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NOTICE INVITING TENDER

(Document No PS:MSX:NIT)

TENDER NO.: BHEL/NR/SCT/VRMP/GTG & STG/1158

NAME OF WORK: ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) AND HANDING OVER OF 1 X 59.3 MW GTG, 1 X 15.5 MW STG, DEAERATOR SYSTEM, 11 KV EMERGENCY DG SETS, HP AND LP PUMPS, FIRE FIGHTING SYSTEM, ASSOCIATED STATIC AND ROTATING AUXILIARIES OF GTG AND STG ETC. AT 1 X 75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP), VISAKHAPATNAM, ANDHRA PRADESH.

Bharat Heavy Electricals Limited



Ref: BHEL/NR/SCT/VRMP/GTG & STG/1158

Date: 03/06/2019

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NOTICE INVITING E-TENDER (NIT)
BIDDER TO SUBMIT OFFERS ON PORTAL <https://bhel.abcprocure.com>

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To

Dear Sir/Madam

Sub : NOTICE INVITING E-TENDER

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

1. Salient Features of NIT

SL NO	ISSUE	DESCRIPTION
i	TENDER NUMBER	BHEL/NR/SCT/VRMP/GTG & STG/1158
ii	Broad Scope of job	ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) AND HANDING OVER OF 1 X 59.3 MW GTG, 1 X 15.5 MW STG, DEAERATOR SYSTEM, 11 KV EMERGENCY DG SETS, HP AND LP PUMPS, FIRE FIGHTING SYSTEM, ASSOCIATED STATIC AND ROTATING AUXILIARIES OF GTG AND STG ETC. AT 1 X 75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP),VISAKHAPATNAM, ANDHRA PRADESH
iii	DETAILS OF TENDER DOCUMENT	
a	Volume-IA	<i>Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc</i> Applicable
b	Volume-IB	<i>Special Conditions of Contract (SCC)</i> Applicable
c	Volume-IC	<i>General Conditions of Contract (GCC)</i> Applicable
d	Volume-ID	<i>Forms and Procedures</i> Applicable
e	Volume-II	<i>Price Schedule (Absolute value).</i> Applicable
iv	ISSUE OF TENDER DOCUMENTS	From BHEL website (www.bhel.com) and https://bhel.abcprocure.com Tender documents will be available at website till due date of submission Applicable
v	DUE DATE & TIME OF OFFER SUBMISSION	Date : 17/06/2019, Time : 1500 HRS Place : on https://bhel.abcprocure.com Applicable
vi	OPENING OF TENDER	At due date / time Date : 17/06/2019, Time : 1530 HRS Notes: (1) In case the due date of opening of tender becomes a non-working day, then the due date & time of offer submission and opening of tenders get extended to the next working day. (2) Bidder may depute representative to witness the opening of tender. However it being an e-tender it shall be opened online Applicable

vii	EMD AMOUNT	Rs. 14,64,000/-	Applicable
viii	COST OF TENDER	Rs 2000/-.	Applicable
ix	LAST DATE FOR SEEKING CLARIFICATION	Five days before bid submission due date. Along with soft version also, addressing to contact address given below 1) Name: G.V. RAJA SEKHAR Designation: Sr. Manager Deptt: SCT Address: BHEL-PSNR, PLOT NO. 25, SECTOR – 16A, NOIDA - 201301 Phone: (Landline) 0120-2416232 Email : gvr@bhel.in 2) Name: CHITTARANJAN SWAIN Designation: Dy. MANAGER Deptt: SCT Address: BHEL-PSNR, PLOT NO. 25, SECTOR – 16A, NOIDA - 201301 Phone: (Landline) 0120 - 2416500 Email : cs@bhel.in	Applicable
x	SCHEDULE OF Pre Bid Discussion (PBD)		Not applicable.
xi	INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)	Please refer clause no.15a.	Applicable
xii	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com -->Tender Notifications →View Corrigendums) & portal https://bhel.abcprocure.com and not in the newspapers. Bidders to keep themselves updated with all such information	
xiii	Tender submission	on portal https://bhel.abcprocure.com	

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

As this tender is an E-Tender and no paper bids will be accepted therefore the scanned copy of the Demand Draft or the Cash Receipt issued by BHEL PSNR should be uploaded in the E procurement portal. Hard Copy

of the demand draft should reach BHEL PSNR HQ Noida before the due date and time of bid submission. BHEL shall not be responsible for postal or any other delays in this regard.

4. Unless specifically stated otherwise, tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) in the manner described in Clause no. 1.9 of General Conditions of Contract.

'One Time EMD' will not be considered for this tender. All the bidders who have 'One Time EMD' with BHEL and want to participate in this tender, would also submit the requisite amount of EMD as mentioned in Clause No. 1, Salient Features of NIT, Sl. No. (vii) above.

However, the One Time EMD can be adjusted against the EMD applicable against this tender on specific request of bidder.

For Electronic Fund Transfer the details are as below:-

a) **Name of the Beneficiary** -: Bharat Heavy Electricals Limited

b) **Bank Particulars**

i).	Bank Name :-	STATE BANK OF INDIA
ii).	Bank Telephone No.(with STD code):-	011-23475566
iii).	Branch Address:-	CAG II BRANCH, NEW DELHI 4 th & 5 th FLOOR, REDFORT CAPITAL, PARASNATH TOWERS, BHAI VEER SINGH MARG, GOLE MARKET, NEW DELHI-110001
iv).	Bank Fax No. (with STD code) :-	011-23475566
v).	Branch Code :-	17313
vi).	9 Digit MICR Code of the Bank Branch :-	110002562
vii).	Bank Account Number :-	10813608647
viii).	Bank Account Type :-	CASH CREDIT
ix).	11 Digit IFSC Code of Beneficiary Branch:-	SBIN0017313

(Note:- In case of E-Tenders, no paper bids shall be accepted, therefore, the scanned copy of the Banker's Cheque/ Demand Draft/ Pay Order/ Details of payment made through Electronic Fund Transfer/ Fixed Deposit Receipt (FDR) / Bank Guarantee should be uploaded in the E-Procurement Portal and hard copy of the same should reach BHEL-PSNR HQ Noida before the due date and time of bid submission. BHEL shall not be responsible for postal or any other delays in this regard.)

5. **Procedure for Submission of Tenders**: This is an E-tender floated online through our E-Procurement Site <https://bhel.abcprocure.com>. The bidder should respond by submitting their offer online only in our e-Procurement platform at <https://bhel.abcprocure.com>. Offers are invited in two-parts only.

Documents Comprising the e-Tender

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

a. Technical Tender (UN priced Tender)

All Technical details (eg. Eligibility Criteria requested (as mentioned below)) should be attached in e-tendering module, failing which the tender stands invalid & may be REJECTED. Bidders shall furnish the following information along with technical tender (preferably in pdf format):

- i. Tender Cost and Earnest money Deposit (EMD) furnished in accordance with NIT Clause 3.0 & 4.0.
- ii. Technical Bid (without indicating any prices).

b. Price Bid:

- i. Prices are to be quoted in the attached Price Bid format online on e-tender portal.
- ii. The price should be quoted for the accounting unit indicated in the e-tender document.

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

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.**

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).

The Requirement:

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

BHEL has finalized the e-procurement service Provider:-

M/s AbcProcure, Ahmedabad

A-202/208, Wall Street-II, Opp. Orient Club, Nr. Gujarat College,

Ellis Bridge, Ahmedabad-380006

The contact details of the service provider are given below:

Name	Contact Nos.	e-mail ID	Role	Location
Swapnil Hamilton	+91 79 40270549	swapnil.h@eptl.in	Support Executive	HO – Ahmedabad
Hardik Oza	+91 79 40270560	Hardik.oza@eptl.in	Support Executive	HO – Ahmedabad
Ankur Bhatt	+91 79 40270590	ankur.bhatt@eptl.in	Support Executive	HO – Ahmedabad
Prashant Rajyaguru	+91 79 40270545 / 9016859416	prashant@eptl.in	Ast. Manager – Implementation & Support	HO – Ahmedabad
Dharam Rathod	+91 79 40270596 / 9374519754	dharam@eptl.in	Manager – Implementation & Support	HO – Ahmedabad
Pradip Parmar	+91 79 40270532 / 9328657215	pradip@eptl.in	Sr Manager – Implementation & Support	HO – Ahmedabad
Devang Patel	+91 79 40270576 / 99983 05442	devang@eptl.in	Sr Manager – Implementation & Support	HO – Ahmedabad

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

1. The contact details of the DSC Certifying Authority as given below

1	GNFC	www.ncodesolutions.com
2	e-Mudhra	http://www.e-Mudhra.com
3	Safescrypt	www.safescrypt.com

Vendors are also requested to go through seller manual available on <https://bhel.abcpocure.com>.

6. **Not Used**

7. 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. 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. **Assessment of Capacity of Bidders:**

Bidder's capacity for executing the job under tender shall be assessed 'LOAD' wise and 'PERFORMANCE' wise as per the following:

- I. **LOAD**: Load takes into consideration **ALL** the contracts of the Bidder under execution with BHEL Regions, irrespective of whether they are similar to the tendered scope or not. The cut off month for reckoning 'Load' shall be the 3rd Month preceding the month corresponding to the 'latest date of bid submission', in the following manner -

(**Note**: For example, if latest bid submission is in Jan 2017, then the 'load' shall be calculated up to and inclusive of Oct 2016)

Total number of Packages in hand = Load (P)

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

- II. **PERFORMANCE**: Here 'Monthly Performance' of the bidder for all the packages (under execution/ executed during the 'Period of Assessment' in all Power Sector Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced shall be taken into consideration. The 'Period of Assessment' shall be 6 months preceding and including the cut off month. The cut off month for reckoning 'Period of Assessment' shall be the 3rd Month preceding the month corresponding to 'latest date of bid submission', in the following manner:

(**Note**: For example, if 'latest date of bid submission' is in Jan 2017, then the 'performance' shall be assessed for a 6 months' period up to and inclusive of Oct 2016 (i.e. from May 2016 to Oct 2016), for all the unit wise identified packages (refer Table -1))

- 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) P₁, P₂, P₃, P₄, P₅, ... P_N etc. be the packages (under execution/ executed during the 'Period of Assessment' in all Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions = P_T (i.e. P_T = P₁ + P₂ + P₃ + P₄ + ... P_N)

