is not carried out by subcontractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost along with BHEL overheads will be deducted from contractor's bill. Such decisions of BHEL shall be binding on the subcontractor

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at
- Different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from high location.
- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Labour camp area shall be kept clear and materials like pipes, steel, sand, concrete, chips and bricks, etc. shall not be allowed in the camp to obstruct free movement of men and machineries.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power line.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas

## **11.6 WASTE MANAGEMENT**

Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained.

### **11.6.1 BINS AT WORK PLACE**

- Sufficient rubbish bins shall be provided close to workplaces.
- Bins should be painted yellow and numbered.
- Sufficient nos. of drip trays shall be provided to collect oil and grease.
- Sufficient qty. of broomsticks with handle shall be provided.
- Adequate strength of employees should be deployed to ensure daily monitoring and service for waste management.

### **11.6.2 STORAGE AND COLLECTION**

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other work places.
- Do not burn construction rubbish near working site.



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### 11.6.3 SEGREGATION

- Earmark the scrap area for different types of waste.
- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

### 11.6.4 DISPOSAL

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Make schedule for collection and disposal of waste.

### 11.6.5 WARNING AND SIGNS

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.
- Comply with all the requirements of Pollution Control Board (PCB) for storage and disposal of hazardous waste.

## 11.7 TRAFFIC MANAGEMENT SYSTEM

### 11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

- Traffic routes in a work place shall be suitable for the persons or vehicles using them. This shall be sufficient in number and of sufficient size. This shall reflect the suitability of traffic routes for vehicles and pedestrians.
- Where vehicles and pedestrians use the same traffic routes there shall be sufficient space between them. Where necessary all traffic routes must be suitably indicated. Pedestrians or vehicles must be able to use traffic routes without endangering those at work. There must be sufficient separation of traffic routes from doors, gates and pedestrian traffic routes.
- For internal traffic, lines marked on roads / access routes and between buildings shall clearly indicate where vehicles are to pass.
- Temporary obstacles shall be brought to the attention of drivers by warning signs or hazard cones.
- Speed limits shall be clearly displayed. Speed ramps preceded by a warning signs or marker are necessary.
- The traffic route should be wide enough to allow vehicles to pass and re-pass oncoming or parked traffic and it may be advisable to introduce on-way system or parking restrictions.
- Safest route shall be provided between places where vehicles have to call or deliver.
- Avoid vulnerable areas/items such as fuel or chemicals tanks or pipes, open or unprotected edges and structures likely to collapse



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- Safe areas shall be provided for loading and unloading.
- Avoid sharp or blind bends. If this is not possible hazards should be indicated e.g. blind corner.
- Ensure road crossings are minimum and clearly signed.
- Entrance and gateways shall be wide enough to accommodate a second vehicle without causing obstruction.
- Set sensible speed limits which are clearly sign posted.
- Where necessary ramps should be used to retard speed. This shall be preceded by a warning sign or mark on the road.
- Forklift trucks shall not pass over road hump unless of a type capable of doing so.
- Overhead electric cable, pipes containing flammable hazardous chemical shall be shielded by using goal posts height gauge posts or barriers.
- Road traffic signs shall be provided on prominent locations for prevention of incidents and hazards and for quick guidance and warning to employees and public. Safety signs shall be displayed as per the project working requirement and guideline of the state in which project is done. Vehicles hired or used shall not be parked within the 15m radius of any working area. Any vehicle, that is required to be at the immediate/near the vicinity, shall be approved by the person in-charge of the site.

#### 11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

- Where traffic routes are used by both pedestrians and vehicles road shall be wide enough to allow vehicles and pedestrians safely.
- Separate routes shall be provided for pedestrians to keep them away from vehicles. Provide suitable barriers/guard at entrances/exit and the corners or buildings.
- Where pedestrian and vehicle routes cross, appropriate crossing shall be provided.
- Where crowd is likely to use roadway e.g. at the end of shift, stop vehicles from using them at such times.
- Provide high visibility clothing for people permitted in delivery area.

#### 11.7.3 WORK VEHICLE

Work vehicle shall be as safe stable efficient and roadworthy as private vehicles on public roads. Site management shall ensure that drivers are suitably trained. All vehicle e.g. heavy motor vehicle forklift trucks dump trucks mobile cranes shall ensure that the work equipment conforms to the following:

- A high level of stability.
- A safe means of access/egress.
- Suitable and effective service and parking brakes.
- Windscreens with wipers and external mirrors giving optimum all round visibility.
- Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
- Provision of seat belts.
- Guards on dangerous parts.
- Driver protection - to prevent injury from overturning and from falling objects/materials.
- Driver protection from adverse weather.
- No vehicle shall be parked below HT/LT power lines.
- Valid Pollution Under Control certification for all vehicles



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**11.7.4 DAILY CHECK BY DRIVER**

- There should also be daily safety checks containing below mentioned points by the driver before the vehicle is used.
  - Brakes.
  - Tires.
  - Steering.
  - Mirrors.
  - Windscreen waters.
  - Wipers.
  - Warning signals.
  - Specific safety system i.e. control interlocks
- Management should ensure that drivers carry out these checks.

**11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES**

- All drivers shall hold a valid driving License for the class of vehicle to be driven and be registered as an authorized BHEL driver with the Administration Department.
- Securing of the load shall be by established and approved methods, i.e. chains with patented tightening equipment for steel/heavy loads. Sharp corners on loads shall be avoided when employing ropes for securing.
- All overhangs shall be made clearly visible and restricted to acceptable limits
- Load shall be checked before moving off and after traveling a suitable distance.
- On no account is construction site to be blocked by parked vehicles Drivers of vehicles shall only stop or park in the areas designate by the stringing foreman.
- Warning signs shall be displayed during transportation of material.  
All vehicles used by BHEL shall be in worthy condition and in conformance to the Land Transport requirement.