- b) Number of Months 'T₁' for which 'Monthly Performance Evaluation' as per relevant formats, should have been done in the 'Period of Assessment' for the corresponding similar package P₁. Similarly T₂ for package P₂, T₃ for package P₃, 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 'S₁' of 'Monthly Performance Evaluation' Scores (S₁₋₁, S₁₋₂, S₁₋₃, S₁₋₄, S₁₋₅.... S_{1-T1}) for similar package P₁, for the 'period of assessment' 'T₁' (i.e. $S_1 = S_{1-1} + S_{1-2} + S_{1-3} + S_{1-4} + S_{1-5} + \dots + S_{1-T1}$). Similarly, S₂ for package P₂ for period T₂, S₃ for package P₃ for period T₃ 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

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

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

- e) Bidders to note that the risk of non-evaluation or non-availability of the 'Monthly Performance Evaluation' reports as per relevant formats is to be borne by the Bidder.
- f) Table showing methodology for calculating 'a', 'b' and 'c' above

Sl. No.	Item Description	Details for all Regions							Total
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
1	Similar Packages for all Regions → (under execution/ executed during period of assessment)	P ₁	P ₂	P ₃	P ₄	P ₅	...	P _N	Total No. of similar packages for all Regions = P _T i.e. Sum (Σ) of columns (iii) to (ix)
2	Number of Months for which 'Monthly Performance Evaluation' as per relevant formats should have been done in the 'period of assessment' for corresponding Similar Packages (as in row 1)	T ₁	T ₂	T ₃	T ₄	T ₅	...	T _N	Sum (Σ) of columns (iii) to (ix) = T _T
3	Monthly performance scores for the corresponding period (as in Row 2)	S ₁₋₁ , S ₁₋₂ , S ₁₋₃ , S ₁₋₄ , ... S _{1-T1}	S ₂₋₁ , S ₂₋₂ , S ₂₋₃ , S ₂₋₄ , ... S _{2-T2}	S ₃₋₁ , S ₃₋₂ , S ₃₋₃ , S ₃₋₄ , ... S _{3-T3}	S ₄₋₁ , S ₄₋₂ , S ₄₋₃ , S ₄₋₄ , ... S _{4-T4}	S ₅₋₁ , S ₅₋₂ , S ₅₋₃ , S ₅₋₄ , ... S _{5-T5}		S _{N-1} , S _{N-2} , S _{N-3} , S _{N-4} , ... S _{N-TN}	-----
4	Sum of Monthly Performance scores of the corresponding Package for the corresponding period (as in row-3)	S ₁	S ₂	S ₃	S ₄	S ₅	...	S _N	Sum (Σ) of columns (iii) to (ix) = S _T

- ii). Calculation of Overall 'Performance Rating' (R_{BHEL}) in case at least 6 evaluation scores for 'similar Package/Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment':

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' i.e. 6 months preceding and including the cut-off month
- 12 months preceding and including the cut-off month
- 24 months preceding and including the cut-off month

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

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

Sl. no.	Overall Performance Rating (R_{BHEL})	Corresponding value of 'L'
1	=60	NA
2	> 60 and $\leq$ 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 'I' above)

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

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

IV. Explanatory note:

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

ii). Identified Packages (Unit wise)

Table-1

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

- iii). Bidders who have not been evaluated for at least six package months in the last 24 months preceding and including the Cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions, shall be considered "NEW VENDOR".

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

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

The "FIRST TIMER" tag shall remain till completion of all the contracts against which vendors has been tagged as First Timer or availability of 6 evaluation scores within last 24 months preceding and including the cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions.

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

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

- iv). Consequent upon applying the criteria of 'Assessment of Capacity of Bidders' detailed above on all the bidders qualified against Technical and Financial Qualification criteria, if the number of qualified bidders reduces to less than four, then for further processing of the Tender, BHEL at its discretion reserves the right to also consider the bidders who are "not qualified" as per criteria of 'Assessment of Capacity of Bidders' and for this, procedure described in following three options shall be followed:
- All the bidders having Overall Performance Rating ('R_{BHEL}') ≥60 shall be considered qualified against criteria of 'Assessment of Capacity of Bidders'.
 - If even after using option "a", the number of qualified bidders remains less than four, then in addition to bidders considered as per option "a", "First timer" bidders having average of available performance scores ≥60 upto and including the Cut Off month shall also be considered qualified against criteria of 'Assessment of Capacity of Bidders'.
 - If even after using option "a" and "b", the number of qualified bidders remains less than four, then in addition to bidders considered as per option "a" and "b", "First timer" bidders for whom no performance score is available in the system upto and including the Cut Off month, shall also be considered qualified against criteria of 'Assessment of Capacity of Bidders'.

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

including the Cut Off month, shall be considered qualified against criteria of 'Assessment of Capacity of Bidders' for further processing of tender.

- v). 'Under execution' shall mean works in progress as per the following:
 - a. Up to execution of 90% of anticipated Contract Value in case of Civil, MM, Structural and Turbo Blower Packages
 - b. Up to Steam Blowing in case of Boiler/ESP/Piping Packages
 - c. Up to Synchronization in all Balance Packages

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

- vi). Contractor shall provide the latest contact details i.e. mail-ID and Correspondence Address to SCT Department, so that same can be entered in the Contractor Performance Evaluation System, and in case of any change/discrepancy same shall be informed immediately. Login Details for viewing scores in Contractor Performance Evaluation System shall be provided to the Contractor by SCT Department.
- vii). Performance Evaluation for Activity Month shall be completed in Evaluation Month (i.e. month next to Activity Month) or in rare cases in Post Evaluation Month (i.e. month next to Evaluation Month) after approval from Competent Authority. In case scores are not acceptable, Contractor can submit Review Request to GM Site/ GM Project latest by 25th of Evaluation Month or 3 days after approval of score, whichever is later. However, acceptance/rejection of 'Review Request' solely depends on the discretion of GM Site/GM Project. After acceptance of Review Request, evaluation score shall be reviewed at site and the score after completion of review process shall be acceptable and binding on the contractor.
- viii). Project on Hold due to reasons not attributable to bidder -
 - a. **Short hold:** Evaluation shall not be applicable for this period, however Loading will be considered.
 - b. **Long hold:** Short hold for continuous six months and beyond or hold on account of Force Majeure shall be considered as Long Hold. Evaluation as well as Loading shall not be considered for this period.
- ix). Performance evaluation in CL 9 above is applicable to prime bidder and Consortium partner (or Technical tie up partner) for their respective scope of work.

- 10. Since the job shall be executed at site, bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.
- 11. For any clarification on the tender document, the bidder may seek the same over e-procurement portal as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.
- 12. BHEL may decide holding of pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.
- 13. In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender

documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail.

14. Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.
15. 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 Clause No. 1, Salient Features of NIT, Sl. No. (xi) above.**

15a **Integrity Pact (IP)**

- i) 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. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

SI	IEM	Address	Phone & Email
1.	Mrs. Pravin Tripathi, IA & AS (Retd.)	D-243, Anupam Gardens, Lane IB, Neb Sarai, Sainik Farms, New Delhi – 110 068	pravin.tripathi@gmail.com

- ii) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part 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.
- iii) Please refer Section-8 of the IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

Note:

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are as per **Clause No. 1, Salient Features of NIT, Sl. No. (ix) above.**

16. The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the Pre Qualification Criteria specified in this NIT as per Annexure-I (as applicable), past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right not to consider offers of parties under HOLD.
17. In case BHEL decides on a 'Public Opening', the date & time of opening of the PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful/Disqualified bidders under intimation to the respective bidders-
18. Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise
19. (a) BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-

acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

- (b) Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'Process compliance form' (to the designated service provider) as well as 'Online sealed bid' in the Reverse Auction. Non-submission of 'Process compliance form' or 'Online sealed bid' by the agreed bidder(s) will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).
 - (c) The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. **The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.**
 - (d) If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).
 - (e) If reverse auction process is unsuccessful, sealed envelope price bids of all the techno-commercially qualified bidders shall be opened and the tender shall be processed accordingly. However, the envelope sealed bid(s) of techno-commercially acceptable bidder(s) who had agreed to participate in the RA and had failed to submit the online sealed bid shall not be opened.
20. On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.
 21. In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.
 22. The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.
 23. **Consortium Bidding** (or Technical Tie up): Not Applicable
 24. The bidder shall upload documents in support of possession of 'Qualifying Requirements' duly self-certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.
 25. The bidder may have to produce original document for verification if so decided by BHEL.
 26. It may please be noted that guidelines/rules in respect of Suspension of Business dealings', 'Vendor evaluation format', 'Quality, Safety & HSE guidelines', milestone/ completion certificate, etc may undergo change from time to time and the latest one shall be followed. The abridge version of extant 'Guidelines for suspension of business dealings with suppliers/ contractors' is available on www.bhel.com on "**supplier registration page**".
 27. The offers of the bidders who are on the banned/ hold list as also the offer of the bidders, who engage the services of the banned/ hold firms, shall be rejected. The list of **banned/ hold firms** is available on BHEL web site www.bhel.com

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

27.1.1 Commitment by BHEL:

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

27.1.2 Commitment by Bidder/ Supplier/ Contractor:

- (i) The bidder/ supplier/ contractor commit to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.
- (ii) The bidder/ supplier/ contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.
- (iii) The bidder/ supplier/ contractor will perform/ execute the contract as per the contract terms & conditions and will not default without any reasonable cause, which causes loss of business/ money/ reputation, to BHEL.

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

28. Not Applicable

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

30. Order of Precedence

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

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

for BHARAT HEAVY ELECTRICALS LTD

(SCT)

Enclosure:-

- (i) Annexure-1: Pre Qualifying criteria.
- (ii) Annexure-2: Check List.
- (iii) Annexure-3: Authorization of representative who will participate in the online Reverse Auction Process.
- (iv) Annexure-4: Integrity pact
- (v) Other Tender documents as per this NIT.