**11.7.6 MAINTENANCE**

All Vehicles used for transportation of man and material shall undergo scheduled inspections on frequent intervals to secure safe operation. Such inspections shall be conducted in particular for steering, brakes, lights, horn, doors etc. Site management shall ensure that work equipment is maintained in an efficient, working order and in good repair. Inspections and services carried out at regular intervals of time and or mileage. No maintenance shall be carried below HT/LT power lines.

**11.8 EMERGENCY PREPAREDNESS AND RESPONSE**

- Emergency preparedness and response capability of site shall be developed as per Emergency Preparedness and Response plan issued by Regional HQ
- Availability of adequate number of first aiders and fire warden shall be ensured with BHEL and its subcontractors
- All the subcontractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Subcontractor should nominate his supervisor to coordinate and implement the safety measures.
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape.



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- Appropriate type and number of fire extinguisher shall be deployed as per Fire extinguisher deployment plan and validity shall be ensured periodically through inspection
- Adequate number of first aid boxes shall be strategically placed at different work places to cater emergency need. Holder of the first aid box shall be identified on the box itself who will have the responsibility to maintain the same.
- First aid center shall be developed at site with trained medical personnel and ambulance
- Emergency contact numbers (format given in EPRP) of the site shall be displayed at prominent locations.
- Tie up with fire brigade shall be done in case customer is not having fire station.
- Tie up with hospital shall be done in case customer is not having hospital.
- Disaster Management group shall be formed at site
- Mock drill shall be arranged at regular intervals. Monthly report of the above to be given to BHEL safety Officer as per prescribed BHEL formats
- Mock drill shall be conducted on different emergencies periodically to find out gaps in emergency preparedness and taking necessary corrective action

## 12.0 HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSEMS requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

### 12.1 DAILY HSE CHECKS

Both the Site Supervisors and safety officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

- Personal Safety wears & gear compliance.
- Complying with site safety rules and permit-to-work (PTW).
- Positions and postures of workers.
- Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

### 12.2 INSPECTION OF PPE

- PPEs shall be inspected by HSE officer at random once in a week as per format no. HSEP:13-F06 for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.



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### 12.3 INSPECTION OF T&Ps

- A master list of T&Ps shall be maintained by each subcontractor.
- All T&Ps being used at site shall be inspected by HSE officer once in a month as per format no. HSEP:13-F07 for its healthiness and maintenance.
- The T&Ps which require third party inspection shall be checked for its validity during inspection. The third party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.
- The validity of T&P shall be monitored as per "Status of T&Ps" format no. HSEP:13-F08

### 12.4 INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by HSE officer once in a month as per format no. HSEP:13-F09 for healthiness, maintenance and validity of third party inspection.
- The date of third party inspection and next due date shall be painted on cranes and winches.
- The operators/drivers shall be authorized by sub-contractor based on their competency and experience and shall carry the I-card.
- The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

### 12.5 INSPECTION ON HEIGHT WORKING

- Inspection on height working shall be conducted daily by supervisors before start of work to ensure safe working condition including provision of
  - Fall arrestor
  - Lifelines
  - Safety nets
  - Fencing and barricading
  - Warning signage
  - Covering of opening
  - Proper scaffolding with access and egress.
  - Illumination
- Inspection on height working shall be conducted once in a week by HSE officer as per format no. HSEP:14-F10.
- Medical fitness of height worker shall be ensured.
- Height working shall not be allowed during adverse weather.

### 12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

- Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
- Gas cylinders shall be kept upright.
- Use of Flash back arrestor shall be ensured at both ends.



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- Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per format no. HSEP:14-F11.
- Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
- Availability of fire extinguisher at vicinity shall be ensured.

**12.7 INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES**

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no. HSEP:14-F12.

**12.8 INSPECTION OF ELEVATOR**


- Elevators shall be inspected by concerned supervisors once in a week as per format no. HSEP:14-F13.
- All elevators shall be inspected by competent person and validity shall be ensured.
- The date of third party inspection and next due date shall be painted on elevator.

**13.0 HSE PERFORMANCE**

HSE performance of the subcontractor shall be monitored as per the following parameters:

Sl. No.	Parameters of measurement
1	Timely deployment of qualified safety officer and cumulative number of days in a month the required no. of qualified safety officer is available
2	Shortfall in number of meetings in the month conducted or attended by the safety officer
3	Level of compliance wrt decisions taken in previous meetings/audit/inspection/as reported.
4	Delay in submission of monthly report on safety in the prescribed format
5	Delay in reporting any incident including near-miss to BHEL /Customer/statutory authority( if required)
6	Degree of PPE non-compliance
7	Non- conducting of health check-up as per BOCW requirements
8	Non availability of proper first-aid facility , ambulance, adequate labour welfare initiatives
9	Non conductance of induction training and tool box meeting
10	Total number of instances in the month, House keeping NOT attended inspite of instructions by BHEL i.e. removal/disposal of surplus earth/ debris/scrap/unused/surplus cable drums/other electrical items/surplus steel items/packing material

- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen.
- To decide HSE reward performance towards HSE shall be evaluated for workmen and it shall be awarded regularly in public gathering.
- If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job.

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#### 14.0 HSE PENALTIES

- As per contractual provision HSE penalties shall be imposed on subcontractors for non-compliance on HSE requirement as per format no. HSEP:14-F14. The list in the format is only indicative. For any other violation, not listed in the format, the minimum penalty amount is to be decided as per BOCW act.
- If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.
- The penalty amount shall be recovered by Site Finance department from subcontractors from the RA/Final bill.