ANNEXURE - 1**PRE QUALIFYING REQUIREMENTS**

JOB	ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) AND HANDING OVER OF 1 X 59.3 MW GTG, 1 X 15.5 MW STG, DEAERATOR SYSTEM, 11 KV EMERGENCY DG SETS, HP AND LP PUMPS, FIRE FIGHTING SYSTEM, ASSOCIATED STATIC AND ROTATING AUXILIARIES OF GTG AND STG ETC. AT 1 X 75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP), VISAKHAPATNAM, ANDHRA PRADESH.
TENDER NO	BHEL/NR/SCT/VRMP/GTG & STG/1158

SL. NO.	NAME AND DESCRIPTION OF PRE-QUALIFICATION CRITERIA	BIDDER'S CLAIM IN RESPECT OF FULFILLING THE PQR CRITERIA
A	Submission of Integrity Pact duly signed	Applicable
B	Assessment of Capacity of bidder to execute the work as per clause 9.0 of NIT	Applicable – by BHEL
C	<u>TECHNICAL:</u> Bidder should have executed for any one of the following; 1) One STG/ GTG job of ≥ 20 MW OR 2) One Boiler (necessarily consisting of rotating machines) of one unit of ≥ 100 MW, under direct order of BHEL. OR 3) One R & M job of Steam Turbines of ≥ 100 MW OR 4) Three number capital overhauling works of STG, each of ≥ 250 MW against BHEL's direct orders.	Applicable
D D-1	<u>FINANCIAL:</u> <u>TURNOVER:</u> Bidders must have achieved an average annual financial turnover (Audited) of Rs. 219.60 Lakhs or more over last three Financial Years (FY) i.e. (2015-2016, 2016-2017, 2017-2018). Bidder shall submit the Audited Balance Sheet and Profit & Loss Account in support of this. In case audited financial statements have not been submitted for all the three years as indicated above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years. If financial statements are not required to be audited statutorily, then instead of audited financial statements, financial statements are required to be certified by Chartered Accountant.	Applicable

D-2	<u>NET WORTH:</u> Net worth (only in case of companies) of the bidder should be positive. Note: Net worth shall be calculated based on the latest Audited Accounts, as furnished for 'D-1' above. Net worth = Paid up share capital* + Reserves. (* : Share Capital or Partnership Capital or Proprietor Capital as the case may be).	Applicable
D-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 for 'D-1' above. Note: PROFIT shall be PBT earned during any one year of last three financial years as in 'D-1' above.	Applicable
D-4	Bidder must not be under Bankruptcy Code Proceedings (IBC) by NCLT or under Liquidation/ BIFR, which will render him ineligible for participation in this tender and shall submit undertaking to this effect.	Applicable
E	Approval of Customer	Applicable
F	Consortium Criteria	Not Applicable

Explanatory Notes for QR 'C':

1. For evaluation of PQR, the credentials of the bidder alone, and not that of the Group Company shall be considered.
2. Completion date for achievement of the technical criteria should be in the last 7 years ending on the 'latest date of Bid Submission' of Tender irrespective of date of the start of work.
3. For SI no 'C',
 - (a) "**Executed**" means achievement of milestones as defined below;
 - (i) "BOILER LIGHT UP" in respect of Boiler.
 - (ii) "SYNCHRONISATION" in respect of STG/ GTG.

The bidder should have achieved the above criteria, even if the contract has not been completed or closed.
 - (b) Boiler means HRSG or WHRB or any other types of Steam Generator.
 - (c) For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5 TPH 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 of the same in terms of MW shall be considered for evaluation.
 - (d) Scope of Capital overhaul of STG shall cover Bearing inspection work and overhauling of all cylinders of the Turbine.
 - (e) Experience of Oil/ Gas fired Boilers can also be considered.

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.

ANNEXURE - 2**CHECK LIST****NOTE: - Tenderers are required to fill in the following details and no column should be left blank**

1	Name of the Tenderer	
2	Address of the Tenderer	
3	Type of the Firm/ Company	
(i)	In case of Individual Tenderer	His / her full name, address and place & nature of business shall be furnished along with the offer.
(ii)	In case of Partnership Firm	The names of all the partners and their addresses, A copy of the partnership deed/instrument of partnership duly certified by the Notary Public shall be furnished along with the offer.
(iii)	In case of Companies	a) Date and place of registration including date of commencement certificate in case of Public Companies (certified copies of Memorandum and articles of Association are also to be furnished). b) Nature of business carried on by the Company and the provisions of the Memorandum relating thereof.
4.a	Details of Contact person for this Tender	Name : Mr/ Ms Designation: Telephone No: Mobile No: Email ID: Fax No:
4.b	Details of alternate Contact person for this Tender	Name : Mr/ Ms Designation: Telephone No: Mobile No: Email ID: Fax No:
5	EMD DETAILS	Mode of payment: Demand Draft/ NEFT/ RTGS/ OTHER Details of Transaction:
6	Validity of Offer	TO BE VALID FOR SIX MONTHS FROM DUE DATE
	DESCRIPTION	APPLICABILITY (BY BHEL)
7	Whether all pages of the Tender documents including annexures, appendices etc are read and understood	Applicable
8	Whether the format for compliance with PRE QUALIFICATION CRITERIA (ANNEXURE – 1) is understood and filled with proper supporting documents referenced in the specified format	Applicable
9	Audited Balance Sheet and profit & Loss Account for the last three years	Applicable
10	Copy of PAN Card	Applicable
11	Copy of GST registration	Applicable

SL. NO.	DESCRIPTION	APPLICABILITY (BY BHEL)	ENCLOSED BY BIDDER
12	Organization Chart of the tenderer's organization, including the names, addresses and contact information of the Directors/Partners shall be furnished along with the offer.	Applicable	YES / NO
13	Integrity Pact	Applicable	YES / NO
14	Offer forwarding letter / tender submission letter [Form No. F-01 (Rev 00)]	Applicable	YES / NO
15	Declaration by Authorised Signatory [Form No: F-02 (Rev 00)]	Applicable	YES / NO
16	Declaration by Authorised Signatory regarding Authenticity of submitted documents [Form No: F-02A (Rev 00)]	Applicable	YES / NO
17	No Deviation Certificate [Form No: F-03 (Rev 00)]	Applicable	YES / NO
18	Declaration confirming knowledge about Site Conditions [Form No: F-04 (Rev 00)]	Applicable	YES / NO
19	Declaration for relation in BHEL [Form No: F-05 (Rev 00)]	Applicable	YES / NO
20	Non-Disclosure Certificate [Form No: F-06 (Rev 00)]	Applicable	YES / NO
21	Bank Account Details for E-Payment [Form No: F-07 (Rev 00)]	Applicable	YES / NO
22	Format for seeking clarification [Form No: F-08 (Rev 00)]	Applicable	YES / NO
23	Capacity Evaluation of Bidder for current Tender [Form No: F-09 (Rev 00)]	Applicable	YES / NO
24	Power of Attorney for Submission of Tender/Signing Contract Agreement [Form No: F-25 (Rev 00)]	Applicable	YES / NO
25	Analysis of Unit rates [Form No: F-26 (Rev 00)]	Applicable	YES / NO
26	Tie Ups/Consortium Agreement are submitted as per format [Form No: F-22 (Rev 00)]	Not Applicable	YES / NO

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

DATE :

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

ANNEXURE - 3**AUTHORIZATION OF REPRESENTATIVE WHO WILL PARTICIPATE IN THE ONLINE REVERSE AUCTION PROCESS;**

1	NAME & DESIGNATION OF OFFICIAL	
2	POSTAL ADDRESS (COMPLETE)	
3	TELEPHONE NOS. (LAND LINE & MOBILE BOTH)	
4	FAX NO.	
5	E-MAIL ADDRESS	
6	NAME OF PLACE/ STATE/ COUNTRY, WHEREFROM S/HE WILL PARTICIPATE IN THE REVERSE AUCTION	

BHEL-IP

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

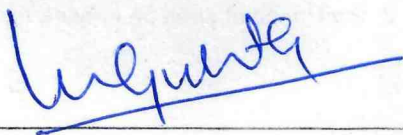
1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions:



Section 2 - Commitments of the Bidder(s)/ Contractor(s)

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
- 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.
- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- 2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and will await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

- 4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/ Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to



demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee, whichever is higher.

Section 5 - Previous Transgression

- 5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
- 5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 - Equal treatment of all Bidders/ Contractors / Sub-contractors

- 6.1 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors. In case of sub-contracting, the Principal contractor shall be responsible for the adoption of IP by his sub-contractors and shall continue to remain responsible for any default by his sub-contractors.
- 6.2 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors / Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 - Independent External Monitor(s)

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality in line with Non- disclosure agreement.
- 8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

- 8.5 The role of IEMs is advisory, would not be legally binding and it is restricted to resolving issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.
- 8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process, the matter should be examined by the full panel of IEMs jointly as far as possible, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.
- 8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to CMD, BHEL, at the earliest. They may also send their report directly to the CVO and the Commission, in case of suspicion of serious irregularities requiring legal/ administrative action. IEMs will tender their advice on the complaints within 10 days as far as possible.
- 8.8 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.
- 8.9 IEM should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the organization should be looked into by the CVO of the concerned organisation.
- 8.10 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code/ Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 8.11 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.
- 8.12 The word 'Monitor' would include both singular and plural.

Section 9 - Pact Duration

- 9.1 This Pact shall be operative from the date IP is signed by both the parties till the final completion of contract for successful bidder and for all other bidders 6 months after the contract has been awarded. Issues like warranty / guarantee etc. should be outside the purview of IEMs.
- 9.2 If any claim is made/ lodged during currency of IP, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

- 10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.



BHEL-IP

- 10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- 10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- 10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
- 10.5 Only those bidders / contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

For & On behalf of the Principal

(Office Seal)

Place-----

Date-----

Witness:-----

(Name & Address) -----

For & On behalf of the Bidder/

Contractor

(Office Seal)

Witness:-----

(Name & Address) -----

Signature

 **वी. के. गुप्ता / V. K. GUPTA**
अध्यक्ष महाप्रबंधक (उप संचिदा एवं क्रय)
Addl. General Manager (SCP)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड, पावर सेक्टर-उत्तरी क्षेत्र
Bharat Heavy Electricals Ltd., Power Sector-Northern Region
प्लॉट सं.25, सेक्टर-16ए, नोएडा/Plot No.25, Sec.16A, Noida

Rev 01
1st June
2012

TECHNICAL CONDITIONS OF CONTRACT (TCC)

(Document No PS:MSX:TCC)

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

FOR THE

“WORK OF ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) and HANDING OVER OF 1X59.3 MW GTG, 1X15.5 MW STG, DEAERATOR SYSTEM, 11KV EMERGENCY DG SETS, HP and LP PUMPS, FIRE FIGHTING SYSTEM, ASSOCIATED STATIC AND ROTATING AUXILIARIES of GTG and STG ETC. AT 1X75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP), VISHAKAPATNAM, ANDHRA PRADESH.”



Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)
Power Sector – Northren Region,
Plot No. 25 , Sector - 16A ,
Distt. Gautam Budh Nagar, NOIDA – 201 301 (INDIA)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

THE TECHNICAL CONDITIONS OF CONTRACTS (TCC) ARE DEFINED AS:

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3. Annexures to the contract (Chapter- 8 of TCC Part -2)	Page No. 118 to 340

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TECHNICAL CONDITIONS OF CONTRACT (TCC) PART I
Chapter I: Project Information

Sl. No.	Title	Description
1.1	Owner	Hindustan Petroleum Corporation Limited.(HPCL)
1.2	Project Title	1X75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP)
1.3	Type of Project	Modernisation Project, Brown Field.
1.4	Location	Visakh Refinery, Visakhapatnam, Andhra Pradesh
1.5	Nearest road head	Visakhapatnam (15 Km), Nearest National Highway- NH5
1.6	Nearest Airport railway station	Nearest Airport Visakhapatnam (10 Km),
1.7	Nearest Railway station	Visakhapatnam (15 Km),
1.8	Ambient Temperature/ wind and Rainfall data	Maximum wind velocity is for cyclone prone region. Wind pressure shall be based on IS: 875 Ambient temperature – Maximum 45°C and minimum 12.5°C. Rainy Season- June, July during S/W monsoon. Also rain occurs in Nov. /Dec. at the time of N/E monsoon. Rainfall data for 1-hour period - 80 -100 mm Maximum Rainfall in 24-hour period - 293 mm Wind Velocity - Maximum 185 km/hr and minimum 1-5 km/hr.
1.9	Relative Humidity	Maximum 60% and minimum 95%

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2.0	SCOPE OF WORK
2.1	BHEL has been awarded the work of : Project management, Process /Thermal / Hydraulic / mechanical design & engineering, procurement, manufacture /fabrication, testing, assembly, painting, packing & forwarding, transport, storage, erection, Site testing, Pre-commissioning and Commissioning of CPP Package of minimum 59.3 MW having GTG fuel as RLNG, Naphtha & HSD. The scope also includes site assembly, erection, site test, pre-commissioning, commissioning, performance guarantee, performance guarantee test run (PGTR) for complete package comprising of Gas Turbine Generator (GTG), Heat Recovery Steam Generator (HRSG), steam turbine Generator (STG), BOP packages, 66 kV Gas insulated switchboard, 33kV Gas insulated switchboard and 11 kV switchboard along with associated auxiliaries and accessories, 220/33 KV Transformers, 220/66 KV Transformers, civil, structural works, piping, insulation, electrical, instrumentations & control & all works etc. as required to complete the job in all respects.
2.2	The work under this contract scope shall cover erection, testing, commissioning (ETC), trial operation and handing over of 1X59.3MW GTG along with its auxiliaries and accessories, 1x15.5MW STG and its associated auxiliaries and accessories, Low and High Pressure Pumps with their Motors etc., 11KV Emergency DG set with its auxiliaries (such as inlet air system, steel chimney etc.), Fire-Fighting system, PHEs, Hoists, HOT cranes and associated integral piping systems of GT, STG, Pumps, DG sets such as Control, Lube Oil, Jacking Oil, Seal steam etc. along with the insulation, supply and application of paints.
2.3	This contract scope broadly consists of following works as described below but not limited to following:
2.3.1	Material shifting from yard/place of unloading to erection site.
2.3.1.1	BHEL material storage yard is located at BHEL HPVP (BHVP) Colony premises, Visakhapatnam and the erection site is at HPCL VRMP, Vishakhapatnam. The contractors' scope is receipt of material,taking delivery of the materials from BHEL storage yard at HPVP, other place of storage at HPVP, HPCL site etc. and transportation of the material to erection site at HPCL VRMP, Visakhapatnam.
2.3.1.2	All the erection material is stored at BHEL HPVP Colony premises. The distance to be traversed for shifting of the material from BHVP stores to erection site is approx.20 km, as per the designated route and identified material entry/exit gates of BHVP and HPCL. In case, due to any issues encountered during shifting of material by BHEL/EIL/ HPCL/ local administration, it is possible that a new route/gate may be decided by HPCL/BHEL and informed to the contractor, which may then require traversing of relatively longer distance for shifting of material. Also, local administration for any reasons may restrict the timing of material shifting from BHVP to HPCL plant. In all such cases, the contractor has to abide/adhere to all the guidelines/restriction/rules put in place for material transportation and has to shift the material as per planned schedule, at no extra cost to BHEL.

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	The contractor has to plan his material shifting in a way that there is no delay in shifting of material and the E&C is carried out as per planned monthly/weekly/daily program.
2.3.1.3	At BHVP material yard/stores, the material will be loaded on the contractor's (bidder) trailer by BHEL MM contractor. A crane(40MT) with operator and manpower is in the scope of MM contractor for loading of the consignments at yard. For consignments beyond capacity of 40 MT crane unloaded in the store yard, the crane or loading arrangement has to be made by the contractor of this work scope at no extra cost to BHEL. For instance, the steam turbine Generator(beyond capacity of 40 MT crane) is unloaded in the BHEL yard. All arrangements for transportation and loading for the Stator such as the cranes/ sleeper-jack arrangement,slings and manpower has to be arranged BY THE CONTRACTOR within this contract scope at no extra cost to BHEL. The contractor of this scope will have to arrange the trailers of suitable capacity for transportation of the material,consignments of this contract scope from BHEL yard to Erection site. The contractor may also be required to assist the MM contractor, if any special tool/tackle for loading is required. For facilitating MM contractor in better management of material loading, the contractor shall have his material shifting manpower at the yard to support the MM contractor during loading. For unloading and erection at site, BHEL 135 MT crane will be made available.
2.3.1.4	The ODC consignments such as Steam Turbine, Gas Turbine, GT Generator, DG set skids etc. of this work scope may directly be unloaded at site. Here all the arrangements for unloading of the package, shifting to foundation and erection will have to be made by the contractor. BHEL will only provide cranes as stipulated in chapter V of TCC. All other arrangements for unloading shifting has to be made by contractor within the lumpsum cost. Arrangement of sleeper jacks for unloading/loading is in the scope of the vendor.
2.3.1.5	For all material required to be erected in this contract scope, unloading of material at site and shifting to foundation is in the scope of this contract. Accordingly, all arrangements are to be made by the contractor other than any Cranes/T&P provided by BHEL.
2.3.2	E&C works of the covered scope-
	Followings works broadly cover the E&C scope of works:
2.3.2.1	Identification and development of loading-unloading procedures, pre-assembly, assembly and erection procedures for all equipment, structures and systems of this package as specified therein. The contractor has to prepare procedure in line with the safety and quality standards, drawings, QAP's, FQP of BHEL/EIL and get these approved from BHEL/EIL before starting erection/shifting/loading of each equipment.
2.3.2.2	Placement, erection, alignment, welding, NDT, insulation and painting, cement lining, testing, mechanical completion, pre-commissioning and commissioning, trial run and handing over of the equipment, piping, and other packages of this contract scope as per detailed technical drawings and specification.
2.3.2.3	Preservation, safe keeping, watch and ward of the material at site.

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2.3.2.4	Checking, dressing, chipping and levelling of foundations.
2.3.2.5	Pre-assembly, erection/placement, alignment, machining and grouting, welding of various equipment, piping of this package.
2.3.2.6	Welding, heat treatment, radiography, UT and other non-destructive tests wherever required as per approved quality plan/drawings/ documents.
2.3.2.7	Hydraulic testing, Air tightness test, Air Blasting, trial run of auxiliaries, and other pre commissioning tests as per approved quality plan/drawings/ documents
2.3.2.8	Insulation and finish painting including supply of paints etc.
2.3.2.9	Mass water flushing of piping, lube oil flushing, as per the requirement of the system. Arrangement of fixing of steam blowing and hydro-test blanks and restoration as per requirement.
2.3.2.10	Erection and commissioning of Gas Turbine & Gas Turbine generator with all auxiliaries and its integral piping.
2.3.2.11	Erection and Commissioning of Steam turbine & steam turbine generator with all Auxiliaries and its integral piping.
2.3.2.12	Erection and Commissioning of Boiler Feed Pumps ,other LP and HP pumps and associated auxiliaries.
2.3.2.13	Placement, Assembly, Erection, welding and NDT of Deaerator with Feed Storage Tank with platform and accessories.
2.3.2.14	Erection and commissioning of 2X6750 KVA DG sets, its auxiliaries and piping
2.3.2.15	Erection and Commissioning of Auxiliaries of Turbine, Generator, BFPs and other systems
2.3.2.16	Erection and commissioning of Fire Fighting system i.e. water and inert gas based. Cement lining of water based fire protection system as per specifications.
2.3.2.17	Unit trial operation, resolving any deficiencies observed and handing over to customer.
2.3.2.18	Assistance during PG Testing of main equipment along with all auxiliaries. Completion of punch points and assistance for handing over of unit (s) to customer.
2.3.2.19	Deployment of Automatic Blast cleaning and Painting machine for carrying out cleaning and painting in this project.
2.3.2.20	Painting of all equipment as per requirement along with supply of required materials, machineries and other resources as required to carry out the job.
2.3.2.21	Insulation of the equipments of contract scope, other than steam turbine.
2.3.2.22	Liasioing for Statutory permissions/approvals for equipment of this contract scope for ex. Firefighting, DG sets etc.
2.3.2.23	Preparation of MIRs, following of safety and quality norms and documentation, preparation of material status and up-gradation of activities, networks at regular intervals.
2.3.2.24	Grouting of Equipments: The grouting is in the scope of The CIVIL contractor. The the supply of cement, shuttering and other arrangements are in the scope of the CIVIL Contractor. However, contractor will have to arrange, gravel/ sand etc. for filling in the bolt holes and any material for protection of mechanical equipment/ bolts etc. and application