#### 15.0 OTHER REQUIREMENTS

- In case of any delay in completion of a job due to mishaps attributable to lapses by the subcontractor, BHEL shall have the right to recover cost of such delay from the payments due to the subcontractor, after notifying the subcontractor suitably.
- If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
- If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.
- In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.
- The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.
- The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
- The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.
- BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.



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- BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

#### 16. NON COMPLIANCE

NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE SUBCONTRACTOR AS UNDER FOR EVERY INSTANCE OF VIOLATION NOTICED:

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slings properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

- Legend:-

\*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the subcontractor. The amount collected above will be utilized for giving award to the employees who could avoid incident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.



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#### 17.0 HSE AUDIT/INSPECTION

- Regular HSE Audit/inspection shall be carried out by Subcontractor as per Site HSE audit calendar.
- HSE checklist(**Annexure 02**) shall be used for carrying out audit/inspection and report shall be submitted to BHEL sitemangement
- All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed off by site in a time bound manner and reported back the implementation status
- Corrective action and Preventive action on HSE issues raised by certification body issued by Regional HQs shall be implemented by site and reported to Site management.

#### 18.0 MONTHLY HSE REVIEW MEETING

- Site shall hold HSE review meeting every month to discuss and resolve HSE issues of site and improve HSE performance. It will also discuss the incidents occurred since previous meeting, its root cause and Corrective action and Preventive action. The agenda is given below:
  - Implementation of earlier MOM
  - HSE performance
  - HSE inspection
  - HSE audit and CAPA
  - HSE training
  - Health check-up camp
  - HSE planning for the erection and commissioning and installation activities in the coming month
  - HSE reward and promotional activities
- The meeting shall be chaired by Construction Manager, convened by HSE coordinator and attended by all HOS, Site Incharge of Subcontractors and HSE officer of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

#### 19.0 FORMATS USED(Details available in Annexure-04)

SL. No.	Format Name	Format No.	Rev No.
01	Inspection of First Aid Box	HSEP:13-F01	00
02	Health Check Up	HSEP:13-F02	00
03	HSE Induction Training	HSEP:13-F03	00
04	Tool Box Talk	HSEP:13-F04	00
05	Monthly Site HSE Report	HSEP:13-F05	00
06	Inspection of PPE	HSEP:13-F06	00



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07	Inspection of T&Ps	HSEP:13-F07	00
08	Status of T&Ps	HSEP:13-F08	00
09	Inspection of Cranes and Winches	HSEP:13-F09	00
10	Inspection on Height Working	HSEP:13-F10	00
11	Inspection on Welding & Gas Cutting	HSEP:13-F11	00
12	Inspection on Electrical Installation	HSEP:13-F12	00
13	Inspection on Elevator	HSEP:13-F13	00
14	HSE Penalty	HSEP:13-F14	00
15	Accident /incident / property damage /fire incident report	HSEP:13-F15	00



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**20.0 ANNEXURES**

**ANNEXURE 01**

**As per Contract Labour (Regulation & Abolition Act), Central Rules, 1971,**

- (1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

**(a) For establishments in which the number of contract labour employed does not exceed fifty, each first aid box shall contain the following equipment:**

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

**(b) For establishment in which the number of contract labour exceeds fifty each first-aid box shall contain the following equipment:**

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.



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(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recoument of the equipment when necessary.



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**ANNEXURE 02**

**HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT**

PROJECT: \_\_\_\_\_

SUBCONTRACTOR: \_\_\_\_\_

DATE : \_\_\_\_\_

OWNER : \_\_\_\_\_

INSPECTION BY: \_\_\_\_\_

Note : write 'NA' wherever the items is not applicable

Item	Y e s	N o	Remarks	Action
<b>HOUSEKEEPING</b>				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
<b>PERSONNEL PROTECTIVE EQUIPMENTS</b>				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
<b>EXCAVATIONS / OPENINGS</b>				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
<b>WELDING, CUTTING</b>				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
<b>SCAFFOLDING</b>				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
<b>LADDER</b>				
Extension side rails 1 m above				
Top of landing				
Properly secured				



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Angle + 70 <sup>0</sup> from horizontal				
Other				
<b>HOISTS, CRANES AND DERRICKS</b>				
Condition of cables and sheaf OK				
Condition of slings, chains, hooks OK				
Inspection & maintenance log maintained				
Outriggers used				
Signals observed and understood				
Qualified operators				
Others				
<b>MACHINERY, TOOLS &amp; EQUIPMENT</b>				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
<b>VEHICLE AND TRAFFIC</b>				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
<b>TEMPORARY FACILITIES</b>				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
<b>FIRE PREVENTION</b>				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
<b>ELECTRICAL</b>				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
<b>HANDLING &amp; STORAGE OF MATERIALS</b>				
Properly stored or stacked				
Passageways clear				
Other				
<b>FLAMMABLE GASES AND LIQUIDS</b>				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				



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Other				
<b>WORKING AT HEIGHT</b>				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
<b>ENVIRONMENT</b>				
Lubricant waste/engine oils properly dispose.				
Waste from Canteen, offices, sanitation etc. disposed properly.				
Disposal of surplus earth, stripping materials, expired batteries, oily rags and combustible materials done properly.				
<b>HEALTH CHECKS</b>				
Hygienic conditions at labor camps O.K.				
Availability of first-aid facilities				
Proper sanitation at site, office & labor camps.				
Arrangement of medical facilities.				
Measures for dealing with illness.				
Availability of potable drinking water for workmen & staff.				
Provision of crèches for children.				