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	of the same. The contractor shall coordinate and assist the CIVIL contractor during grouting, so that the process is completed without interruptions.
2.3.2.25	Handling and filling of Chemicals, Lubricants/gas/ preservatives during, erection, preservation, chemical cleaning / flushing / blowing, pre-commissioning, Commissioning and subsequent topping up till Trial operation completion.
2.3.2.26	Erection and commissioning of electrical motors of the equipment's and auxiliaries, inclusive of CT mounting, testing etc. The greasing of these motors is in the scope of this contract.
2.3.2.27	The erection, commissioning and testing of actuators of motorized valves erected in this contract scope.
2.3.2.28	Completion of all punch points and assistance in handing over of unit to customer. Execution of all Mechanical jobs identified during OWNER Technical audits, check list of pre-commissioning and commissioning.
2.3.2.29	Unit trial operation and handing over of equipment's of this contract scope and resolving any deficiencies observed during handing over. Assistance during trial operation of 1X75MW CPP as a whole system.
2.3.2.30	The contractor shall also supply paints, primers and other consumables as required for painting of the scope of work. Any special paints if supplied at site by the OEMs/ BHEL Units shall be issued free of cost to the contractor for application.
2.3.2.31	Digital Radiography and NDT: Contractor will have to use digital radiography to the extent possible, which will provide Real time digital imaging and helps faster interpretation (Refer Doc. No. B016-00-000-19-41-1002). Use of Selenium based source for radiography is to be implemented as per Instruction of BHEL so that radiography can be done with minimum interference with other construction activities. Only digital radiography has to be carried out in this project until the hard copies are required for. Use of Close Proximity & AUT (PAUT + TOFD) for major piping NDT. Contractor will be allowed to carry out Radiography with Close Proximity technique & AUT (PAUT + TOFD) Inside Refinery. However, in case Radiography with other technique is required to be carried out, same shall be done with prior approval of Engineer In-charge.
2.3.2.31.1	The contractor will have to use Auto UT (TOFD+PAUT) Machine for carrying out UT, and following equipment/arrangement wherever required as per the quality plan or drawings: - Hanging Scaffold to facilitate continuous piping erection work - Equipment for Digital Radiography - X-ray and Gamma ray Radiography sources - Stress Relieving Equipment with Recording facility
2.3.2.32	ADDITIONAL PLATFORM / STRUCTURES

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	Erection of equipment handling systems for ex. hoists including those supplied by MU's/ Vendors & additional platforms and approaches wherever required by the engineer / customer to facilitate operation are to be fabricated and installed at site within the lumpsum contract. Erection of permanent Platforms (with grating, railing, toe-guards and stairs) for safe approach and operation of equipment, auxiliaries and valves of this contract scope as per BHEL and customer requirement for safe operation is part of this contract. Supply of structural materials for these platforms shall be done by BHEL. It may be required to reclaim material from the available scrap. Approx. 25 MT platforms may be required to be fabricated & erected within the lumpsum price. This tonnage(25 MT) does not include those platforms and approaches which are supplied by the manufacturing units and already forms part of the erectable tonnage under this contract. There is no separate payment for carrying out this work and it is part of the lump sum contract value.
2.3.2.33	Contractor shall arrange scaffolding pipes for temporary platform required for erection & commissioning works of equipment. All scaffolding pipes shall be painted as required by EIL/HPCL, before use at site.
2.3.2.34	Temporary Piping: Any temporary piping hangers and supports , fittings, strainers, valves and blanks for hydro testing of the pipelines, valves and equipment of this Package shall be erected by the contractor . It is the Contractors responsibility to erect and commission all pumps, tanks, instruments and other accessories of this scope of works that would be required for testing operations. Erection, Laying, Welding, NDE/Radiography of temporary Piping, Valves, Tanks, Supports etc. for Air Blowing, Steam Blowing, Chemical Cleaning/ Flushing, Thermal shocks etc. and their subsequent dismantling after completion of work, disposal of effluent after flushing. Erection of all temporary piping, valves, pumps, tanks etc. required for above operations and other commissioning activities including post commissioning, Unit trial operation and handing over of above systems as per specifications/ drawings/ data sheets. Dismantling of the above and all temporary piping and systems is also in the lumpsum scope.
2.3.2.35	Earthing of Tanks/pipelines - Flats are required to be welded for earthing protection in Hazardous areas as per drawing/specification provided. Before Hydro testing of Pipelines, the contractor shall weld a plate on the pipe/tank etc.

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	Lugs/flat/plate on piping required as a part of Earthing protection in Hazardous area is to be welded on the pipes by contractor of this work scope. Further works to be carried out by Electrical contractor.
2.3.2.36	The customer or their Consultant will depute their representative for checking and supervision of important stages of work in line with the quality plans and drawing specifications. The contractor shall be required to provide all facilities for inspection of works, without any cost implications to the BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the contractor in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.
2.3.2.37	<u>Scaffoldings & Barricading</u> - Suitable steel scaffoldings only shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that can be safely done using ladders or certified (by Third party competent person) man-basket. When a ladder is used, an extra workman shall always be engaged for holding the ladder. - The Contractor shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. - All scaffolds shall be inspected by a competent Scaffolding Inspector of the Contractor. He shall paste a GREEN tag (duly signed by competent Scaffolding Inspector) on each scaffold found safe and a RED tag (duly signed by competent Scaffolding Inspector) on each scaffold found unsafe. Scaffolds with GREEN tag only shall be permitted to be used and Scaffolds with RED ones shall immediately be made inaccessible. Work being found continuing on scaffolds with RED tag shall be considered unauthorized work by Contractor and may invite penalization from EIL/Owner. For every 120-125 m² /m³ area / volume or its parts there of minimum one TAG shall be provided. - The Contractor shall ensure positive barricading (indicative as well as protective) of the excavated, radiography, heavy lift, high pressure hydrostatic & pneumatic testing and other such areas. Sufficient warning signs shall be displayed along the barricading areas. - Scaffolding shall be constructed using foot seals or base plates only.
2.3.2.37.1	- Hanger type of scaffolding (Positive Isolation) with safe access on Pipe Rack shall be used during erection work - Temporary Stair access (DOKAS Ladder) for safe access/ egress shall be used during erection.

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2.3.2.38	Piping and equipment, as per requirement / drawings are to be thermally insulated with bonded / unbonded mineral wool /LRB mineral wool and to be covered with aluminium cladding.
2.3.2.39	All the above systems of piping include erection of pipes, bends, elbows, valves, fittings, impulse piping including root valves, sampling lines, drains, hangers and supports & other accessories so as to make the systems complete in all respect.
2.3.2.40	For the works of this contract scope: 1) There shall not be any supply of welding electrode. 2) Pipe shoe fabrication, if required is in Erection Agency/ Contractor Scope. Necessary plates, pipes shall be supplied loose. 3) Spring Hangers and Rigid Hangers are supplied in assemblies. 4) Fabrication and Installation of Auxiliary Structure for Pipe Supports is in Erection Agency/ Contractor Scope. Necessary Structural Steel and Plates shall be supplied loose. 5) Insulation mattress, Aluminium Cladding & Insulation Ancillaries will be supplied under separate packages. Application of Thermal Insulation is in the Scope of Erection Agency except for Steam Turbine. 6) The material required for temporary supports may be arranged from BHEL supply, with permission from BHEL. 7) Galvanised piping will be supplied in plain lengths. Threading on piping where required to suit the piping isometrics/layout shall be done by erection agency
2.3.2.41	Final Painting of the finished Works
2.3.2.41.1	<u>Procurement/Supply of Paints</u> Contractor has to supply all paints, primers and other consumables for painting of relevant area of contract scope as per EIL/HPCL/BHEL painting schedule. The EIL specs for painting are attached for reference. Wherever EIL specs are not available/ BHEL painting procedures, specs shall be applicable.
2.3.2.41.2	The contractor has to obtain BHEL prior approval before procurement of paints, primers etc. These shall be procured from BHEL approved suppliers, with prior approval from BHEL site.
2.3.2.41.3	Contractor shall produce manufacturer's test certificate. BHEL reserves the right to reject any material not found satisfactory.
2.3.2.41.4	Material shall be supplied by contractor within the lump sum price quoted by the contractor. No extra claim is admissible for supply of paints/primer and other consumables etc.
2.3.2.41.5	Application of paints for final painting includes surface preparation, cleaning, marking of identification marks, color bands, direction of rotation / flow marks, legends etc. is to be completed as per HPCL/ BHEL site requirement.
2.3.2.41.6	<u>Painting: General specs to be followed at site for piping, equipment, skids, ducting etc.</u> Surface preparation and Painting for all the Piping items, equipment, ducts, skids of this package is in the scope of erection agency and shall be as per the applicable Painting & Coating Schedule/Specification of EIL/HPCL to be provided at the time of execution.

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	Surface Preparation Coating and Final Painting for Structural steel for equipment, Piping Supports and Piping material is to be done as: Piping material shall be supplied with rust preventive coating. Further, all coating system including surface preparation, primer, and finish coat for piping shall be done at field only. Method of Surface preparation: Blast cleaning (Grit Blasting) may be required to be done. No Sand blasting is permitted. Final color coding shall be as per contract specification of Customer.					
2.3.3	Support Services to be provided to other BOP contractor as defined below					
2.3.3.1	The erection and commissioning of following packages is not in the scope of this contract. These shall be erected/commissioned by the respective BOP vendors/OEMs. However, the material shifting works from store yard to erection site for the below detailed BOPs(Balance of Plant), shall be in this contract scope: <table><tr><td>1.</td><td>Air Conditioning System</td><td>01 Set</td><td>167 MT</td><td>Material shifting are in the scope of this contract.</td></tr></table>	1.	Air Conditioning System	01 Set	167 MT	Material shifting are in the scope of this contract.
	1.	Air Conditioning System	01 Set	167 MT	Material shifting are in the scope of this contract.	
The maximum weight of single item that is to be handled and transported in AC system is approx. 11 MT (LP Steam Driven Vapour AbsorptionMachine of 185 TR capacity- 04 No.s). Other items of AC system are within this weight range and are typical of the equipment, piping, ducting used in a normal VAM based AC system. The major items are FRP based cooling towers, hoists, AHUs, Fresh air system, dampers, piping and its accessories.						
2.3.3.2	Material handling/shifting works from BHEL yard to erection site at HPCL plant shall be in the scope of this contract. This shall include shifting of material from storage yard and transportation on trailer to place near erection site.					
2.3.3.3	The loading of BOP material (within the capacity of 40 MT crane) at BHEL stores at BHVP shall be in the scope of MM contractor but the unloading of the material of these BOPs at HPCL plant site is in this contract scope. Provision for cranes/hydra and lifting tools and tackles such as slings / d-shackles at plant site to shift the material to erection site.					
2.3.3.4	Facilities required (Electricity, Water etc.) by the OEM of AC system during E&C of the system are to be provided by vendor of this contract scope.					
2.3.3.5	Contractor shall assist the OEM of AC system with the cranes of this contract scope during erection.					
2.3.3.6	There shall be no extra claim for carrying out the activities of Sl.No.2.3.3.2.The contractor shall include the cost against such works in its price bid. The cost against the same will be considered as included in the contract value by the contractor and no further/extra claim in carrying out these works will be admissible.					

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2.3.3.7	These works as listed above in 2.3.3, shall be executed as per instruction of the BHEL engineer to meet the E&C schedule of these packages. Contractor has to schedule these works in such a manner so that his E&C scope of works are not affected. If required, additional manpower, T&P as required may be deployed by the contractor for carrying out these works. In case of delay on part of the contractor in providing assistance as mentioned in 2.3.3 and its sub-clauses, BHEL may exercise the option of carrying out these works at risk and cost of the contractor of this work scope. (The erection program of BOP shall be provided by BHEL to the contractor of this work scope. The delay in transportation of material shall be measured with respect to this program for erection of the package items)
2.3.3.8	All the documentation for issue /receipt from stores etc. and erection, safety permits etc. shall be in the scope of the BOP package scope.
2.3.3.9	Further, all other works of erection commissioning are in the BOP vendor scope only.
2.3.4	Manpower Services to be provided to BHEL
2.3.4.1	The contractor under this contract shall also provide services of following manpower free of cost exclusively for use by BHEL:
2.3.4.2	For this project as the office operations of BHEL are distributed at 03 places (i.e. site office, EIL campus, BHVP colony), secretarial and menial works manpower will be required at all places for maintenance of office and sundry official and establishment works. Following manpower exclusively for use by BHEL at site or office is to be provided on free of cost basis as detailed below.
2.3.4.3	10 man months of Skilled workers- for working at BHEL office and site or as per BHEL discretion.
2.3.4.4	10 man months of Semi-skilled workers - for working at BHEL office and site or as per BHEL discretion.
2.3.4.5	10 man months of Unskilled workers- for working at BHEL office and site or as per BHEL discretion.
2.3.4.6	BHEL reserves its rights to consume these manpower up to the extent as mentioned in clause no. 2.3.4.3 to 2.3.4.5, even after scheduled completion date of the contract but before final billing.
2.3.4.7	In case contractor fails to provide above-mentioned manpower as desired by BHEL, then BHEL will have the right to hire such services from other agencies. In such case, BHEL shall recover amounts against such deployment at the risk and cost of contractor.
2.3.4.8	In case these services remain un-utilized, fully or partly till the final bill submission by contractor, for reasons attributable to BHEL, the charges for unutilised man-months shall be recovered/deducted from contractor`s final bill at the following rates. These rates for recovery/deduction from Final Bill in case of non-utilisation of man-months of different category workers are inclusive of all BHEL and statutory overheads:

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	<u>Sl. No.</u>	<u>Manpower Type</u>	<u>Recovery/man-month</u>
	1.	Skilled worker	Rs.25,000/-
	2.	Semi-skilled worker	Rs.22,000/-
	3.	Un-Skilled worker	Rs.20,000/-
2.3.4.9	Persons so deployed may have to work in extended hours whenever required at no additional cost to BHEL. Workmen provided as per the above provisions shall be fully trained and experienced in the nature of work for which they are deployed. The person so employed shall solely be in the contractor roll and all the legal/ statutory compliances/accountability regarding these deployment shall be in contractor's scope.		
2.3.4.10	The contractor has to ensure payment of minimum wages as per the category and accordingly compliance to all statutory and regulatory guidelines applicable at the site.		
2.4	The scope of works covering the above clauses 2.3.1 to 2.3.4 and its sub-clauses is further detailed below: Bidder to note that any inadvertent omission in this scope of work shall not absolve contractor of his responsibility for executing any ETC work related to the completeness of the project, regarding the packages of this contract scope. BHEL reserves the right of adding or excluding any components/ items / systems according to the site requirements/ customer requirements to complete various systems in all respects. Any other systems / components which are integral to the scope of work of this contract and whose details may have been missed in this tender (including chapter X) but are supplied by the manufacturing units/PESD/BOI/Customer shall also be erected and commissioned by the contractor within the lump sum rate quoted for this package. No extra claim shall be admissible in any such case.		
2.4.1	The weight to be erected for the Mechanical package under this contract is approx. 2200 MT. The tentative break up is indicated in Chapter X of TCC part -I		
2.5	The brief description of the major equipment to be erected and works to be carried out under the mechanical package are detailed below but are not limited to the following:		
2.5.1	<u>ETC works Of 15.3 MW Steam Turbine Module and Generator</u> The steam turbine and ST Generator with rotor will be dispatched from BHEL factory as assembled module to site. The ST Generator(34 MT) has been unloaded at BHEL yard in BHVP colony and is to be transported from BHVP yard to erection site at HPCL by the contractor. The arrangements for loading and transportation is to be made by the contractor. For unloading and erection at site, 135 MT crane shall be made available free of cost to the contractor.		

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	Similarly, ST module(40 MT) may also be unloaded in BHEL yard in absence of readiness of the TG deck. In such case it will have to be loaded and transported to erection site within this contract scope. In case the STG deck is not available and ST module is unloaded at site then contractor will have to arrange to unload the same in near vicinity. On readiness of the deck, shifting/erection of turbine and generator shall be in the scope of contractor. 135 MT crane shall be made available free of cost. Due to inadequate capacity of EOT crane available in TG HALL & space constraints, Generator stator (weighing 34 MT) and Steam Turbine Module (40 MT) has to be lifted by 135 MT Crane. For this the contractor shall plan with BHEL site in advance and inform BHEL about the structure/building to be put on hold, required for carrying out the erection. All the arrangements regarding this lifting of the Turbine and Generator stator has to be made by the vendor except the Crane i.e. Required size slings, D-shackles, any temporary stools etc. has to be arranged by the vendor. Test certificates for the T&P used has to be submitted to BHEL before start of work. Procedure for lifting/erection of the Turbine and stator with Job Hazard Analysis, shall be submitted and got approved from BHEL, before start of erection/lifting work.
2.5.2	The steam turbine system consists of following systems and accessories such as Turbine Emergency Stop Valve & control valve , Injection Steam Emergency Stop Valves & control valves ,Steam Strainers, Blanket plate for steam blowing, Coupling bolts and Coupling Guard, Solenoid Valve for Remote Tripping, Turbine Sole Plates, Foundation Bolts; Shaft Grounding Device; Mating Flanges for Turbine Inlet and Injection steam Flanges, Gland Sealing System (Automatic), Exhaust-hood spray system, Relief diaphragm on Exhaust-hood, vacuum breaker valve, Gear Box etc.
2.5.3	E&C of Manual Barring Device and Turning Device -Hydraulic
2.5.4	Interconnecting piping between HP valve block & Turbine, Gland Steam Leak-off Line to Gland steam condenser.
2.5.5	Erection and commissioning of Steam Piping for STG integral portion, Turbine Drain Water Piping within TG Block; Complete Lube Oil Piping; Complete Jacking Oil Piping , Relief Valves, Complete Control Oil Piping (Stainless Steel Material); Overhead Lube Oil Tank Piping etc.
2.5.6	E&C of Turbine Enclosure (To meet noise level requirements)-
2.5.7	Turbine Insulation (mineral Wool Mattresses with CAT-9 cement layer) – The application and supply of the turbine insulation is in the scope of the insulation supplier. The vendor of this contract scope has to provide logistic assistance (shifting of material from yard to turbine floor and providing scaffolding etc.) to the insulation vendor in carrying out the work.

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2.5.8	Indicative list of other STG auxiliaries to be erected under this contract is as: - Overhead Lube Oil Tank and associated piping - Main Oil Pumps with AC Motor - Auxiliary Oil Pump with AC Motor - Emergency Oil Pump with DC Motor - Jacking Oil Pump with AC Motor & DC motor - Duplex Filter for Lube Oil - Trans flow valves for duplex oil filters, strainers - Oil coolers - Oil Mist Fan with AC Motor (2x100%) - Oil Accumulators for Lube Oil and Control Oil - Oil Purification Unit - Governing Console - Gland steam condenser. - ST oil cooler 2X100% - ST Generator with its auxiliaries, AIR COOLER, CO2 fire extinguisher equipment for generator etc. - Gear Box etc.
2.5.9	The works involved in erection of Steam turbine and Generator are broadly defined below: - Checking of foundation, marking centerlines , elevation, Chipping of loose concrete from the foundations - Placement of pedestals, catenary setting/leveling, fixing of seismic arrestors - Placement of Turbine - Removal of transportation devices and loading of bearing. - Clearance setting, performance of checks such as centering, roll check etc. - Grouting and foundation bolt stretching and locking. - Placement of Gear Box. - Alignmenet of Turbine shaft with gear box and coupling - Placement of Generator base plates - Air cooled generator with brushless exciter is supplied with assembled Generator rotor . Placement of assembled Generator stator on the foundation. - Performance of checks on the generator and rotor. - Alignment with gear box and coupling - Erection of the Air filter ducts and Air filters of the Generator Cooling system. - Erection, alignment and Grouting of the Generator brushless exciter. - Oil flushing, normalization. - Precommissioning and Commissioning. - Barring Gear, Synchronisation - Placement , erection, alignment and commissioing of auxiliaries of STG . - Erection of integral piping and pre-commissioing thereafter. - Erection of De-aerator, Feed Storage Tank and corresponding piping connections. - Erection of Boiler Feed Pumps, Vaccum Pump/Ejectors, High And Low Pressure Pumps, JOP, AOP, EOP, Gland Steam Condenser, Drain Coolers and other packages as per chapter X. - Turbine enclosure erection
2.5.10	Loading/Unloading of the Steam Turbine Generator: The STG generator is unloaded at yard at BHVP. The vendor will have to arrange for suitable capacity crane and trailer for loading

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	and transportation of the stator to the TG deck area in CPP, within the quoted lumpsum cost. As detailed above, the contractor shall shift the ST generator from yard to site. At site, contractor will have to arrange slings and other T&P for unloading of the Generator from the trailer to a location near to the TG deck . BHEL 135 MT crane shall be issued free of cost for unloading of the stator in the CPP premises and further erection to TG foundation. All other arrangement have to be made by the contractor.
2.5.11	Erection of ST Generator Air Filter and Ducts- The generator air filter and ducts are supplied directly from BHEL vendor works and needs to be assembled at site in line with vendor drawings and documentation. It has to be ensured that air filter housing and upstream cold air inlet ducting mating parts are perfectly joined. However, if external sealing is required the same may be done to prevent air ingress from the atmosphere into the clean air side of the air filters. Hot air duct shall be assembled in line with drawings and anchors. Anchoring fasteners /Hilti machines with bolts may be required for securing the supports.The fasteners as required have to be supplied within the lumpsum cost. The air filter ducts needs to be inspected for cleanliness. Any paint damages, chipping if observed in the inlet duct will be required to be cleaned and touch up painted/repainted depending on requirement. In case paint is not supplied by OEM , then the same shall be supplied by the contractor of this work scope within the quoted price. For erection of the air filter and hot ducting, the scaffolding has to be safely secured and got checked by BHEL safety officer.
2.5.12	<u>FST and Deaerator Erection:</u> Feed Storage Tank shall be supplied to site in 03 pieces or a single assembled piece. Accordingly, contractor shall be prepared for erection arrangement as per below mentioned possibilities: - a.) In case the FST is supplied in 03 pieces, contractor will have to arrange for the erection/lifting of the FST tank by BHEL 135 MT crane.This crane shall be provided on free issue basis. - b.) In case the FST is supplied in 01 piece, erection of FST will have to be explored in following ways: - i.) Erection by 135 MT crane(on free issue basis to the contractor). In this case, 01 columns of the deaerator building and the stair case shall have to be put on hold till erection of the FST. The contractor will have to plan accordingly and inform BHEL in advance regarding the same.