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**ANNEXURE 03**

**REFERENCES**

- Contract documents
- Relevant legislations
- HSEMSM
- Relevant Indian standards as listed below (illustrative only):

SL NO	CODE NAME	TITLE
(1)	IS : 818-1888 (Reaffirmed 2003)	Code of Practice for safety and health requirements in Electric and Gas Welding and Cutting operations.
(2)	IS: 1179-1967 (Reaffirmed 2003)	Specification for Equipment for Eye & Face protection during welding.
(3)	IS : 1989 (Part 2):1986 (Reaffirmed 1997)	Specification for Leather Safety Boots & Shoes
(4)	IS:2925 – 1984 (Reaffirmed 2010)	Specification for Industrial Safety Helmets
(5)	IS:3521 : 1999 (Reaffirmed 2002)	Industrial Safety Belts & Harnesses-Specification
(6)	IS:3646(Part II) – 1966 (Reaffirmed 2003)	Code of Practice for Interior Illumination
(7)	IS:3696 (Part I) – 1987 (Reaffirmed 2002)	Safety Code for Scaffolds and Ladders
(8)	IS: 3696(Part 2) : 1991 (Reaffirmed 2002 )	Scaffolds and Ladders-Code of Safety
(9)	IS:3786 – 1983 (Reaffirmed 2002)	Method for Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Incidents
(10)	IS:4770 : 1991 (Reaffirmed 2006)	Rubber Gloves – Electricals purposes-Specification
(11)	IS:4912 : 1978 (Reaffirmed 2002)	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
(12)	IS: 5983 – 1980 (Reaffirmed 2002)	Specification for Eye-Protectors
(13)	IS:6519 – 1971 (Reaffirmed 1997)	Code of Practice for Selection, Care and Repair of Safety Footwear
(14)	IS:9167:1979	Specification for Ear-Protectors
(15)	IS:6994(Part I)-1973 (Re affirmed 1996)	Specification for Industrial Safety Gloves Leather and Cotton Gloves
(16)	IS:8519 – 1977 (Reaffirmed 1983)	Guide for Selection of Industrial Safety Equipment for Body Protection.
(17)	IS 11006 : 2011	Flash Back(Flame Arrestor) Specification



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(18)	IS:8520 – 1977 (Reaffirmed 2002)	Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection.
(19)	IS:9473:2002	Respiratory Protective Devices-Filtering Half Masks to protect against Particles-Specification.
(20)	IS:9944:1992 (Reaffirmed 2003)	Natural and Man-made Fiber Rope Slings-Recommendations on Safe working loads.
(21)	IS:11057 – 1884 (Reaffirmed 2001)	Specification for Industrial Safety Nets
(22)	IS:12254:1993 (Reaffirmed 2002)	Polyvinyl Chloride (PVC) Industrial Boots-Specification
(23)	IS:13367(Part 1):1992 (Reaffirmed 20030)	Safe Use of Cranes-Code of Practice
(24)	IS:14166:1994 (Reaffirmed 2002)	Respiratory Protective Devices-Full Face Masks Specification
(25)	IS:14746 : 1999 (Reaffirmed 2003)	Respiratory Protective Devices-Half Masks and Quarter Masks - Specification
(26)	IS : 15397 :2003 (Reaffirmed 2008)	Portable Extinguisher Mechanical Foam Type(Stored Pressure)-Specification
(27)	IS: 19011:2002	Guidelines for Quality and/or Environmental Management Systems Auditing



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**ANNEXURE 04 : SAFETY FORMATS  
&  
ANNEXURE 05 : WORK PERMIT FORMATS**

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:13-F01

REV NO.: 00

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<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection :</b>	

Number of employees on the site:- \_\_\_\_\_

Sl.No.	Item	No. Available	Remarks
1	No. of small sterilized dressings		
2	No of medium sized sterilized dressings		
3	No of large sized sterilized dressings.		
4	No of large sized sterilized burn dressings		
5	No of (15 grams) packets sterilized cotton wool		
6	No of pieces of sterilized eye pads in separate sealed packets.		
7	No of roller bandages 10 cm wide.		
8	No of roller bandages 5 cm wide.		
9	Whether tourniquet available		
10	Whether supply of suitable splints available.		
11	No of packets of safety pins.		
12	Whether kidney tray available		
13	Whether sufficient number of eye wash bottles, filled with distilled water or suitable liquid, clearly indicated by a distinctive sign which shall be visible at all times, available.		
14	Whether 4%-xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops available.		
15	Whether (60ml) bottle containing a two percent alcoholic solution of iodine available		
16	Whether (two hundred ml) bottle of mercurochrome (2 per cent) solution in water available.		

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:13-F01

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Sl.No.	Item	No. Available	Remarks
17	Whether 120ml bottle containing Sal volatile having the dose and mode of administration indicated on the label, available.		
18	Whether roll of adhesive plaster (6 cmX1 meter) available		
19	No of rolls of adhesive plaster (2 cmX1 meter)		
20	Whether snake bite lancet available.		
21	Whether (30 grams) bottle of potassium permanganate crystals available.		
22	Whether a pair scissors available		
23	Whether copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India available.		
24	Whether bottle containing 100 tablets (each of 5 grains) of aspirin available		
25	Whether Ointment for burns available		
26	Whether bottle of a suitable surgical anti septic solution available		

Signature of Subcontractor's Site I/C::

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:13-F02

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<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Name of Employee :</b>	

**NAME:**

History Of Past Illness	H/O Epilepsy
	H/O Drug Allergy
	H/O Diabetics/ Hypertension
	H/O Unconsciousness

Personal History

<b>EXAMINATION</b>		<b>OBSERVATION</b>	
<b><u>General Physical Examination</u></b>			
Height	:		
Weight	:		
BMI	:		
Built And nourishment	:		
Pallor	:		
Temperature	:		
Chest Expansion	:	Inspiration	Expansion
Lymph Node Enlargement	:		
<b><u>Ear, Nose, Throat</u></b>	:		
Ear	:		
Nose	:		
Throat	:		

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:13-F02

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EXAMINATION	OBSERVATION
<b>Cardiovascular System Examination :</b>	
Inspection :	
Palpation :	Pulse BP
Auscultation (Heart Sounds) :	
<b>Respiratory System :</b>	
Inspection :	Respiratory Rate
Palpation:	
Percussion :	
Auscultation (Breath Sounds) :	
<b>Examination of Abdomen :</b>	
Inspection :	
Palpation :	
Auscultation (Bowel Sounds) :	
<b>Any Other :</b>	
<b>Clinical Impression</b>	

Signature of the examining doctor





**POWER SECTOR**

**TOOL-BOX TALK**

FORMAT NO: HSEP:13-F04

REV NO.: 00

PAGE NO. 01 OF 01

<b>Name of Site :</b>	
<b>Sub-Contractors Name :</b>	
<b>Date :</b>	

<b>Topic</b>	<b>Name of person delivered Tool Box Talk</b>	<b>No. of Participants attended</b>	<b>Remarks</b>

**Signature of Site I/C of Subcontractor :**



**POWER SECTOR**

**PERSONAL PROTECTIVE EQUIPMENTS**

FORMAT NO: HSEP:13-F06

REV NO.: 00

PAGE NO. 01 OF 01

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection :</b>	

<b>Item</b>	<b>Issued this Month</b>	<b>Nos. Issued up to the Month</b>	<b>Percentage of usage at site</b>
Safety Helmet			
Safety Shoes			
Full Body Harness			
Fall Arrestor			
Safety Nets			
Other PPEs.			

**Signature of Site I/C of Subcontractor :**

**POWER SECTOR****INSPECTION OF T&Ps**

FORMAT NO: HSEP:13-F07

REV NO.: 00

PAGE NO. 01 OF 01

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Date of Inspection :</b>	

Sl.No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs / overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Site Safety Officer ( BHEL)

Signature-Subcontractor/ Subcontractor's  
Safety Officer

**POWER SECTOR****STATUS OF T&Ps**

FORMAT NO: HSEP:13-F08

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

Item	Nos. Deployed	Identification No.	Nos. Tested by competent person	Validity of Test Certificate
Winches				
Chain Blocks				
Wire Rope Slings				
Man Cages				
D-Shackles				
Air Compressors				
Crawler Cranes				
Mobile Cranes				
Hydra Cranes				
Others				

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 01 OF 03

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection:</b>	

Crane Reg. No (Make/Model) \_\_\_\_\_

Name of Driver/Operator \_\_\_\_\_

Sl.no.	Description	Observation	Measures
1	Valid Driving license		
2	Hook & Hook Latch		
3	Over Hoist limit switch		
4	Boom limit switch		
5	Boom Angle Indicator		
6	Boom limit cutoff switch		
7	Condition of Boom		
8	Condition of ropes		
9	Number of load lines		
10	Size and condition of the slings		
11	Stability of the cranes		
12	Soil Condition		
13	Swing Break And Lock		
14	Proper Break And Lock		
15	Hoist Break And Lock		
16	Boom Break And Lock		
17	Main Clutch		
18	Leakage in Hydraulic Cylinders		
19	Out riggers fully extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 02 OF 03

Sl.no.	Description	Observation	Measures
22	Guards of moving and rotating parts		
23	Load chart provided		
24	Number and position of pedant ropes		
25	Reverse Horn		
26	Load Test Details		
27	Operator's fitness		
28	Pollution under control certificate		
29	Fire extinguisher of appropriate type.		
30	Training of the operator		

**WINCH**

Sl. No.	Description	YES	NO	NA	Remarks
1	Has the copy of Third Party Inspection certificate been provided in winch machine shed?				
2	Is winch machine operator experienced enough to operate the winch machine?				
3	Is the winch machine operated by someone other than the winch machine operator?				
4	Is there guard provided in all moving parts like wheel and motor's shaft?				
5	Will it protect against unforeseen operational contingencies?				
6	Are brakes, clutch and locking arrangement working properly?				
7	Has it been ensured that the guard does not constitute a hazard by itself?				
8	Are the cranks and the connecting rods protected by guardrails?				
9	Is there provision for fully covered shed with wooden plank roof?				

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 03 OF 03

Sl. No.	Description	YES	NO	NA	Remarks
10	Is wire rope free from any kind of damage or wear and tear?				
11	Is split pin provided for the protection of clutch and brake locking arrangement?				
12	Is pulley inspected by competent person and certified before use?				
13	Is pulley free from any wear and tear visually?				
14	Is winch rope barricaded with clipsheet for the protection of rope and person?				
15	Is the wire rope lubricated by cardium oil?				
16	Is there any friction in wire rope which may damage the wire rope rather than the rolling parts?				
17	Is there any oil leakage in the hydraulic system of the winch machine?				
18	Has it been ensured that the guard will not cause discomfort or inconvenience to operator?				
	<b>Total Number of NO:</b>				
	<b>Total Number of NA:</b>				
	<b>% Compliance :</b>				

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF HEIGHT WORKING**

FORMAT NO: HSEP:13-F10

REV NO.: 00

PAGE NO. 01 OF 02

<b>Name of Site :</b>	
<b>Name of Sub-Contractor :</b>	
<b>Inspected by :</b>	
<b>Date of Inspection:</b>	

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
1	All the workers have been explained safe work method?		
2	An established communication system has been established and explained to the workers.		
3	Adequate illumination has been ensured.		
4	Work area inspected prior to the start of the work.		
5	Area below the work place barricaded, particularly below hot work.		
6	Workers provided with bags /box to carry bolts, nuts and hand tools		
7	Arrangement for fastening hand tools made.		
8	All work platforms ensured to be of adequate strength and ergonomically suitable.		
9	Fabricated makeshift arrangements are checked for quality and type of material welding, anchoring etc.		
10.	Work at more than one elevation at the same segment is restricted.		
	<b>ACCESS/EGRESS</b>		
1	Walkways provided with handrail, mid-rail and toe guard?		
2	All checkered plates, gratings properly welded/ bolted?		
3	Are ladders inspected and they are in good condition?		
4	Are ladders spliced?		
5	Are ladders properly secured to prevent slipping, sliding or falling?		
6	Do side rails extend 36" above top landing?		
7	Are built up ladders constructed of sound materials?		