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	ii.) Erection of the FST and deaerator with higher capacity crane suitable for erection. This crane shall be provided free of cost by BHEL to the contractor. In case the FST cannot be directly placed on the foundation and is placed on the nearby floor by the crane, than the same may require shifting/dragging upto the foundation. Contractor will have to do required temporary arrangements for the shifting/dragging at no extra cost to BHEL. In both cases of a and b above, the contractor will have to carry out the necessary alignment, welding, NDT, hydrotest of the FST and deaerator, as per requirement(depending of supply) within the lumpsum cost and there shall not be any claims of the contractor in this regard. Insulation and cladding of both FST and Deaerator shall be carried out after Hydrotest. Permanent and temporary platforms shall be erected as per drawing and requirement
2.5.13	Gas Turbine and Generator - The Gas Turbine is Frame 6F.03. It comes as a skid and has to be directly unloaded/shifted on the foundation from the trailer. In the most unlikely case if the foundation is not ready by the time GT skid reaches site. The GT skid will have to be unloaded near to the foundation and shall be shifted to the foundation once it is ready. All arrangements of unloading the GT and shifting to the foundation is in the scope of the contractor. The unloading and erection of the GT skid, GT Generator may be carried out with sleeper jack method or any alternate method within the quoted lumpsum price and with prior approval from BHEL.
2.5.13.1	The indicative list of the accessories and auxiliaries of GT is as: • Gas Turbine Skids • Gas Turbine Generator skid • GT OFF BASE ENCLOSURE • LOAD COUPLING WITH HARDWARELOAD GEARGT walkways

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	• GT Inlet Air Filter House • GT vent ducting • Exhaust Diffuser • Compressor water wash skid • lube oil centrifuge • Field interconnecting piping • Inlet Ducting consisting of Silencers • Expansion Joints & Support Structures • Exhaust System consisting of Ducts • LUBE OIL & GAS FUEL MODULE (ACCE. MODULE) • Diverter Damper • Guillotine Damper • Bypass Stack Transit Pieces • LF, AA, WI compartment • CO2 container along with accessories, except CO2 cylinders • Stack support Structures • Seal Air Fans • GT & Off Base Enclosures • Mist Eliminators and exhaust blowers • Gear Box The item listed above are indicative in nature but not exhaustive. The purpose is to provide a fair idea of the work involved in the GTG to the bidders.
2.5.13.2	Brief description of the works involved in the execution of the ETC works of GT are as:
2.5.13.3	Foundation Checking, Placement, Bolting & Embedded parts The contractor has to inspect civil foundation, coordinates, elevations, distances including diagonals, verticality, foundation bolt pockets of all the foundation bolts of all equipment foundations to be erected under this contract scope.
2.5.13.4	Blue Matching of all the sub-sole plates, solid shim plates & L plates to at least 85% contact are to be done and then, by actual blue matching with the concerned mating part & ensure uniform thickness at all 4 corners.
2.5.13.5	All the shims are to be matched such that there are no burrs, dents & bends. Lapping is required to be done for anchoring pins with the concerned matching parts with tolerances as shown in relevant drawings. All the foundation plates/sub-sole plates of main equipments required to be master levelled within 0.02 mm/meter in all directions & centred to foundation bolts. All the sub-sole plates elevations need to be maintained within 0.20mm. Pockets should be free from any leftover debris during foundation casting & to be chipped-off all around the pockets for at least by

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	25 mm prior to assembly of concerned sub-sole plates before sub-sole plate grouting.
2.5.13.6	Gas Turbine Skid: For placement of main equipment like Gas Turbine skid, all the tools/ tackles, jacks, sleepers, steel beams need to be arranged at site by concerned erection agency. Handling and placement of the equipment should be done carefully at appropriate locations as shown in the applicable documents. All the inputs required for providing jack support plates below the lifting trunions of the base need to be arranged at site by the erection agency in consultation with the concerned erection engineer.
2.5.13.7	It has to be ensured that all temporary fixtures like rotor locking, transport pin etc. fitted to the gas turbine as part of transport requirements are to be removed prior to carrying out checks on the equipment. Drop check & spring back checks are some of the important checks that need to be carried out at site.
2.5.13.8	Shim adjustments, contact area check under the base plates may require several iterations to arrive at an optimum level. All items which were dismantled at works for the purpose of ease of transportation need to be reassembled at site as per applicable documents/lists
2.5.13.9	Inter skid alignment followed by spring back check, alignment of on base rotating equipment in line with applicable documents need to be carried out.
2.5.13.10	Assembly of couplings shall be involving bolt stretching in line with applicable documents. Bolt stretching equipment/device will be provided, while it's operation and maintenance is the responsibility of the erection agency.
2.5.13.11	Alignment fixtures required for GT coupling, if supplied by the BHEL MU works will be provided for alignment on returnable basis. In case the same is not provided, contractor will have to arrange for the same.
2.5.13.12	All the coupling guards and its hardware will be supplied from works, this may require mock-up assembly & responsibility of ensuring final fit up in line with applicable document lies with erection agency.
2.5.13.13	Temporary coupling bolts required for coupling before reaming/honing of the GT coupling- Gear Box coupling – GT Generator coupling or Steam Turbine Gear Box – Generator coupling etc. are to be arranged by the contractor at its cost. In case these are supplied by MU, the same shall be provided to the contractor Free of cost.
2.5.13.14	Inlet ducting Inlet ducting is supplied directly from BHELs vendor works and needs to be assembled at site after ensuring proper assembly of inlet plenum. It involves assembly of inlet ducting from inlet plenum interface to the inlet air filter outlet and their associated support structure, ladders, platforms etc. The overall arrangement should comply with the general arrangement of the unit including coordinates, elevations etc. All the suitable gaskets need to be prepared at site.
2.5.13.15	GT Air Inlet filters and Inlet Air Ducting Air filters are supplied directly from BHEL vendor works and needs to be assembled at site in line with vendor drawings and documentation. It has to be ensured that air filter housing and downstream inlet ducting mating parts are perfectly joined.

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	However if external sealing is required the same may be done to prevent air ingress from the atmosphere into the clean air side of the air filters. The work of air filter shall be performed meticulously, so as to manage its cleanliness and blocking ingress of any loose material in the filters and associated ducting. Fixing of all the lighting arrangements, and any hot work to be completed before start of filter loading.
2.5.13.16	Enclosures It is required to be assembled at site in line with drawings / documents. The scope of enclosures covers mainly, but not limited to (a) Foundation bolting arrangement, frames & support structures, panels arrangement, doors, dampers & partition from compartment to compartment (b) Lighting of compartments, provision of the extra power points etc, hooters including conduiting. (c) CO₂ firefighting piping with GI piping including CO₂ nozzles, CO₂ damper actuators, impulse tubing for all Vent fan dampers etc. Mounting of DP switch & tubing. (d) Walk ways, platforms & handrails to suit the site requirements. Rail & hoist assembly needs to be erected, where ever applicable in line with applicable documents. The erection of enclosures is to be done to ensure proper interfacing with adjacent equipment, like casings, heat exchangers, combustion chambers, valves, piping etc. to allow adequate space for O&M and at the same time ensure perfect sealing of the respective compartments. The enclosure erection shall be planned from the start of the GT erection, and accordingly sequential erection of the enclosure shall be done, so as to avoid any reworks at later stage. If the contractor has to carry out any rework for enclosure erection due to wrong sequencing of erection activities, the same shall be at his own cost only. GT manual is available at site in which complete sequencing of the erection is provided. Vendor to follow the same in line with the associated drawings during erection and commissioing of GT and auxilliaries.
2.5.13.17	Vent fans & Ducting It is required to be assembled at site in line with drawings / documents. It involves assembly of all loose parts like fan casings, impeller, motor, outlet damper with CO₂ latch, transition piece, Gravity louvers, rain protection hood for motor, silencer, differential pressure switch / limit switch, fasteners with gaskets & matching of

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	associated vent ducting with their associated fans in line with applicable vendor documentation. Required supporting of the fan ducting is needed to be fabricated at site as per site requirement. The CO ₂ piping is to be connected to fan CO ₂ damper latch.
2.5.13.18	Water washing skid This equipment is also supplied directly from vendor works, needs to be erected at site in line with vendor documentation. The skid involves centering, levelling & grouting in line with applicable vendor documentation.
2.5.13.19	Mist Eliminator skid It is required to be assembled at site in line with drawings / documents. All the loose parts like filters, drain pot, instrumentation, Vent pipes, NRVs etc may need to be assembled at site after centering, levelling & grouting in line with applicable vendor documentation & needs to be integrated with General arrangement of the unit.
2.5.13.20	Fire Protection System It is required to be assembled at site in line with drawings / documents. It involves assembly of loose parts like Carbon dioxide cylinders, master valve with solenoid, NRVs, discharge hoses, actuation hoses, enclosure, pressure switches, manifolds, tubes and tube fittings, safety relief valves, manual release levers, weighing devices, limit switches etc on to the frame and subsequent centering, levelling and grouting of the frame in line with applicable vendor documentation.
2.5.13.21	Air Processing Unit with coolers It is required to be assembled at site in line with drawings / documents. Loose parts like filter, drain valves, steam dip pot arrangements, SRV, Solenoid etc may need to be assembled at site after centering, levelling & grouting in line with applicable documents. Interconnecting with Cooler needs to be done at site as Air Processing Unit and Cooler are being interfaced altogether.
2.5.13.22	Diverter Damper & Guillotine Dampers It is required to be assembled at site in line with drawings / documents. Erection of dampers involves assembly of loose parts like gear boxes, actuators, piping, valves, seal air fan skids, limit switches, sealing plates, Non-metallic Expansion Joints, Bellows, inter connecting rods, position indicators, control panels, insulation, gaskets, fasteners, accessories for maintenance etc. after centering, levelling & grouting in line with applicable vendor documentation & needs to integrate with other equipment like bypass stack, exhaust ducting etc. as per applicable documentation of the overall unit. Both the equipments are sourced from vendors and may need close inspection of the equipment at time of receipt and also involve welding of the flanges and supports after positioning.
2.5.13.23	Water injection skid This equipment is required to be assembled at site after centering, levelling & grouting in line with applicable general arrangements drgs. Loose parts if any like