**POWER SECTOR****INSPECTION OF HEIGHT WORKING**

FORMAT NO: HSEP:13-F10

REV NO.: 00

PAGE NO. 02 OF 02

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
8	Are rugs and cleats not over 12" on center?		
9	Metal ladders not used around electrical hazards.		
10	Proper maintenance and storage.		
11	Ladders placed at right slope.		
12	Ladders / staircases welded/ bolted properly.		
13	Any obstruction in the stairs.		
14	Are landing provided with handrails, knee rails, toe boards etc.?		
15	Whether ramp is provided with proper slope.		
16	Proper hand rails / guards provided in ramps.		
	<b>Housekeeping</b>		
1	Walkways, aisles & all overhead workplaces cleared of loose material.		
2	Flammable materials, if any, are cleared.		
3	All the de shuttering materials are removed after de shuttering is done.		
4	Platforms and walkways free from oil/grease or other slippery material.		
5	Collected scrap are brought down or lowered down and not dropped from height.		
	<b>PPE And Safety Devices</b>		
1	Use of safety helmet, safety belts ensured for all workers		
2	Anchoring points provided at all places of work.		
3	Common lifeline provided wherever linear movement at height is required.		
4	Safety nets are use wherever required.		
5	Proper fall arrest system is deployed at critical workplaces.		
6	Crawler boards/Safety system or works on fragile roof are used.		

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF WELDING AND GAS  
CUTTING**FORMAT NO: HSEP:13-F11  
REV NO.: 00  
PAGE NO. 01 OF 02

<b>Name of Site</b>	
<b>Name of Sub-Contractor</b>	
<b>Inspected by</b>	
<b>Date of Inspection</b>	

<b>Welding</b>				
Sl.no.	Description	Y e s	N o	Remarks
1	Is electric connection given through 30 mA ELCB/RCCB to welding m/c?			
2	Is electric cable fitted properly in junction box on m/c?			
3	Is electrical cable free from joints?			
4	Are the joints attached firmly & insulated with tape?			
5	Is double earthing given to body of m/c?			
6	Is the physical condition of the m/c good?			
7	Is ON/OFF switch connected to the m/c is working and in good condition?			
8	Are indication lamps on m/c working?			
9	Is the electrode holder in good condition?			
10	Are the cables of the welding m/c lugged & tight properly?			
11	Are return lead connected properly (Rod, Angle, Channels shall not be used)			
	Total No of NO			
	Total No of YES			

**POWER SECTOR****INSPECTION OF WELDING AND GAS  
CUTTING**

FORMAT NO: HSEP:13-F11

REV NO.: 00

PAGE NO. 02 OF 02

Gas Cutting				
Sl. no	Description	Yes	No	Remarks
1	Are Cylinders kept on trolleys?			
2	Physical condition of Gas cylinders Good?			
3	Is there Oil/Grease on valve of the cylinder?			
4	Are pressure regulators in good condition?			
5	Condition of hose pipe OK?			
6	Are hose pipe clamped with hose clip?			
7	Is flash back arrestor & NRV fitted on torch both for O2 and LPG cylinder?			
8	Is nozzle of the torch cleaned?			
	Total Number of NO			
	Total No of YES			
	<b>% Compliance</b>			

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF ELECTRICAL INSTALLATION**

FORMAT NO: HSEP:13-F12

REV NO.: 00

PAGE NO. 01 OF 02

<b>Name of Site</b>	
<b>Name of Sub-Contractor</b>	
<b>Inspected by</b>	
<b>Date of Inspection:</b>	

Sr. No.	Contents	Yes/No	Remarks
<b>A</b>	<b>Cable</b>		
1.	Whether the condition of cable is checked?		
2.	Are cables received from other sites checked for insulation resistance before putting them into use?		
3.	Are all main cables taken either underground / overhead?		
4.	Are welding cables routed properly above the ground?		
5.	Are welding and electrical cables overlapping?		
6.	Is any improper joining of cables/wires prevailing at site?		
<b>B</b>	<b>DBs/SDBs</b>		
1.	Is earth conductor continued upto DB / SDB?		
2.	Whether DBs and extension boards are protected from rain / water?		
3.	Is there any overloading of DBs / SDBs?		
4.	Are correct / proper fuses & CBs provided at main boards and sub-boards?		
5.	Is energized wiring in junction boxes, CB panels & similar places covered all times?		
<b>C</b>	<b>ELCB</b>		
1.	Whether the connections are routed through ELCB?		
2.	Is ELCB sensitivity maintained at 30 mA?		

**POWER SECTOR****INSPECTION OF ELECTRICAL INSTALLATION**

FORMAT NO: HSEP:13-F12

REV NO.: 00

PAGE NO. 02 OF 02

Sr. No.	Contents	Yes/No	Remarks
3.	Are the ELCB numbered and tested periodically & test results recorded in a logbook countersigned by a competent person?		
<b>D</b>	<b>Grounding</b>		
1.	Is natural earthing ensured at the source of power (main DB at Generator or Transformer)?		
2.	Whether the continuity and tightness of the earth conductor are checked?		
3.	Mention the gauge of the earth conductor used at the site.		
4.	Mention the value of Earth Resistance.		
<b>E</b>	<b>Electrically operated Machines or Accessories.</b>		
1.	Whether the plug top is provided everywhere.		
2.	Are all metal parts of electrical equipment and light fittings / accessories grounded?		
3.	Is there any shed or cover for welding machines?		
4.	Are halogen lamps fixed at proper places?		
5.	Are portable power tools maintained as per norms?		
6.	Any other information:		

Signature of Site I/C of subcontractor :



**POWER SECTOR**  
**INSPECTION OF ELEVATOR**

FORMAT NO: HSEP:13-F13  
REV NO.: 00  
PAGE NO. 01 OF 01

<b>Name of Site</b>	
<b>Name of Sub-Contractor</b>	
<b>Inspected by</b>	
<b>Date of Inspection</b>	

Sr. No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs/overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

<b>Signature-Subcontractor/ Subcontractor's Safety Officer</b>	<b>Signature-Site Safety Officer ( BHEL)</b>
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**POWER SECTOR****HSE PENALTY**

FORMAT NO: HSEP:13-F14

REV NO.: 00

PAGE NO. 01 OF 02

**Sub: MEMO for Penalty for non compliances in Safety**

Following lapse (tick marked) was observed and penalty is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

**Safety Area**

SN	Violation of Safety Norms	Fine (in Rs)
01	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03	Not wearing safety shoe	200/-*
04	Not keeping gas cylinders vertically	200/-
05	Not using flash back arrestors	100/-
06	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slings properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

**Legend:-**

\*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.



**POWER SECTOR**

**HSE PENALTY**

FORMAT NO: HSEP:13-F14

REV NO.: 00

PAGE NO. 02 OF 02

Details (if any) related to non- compliance (Name of persons, Nature of deficiency, etc.)

\_\_\_\_\_

Penalty imposed:

1, Rate as per above chart \_\_\_\_\_

2. No. of Persons/ machine/ event/ labour \_\_\_\_\_

3. Total Penalty= 1. X 2. = \_\_\_\_\_


Signature :

Witnessed by: (Sub- Contractor representative) (BHEL Personnel)

Name \_\_\_\_\_

Name \_\_\_\_\_

Distribution: 1 Copy: to Sub- contractor,  
1 Copy to Site Construction Manager(BHEL)

	<b>POWER SECTOR- HQ</b>	FORMAT NO: HSEP:13-F15
	<b>Incident Report</b>	REV NO.: 00
(To be submitted within 24 hours of time of incident)		PAGE NO. 01 OF 01

Type of incident: Fatal/Major/ Minor/Fire/Property Damage/Near-miss

1	NAME OF SITE		3	ACTIVITY AREA	
2	SCOPE OF WORK		4	NAME OF CONTRACTOR	
			5	NAME & DESIGNATION OF BHEL ACTIVITY I/C	
6	DATE & TIME OF ACCIDENT		7	DATE RESUMED	
8	NO. OF WORK-DAYS LOST BY VICTIM (If duty not resumed, give estimated figure)				
9	NO. OF MANHOURS LOST BY OTHERS				
10	PERSONAL DETAILS OF INJURED AND / OR DETAILS OF MATERIALS / EQUIPMENT / PROPERTY DAMAGED				
NAME			NAME OF MATERIAL / EQUIPMENT / PROPERTY		
PERIOD OF EMPLOYMENT					
AGE	YRS	SEX	MALE/ FEMALE	ESTIMATED COST	ACTUAL COST
MARITAL STATUS		SINGLE / MARRIED			
OCCUPATION			NATURE OF DAMAGE		
PART OF BODY INJURED					
NATURE OF INJURY					
AGENCY ( OBJECT / EQUIPMENT / SUBSTANCE ) MOST RESPONSIBLE FOR CAUSING ACCIDENT / INJURY / DAMAGE					
12	PERSON (NAME & DESIGNATION) WITH MOST CONTROL OVER AGENCY (OBJECT / EQUIPMENT / SUBSTANCE ) CAUSING ACCIDENT INJURY / DAMAGE				
13	DESCRIBE CLEARLY HOW THE ACCIDENT OCCURRED (USE ADDITIONAL SHEET, IF REQUIRED)				
ANALYSIS					
14	WHAT ACTS AND / OR CONDITIONS CONTRIBUTED MOST DIRECTLY TO THIS ACCIDENT				
15	WHAT ARE THE BASIC REASON FOR THE EXISTENCE OF THESE ACTS AND / OR CONDITION ?				
16	WHAT CORRECTIVE ACTIONS HAVE BEEN TAKEN TO PREVENT ACCIDENT RECURRENCE ?				
	DATE :		SIGNATURE OF SITE HSE COORDINATOR		
17	COMMENTS OF HEAD / SOX				
	DATE:		SIGNATURE OF HEAD/SOX		



# SAFETY WORK CLEARANCE

Permit no. \_\_\_\_\_

Project: \_\_\_\_\_

Emergency Contact Nos: \_\_\_\_\_

Subcontractor: \_\_\_\_\_

## BURNING/WELDING /HOT WORK PERMIT

Area : \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of Site Engineer (Permit Requesting Authority): \_\_\_\_\_ Sign: \_\_\_\_\_

Name of Work Performing Contractor: \_\_\_\_\_

Name of Package In charge: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_

Description of Work: \_\_\_\_\_

Work Execution Date: \_\_\_\_\_ Time Valid from: \_\_\_\_\_ to \_\_\_\_\_

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Proper Access/Exit available		
2.	Proper ventilation and /or lighting provided.		
3.	Proper and safe scaffolding, platform, ladder provided.		
4.	Welding machine located in a clean and dry area.		
5.	Welding machine grounded at the equipment and proper leakage current protection device (ELCB) provided for welding machine.		
6.	Emergency STOP buttons are in working condition. Welder /Helper knows how to operate it.		
7.	Welding machine input/output cables, welding holder and weld return clamp (Holder) are insulated and in good condition.		
8.	Welder & Fitter trained to connect ground/work return clamps (Holder) to work place prior to energization of welding machine.		
9.	Gas cylinders are stacked vertically and not below the welding / cutting area. Regulator key is available with cylinder.		
10.	Pressure gauges/Flash back arrestor provided and in working condition.		
11.	Personal Protective equipment Minimum applicable: safety helmet, safety goggles, welding helmet, safety shoes, leather gloves, long sleeve and nose mask -provided		
12.	In case of pits, water removed from the pit and wood/rubber insulation provided.		
13.	Safety signboards are in place.		
14.	Adequate and Suitable nos. of fire fighting extinguisher provided.		
15.	Nearby combustible material removed. Housekeeping done.		
16.	Other		

Name of Contractor Safety Officer: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

**Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):**

Name: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of BHEL Safety Representative: \_\_\_\_\_ Sign: \_\_\_\_\_

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

**Permit Cancellation:**

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of Site Engr. (Permit Requesting Authority): \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of BHEL Site Engr. (Permit Issuing Authority): \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

(This permit is valid only for the date it is issued)

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor



# SAFETY WORK CLEARANCE

Permit no. \_\_\_\_\_

Project: \_\_\_\_\_

Emergency Contact Nos: \_\_\_\_\_

Subcontractor: \_\_\_\_\_

## LIFTING ACTIVITY PERMIT

Area : \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of Site Engineer (Permit Requesting Authority): \_\_\_\_\_ Sign: \_\_\_\_\_

Name of Work Performing Contractor: \_\_\_\_\_

Name of Package In charge: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_

Description of Work: \_\_\_\_\_

Work Execution Date: \_\_\_\_\_ Time Valid from: \_\_\_\_\_ to \_\_\_\_\_

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Crane used for lifting activity tested, certified and approved for rated lifting		
2.	All lifting tackles, gears/appliances are tested and certified for lifting works.		
3.	Crane operator is trained and competent for lifting operation.		
4.	Lifting sling/ belt is protected against sharp edge of the jobs to be lifted.		
5.	Access and exit marked and without obstruction.		
6.	Lifting arrangement adequate.		
7.	Unwanted rubbish material removed from work platform.		
8.	Minimum 2 guidelines have been provided for balancing and guiding jobs to be lifted.		
9.	Periphery area of crane booms as well as lifting job is barricaded and unauthorised/no-entry sign board posted.		
10.	Rigger and signal man is trained and competent for lifting work.		
11.	No lifting activity to be carried out during lightening, heavy wind/rain.		
12.	If scaffolding to be used during lift, scaffolding with valid tag available for use.		
13.	Double lanyards safety harness/belt checked and in working condition.		
14.	Safety shoes (non-slip), helmet with chin strap available with employees.		
15.	Others.		

Name of Contractor Safety Officer: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

**Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):**

Name: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of BHEL Safety Representative: \_\_\_\_\_ Sign: \_\_\_\_\_

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

**Name of Work Performing Authority:** \_\_\_\_\_ **Sign:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_**Permit Cancellation:**

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of Site Engr. (Permit Requesting Authority): \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of BHEL Site Engr. (Permit Issuing Authority): \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

(This permit is valid only for the date it is issued)

**Original at BHEL site****Second Copy – BHEL SAFETY****Third Copy : Contractor**



# SAFETY WORK CLEARANCE

Permit no. \_\_\_\_\_

Project: \_\_\_\_\_

Emergency Contact Nos: \_\_\_\_\_

Subcontractor: \_\_\_\_\_

## WORKING AT HEIGHT PERMIT

Area : \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of Site Engineer (Permit Requesting Authority): \_\_\_\_\_ Sign: \_\_\_\_\_

Name of Work Performing Contractor: \_\_\_\_\_

Name of Package In charge: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_

Description of Work: \_\_\_\_\_

Work Execution Date: \_\_\_\_\_ Time Valid from: \_\_\_\_\_ to \_\_\_\_\_

*The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.*

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	All workers on job are medically fit for working at height (Person should not have vertigo)		
2.	Scaffolding with valid tag available for use		
3.	Safety harness with life line support/ fall arrester are checked and in working condition		
4.	Safety shoes ( non-slip), Helmet with chin strip available with employees		
5.	Safety nets are provided as per design and provided 25 ft. below working area & extending 8 ft beyond.		
6.	Horizontal life lines are provided to cater to design specification of 2300kg per person.		
7.	Ladders have been inspected and provided as per BHEL standard/contract.		
8.	All lifting / tightening tools, hand tools/equipment checked and in good condition		
9.	Access and exit marked and without obstruction.		
10.	Lighting arrangement adequate.		
11.	Unwanted and rubbish material removed from working platform.		
12.	Electrical cable, welding Hose/Compressed air hose properly secured and lay down without obstruction.		
13.	Signboards provided on working platforms		
14.	Hazards in the vicinity are identified and communicated to the worker.		
15.	Other		

Name of Contractor Safety Officer: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

**Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):**

Name: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of BHEL Safety Representative: \_\_\_\_\_ Sign: \_\_\_\_\_

*I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.*

**Name of Work Performing Authority:** \_\_\_\_\_ **Sign:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_**Permit Cancellation:**

*I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.*

Name of Work performing Authority: \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of Site Engr. (Permit Requesting Authority): \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Name of BHEL Site Engr. (Permit Issuing Authority): \_\_\_\_\_ Sign: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

(This permit is valid only for the date it is issued)

**Original at BHEL site****Second Copy – BHEL SAFETY****Third Copy : Contractor**