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	filters, strainers, control & Stop Valves, solenoid valves, Control Panels, pumps, conduiting, impulse tubing etc. are to installed and commissioned on to the skid
2.5.13.24	Mobile Centrifuge Full unit required to be operated and maintained by the contractor.
2.5.13.25	Piping inter connection Inter connection piping should be routed based on schematics. All the piping that needs to be fabricated and erected shall have to be tested & to undergo NDT testing like DPT, radiographic examination,digital radiography, hydraulic testing in line with applicable standards & followed by mechanical cleaning like flushing, cardboard blasting, steam blowing as required. For fuel gas piping & CO ₂ piping leak test needs to be conducted. All the vents & drain piping are required to be fabricated & erected at site with applicable standards. Valves, other pipe fittings and supports etc shall form the part of the piping systems are required to be erected as per drawings and documents and engineers instructions. Temporary piping required for flushing of lube oil system needs to be fabricated and erected at site as per schematics within the scope of this contract.
2.5.13.26	Outlet Ductwork Outlet ductwork with support steel structures will be erected to connect between the GT exhaust outlet after diverter damper and the HRSG flange with the NMEJ as per spec / data sheets.
2.5.13.27	Insulation All piping and equipment, as per requirement / drawings are to be thermally insulated with bonded / unbounded mineral wool /LRB mineral wool and to be covered with aluminum cladding. Only spray insulation wherever applicable is not covered in this scope of work.
2.5.14	Erection and commissioning of Pumps: Various type of pumps and compressors supplied for the CPP are listed below: VVHP Boiler Feed Pump-VFD Driven, VHP Export Boiler Feed Pump-VFD Driven, MP Export Boiler Feed Pump,Condensate Transfer Pump, Dump Condensate Transfer Pump, Blowdown Transfer Pump for HRSG, Blowdown Transfer Pump for GSC, Gas Condensate Transfer Pump, DM GT ACC Pump, Oil Free Air Compressor, Naptha forwarding and HSD forwarding pump skids etc.
2.5.14.1	For ETC of pumps and compressors general works are to be executed are as: - Checking of Foundation and chipping to required level - Placement and levelling of equipment/frames. - Fitting of couplings.

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	d.) Centering of equipment and clearance for bolt and frame grouting after preliminary alignment. e.) Alignment and No Load Motor trial run. f.) Final alignment and coupling. g.) Insulation or Painting as per technical Specification h.) Commissioning of pumps and completion of all balance works of the system.
2.5.14.2	The static and rotating auxiliaries under this contract scope are to be erected as per the drawings and documents and technical specifications.
2.5.15	DG set Erection and Commissioning The scope of work of this specification includes the complete work for fabrication, assembly, mechanical erection, commissioning, testing and handing over of DG set along with auxiliaries, complete plant piping etc. for 2X6750 KVA DG sets. This work include shifting, storing and handling of equipment. The tentative list of equipment and piping which are to be erected under this scope are given in Chapter X. These details are tentative and there may be variations in quantity, size and tonnage. Contractor under this scope has to erect and commission the DG sets of 2X6750 KVA rating with all its auxiliaries in line with the drawings and specification within the lumpsum price.
2.5.15.1	The scope of work of this specification includes the complete work for assembly, erection, testing, including engine, alternator, radiator banks, Air compressors(Motor and engine driven) and receivers, HT water preheaters, Fuel supply units, water preheaters, waste oil pumps and tanks, water expansion tanks, HSD Day Tanks, Maintenance water tanks and Pumps, Chimney Stacks (02 No.s of 30 mtr height) with the common supporting structure, Air Intake Filters(Marine Type dry intake Air), Exhaust silencers, Inlet and exhaust ducting etc. and other miscellaneous auxiliary equipment of DG set, associated piping system for complete plant, platforms, fittings, valves, supports, foundation bolts, embedded parts, structural supports etc. Omission of any specific reference to any method, parts, accessories, material required for proper and efficient execution of the work, shall not in any way relieve the contractor from his responsibilities.
2.5.15.2	Pre-assembly, Assembly, erection, levelling, alignment and grouting of all equipment.
2.5.15.3	Fabrication and erection of ducts, supports, hangers, flanges, base frames, trays, platforms, ladders, junction boxes etc.
2.5.15.4	Though statutory approvals are in customers' scope, liaisoning work regarding obtaining required statutory clearances from various Govt. authorities for obtaining approval from MSEB / CEIG / AP, Pollution Control Boards for DG Set i.e. installation approval is in the scope of the contractor.
2.5.15.5	The equipment shall be placed on respective foundation or supports levelled and aligned with precision measuring instruments, checked for proper clearance between moving and stationary parts wherever applicable.

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2.5.15.6	The EOT in the DG Hall is of 5 MT capacity and is generally required for maintainance only. Contractor has to plan DG set erection in view of above and that EOT may be made available only near commissioning or after that.
2.5.15.7	CONTRACTOR shall be responsible for receiving, unloading of items at site and at the locations as identified by CONTRACTOR within the designated plot. All cranes/ sleeper jacks and other arrangements as required for unloading of these items except BHEL 135 MT Crane shall have to be arranged by the contractor.
2.5.15.8	During positioning, assembly, levelling and before fixing, base plate is to be uniformly supported on rectangular metal blocks and shims directly.
2.5.15.9	Grouting of equipments shall be performed as per recommendation by manufacturer/ BHEL. Grouting of the DG set is in the scope of CIVIL agency.Preperatory works for the same and assistance during grouting is in the scope of this contract.
2.5.15.10	All required anchor bolts, anchor fasteners, sleeves, packing, shims of various thickness, shall be supplied and erected by the contractor. The supplied material shall be of best quality. Contractor may be required to submit test certificates of this material before using at site. Mechanical equipment are proposed to be erected either by welding on the insert plates embedded in the civil foundations by civil contractor or by anchor fasteners and sleeves.
2.5.15.11	The equipment and ducts may be delivered in loose parts or sections for convenience in transportation and they are to be assembled at site. Positioning, assembly includes the cleaning, oiling greasing etc.
2.5.15.12	During positioning, levelling and fixing of coupling between Engine & Alternator care should be taken that crank shaft (web) deflection of engine, air gap between alternator rotor and stator, alignment of alternator with engine is within the limit specified. The coupling screws and fastening bolts are required to be tightened to a specified torque recommended by supplier.
2.5.15.13	Contractor shall carryout reaming work of dowelling required for engine, alternator fixing hole, exciter body, bed plates, frame by skilled technicians. Torque for tightening of alternator and engine fasteners shall be done using calibrated torque wrenches. Matching holes are to be drilled and reamed for providing dowels.
2.5.15.14	The contractor shall be responsible for cleaning, lubricating, alignment, checking for proper clearance between moving and stationary parts of any rotating equipment, testing, hydrotesting, air testing wherever applicable, as may be specified in manufacturer's instruction drawings/documents. This will involve dismantling, inspecting modification in fittings and alignment re-assembly of equipments,valves, fittings and other accessories.
2.5.15.15	It is possible that minor repair/rectification, modification work may be needed on the equipment to be erected or fabricated, to be performed for reason not attributable to the contractor. All such work will have to be carried out by the contractor.

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2.5.15.16	Fabrication, erection and testing of the pipe lines of different system (L.O., HSD, compressed air, instrument air, treated and raw water, fuel) and ducting of exhaust and charge air system of DG power plant includes cleaning, pickling, edge preparation, alignment, welding, machining, grinding, dressing, hydro testing ,surface preparation, painting, support fabrication & installation, cutting and fitting of gaskets etc. The joints may be of screwed, welded, flanged joints fitted with gasket or special jointing practice.
2.5.15.17	The acid pickling may be required to be done for fuel, lube, sludge and other system lines (Seamless pipes). The air lines may be required to be washed by alkaline solution at 80°C , if the pipes are greased. All spool pieces shall be connected together after removing all heavy splatters and slag, if any. After pickling, no further welding on pipes is allowed. If pipes are greased, then pipes shall be degreased by washing with hot alkaline solution. All pipes shall be filled with 10 % Hydrochloric Acid (HCl) and 10 % Formalin Inhibitor (HCHO) for 4 – 5 hours to be circulated and then drained. A pump shall be used for circulating the chemical solution into the pipelines. The strengths of mixtures shall not be higher than recommended, as it will cause undue erosion of pipes. The brand name of suppliers of chemicals with strength certificate shall be furnished.
2.5.15.18	The compressed air at 5 bar is then blown into pipes to get away all pickling solution. After all pipes are drained of acid solution, the hot water at 70 ° C shall be used to rinse the pipes before filling neutralisation solution. The pipes are then filled with hot neutralisation solution (temp 40 -50°C) of 10 % caustic Soda (NaOH) and 50 gm Sodium tri – Phosphate (Na₃Po₄) per litre and held for 20 minutes and then drained.
2.5.15.19	The compressed air is blown in the pipelines to agitate the solution and then the pipes are rinsed with hot water (temp 70 ° C).
2.5.15.20	All above steps are to be carried out without interruptions. The pipes are then checked for cleanliness. The above procedure is repeated, if the results are not satisfactory. The pipes are preserved by flushing with protection oil and both ends are fully covered. The record of each pipe undergone pickling shall be maintained with pipe size, line no., length of pipe.
2.5.15.21	After installation of the complete plant, the piping and equipments shall be suitably chemically cleaned, flushed by the respective fluid (water, oil or air) by following the basic procedure. The flushing oil / HSD for flushing of piping shall be supplied by BHEL.
2.5.15.22	All required supervision, labour and services equipment like pump, compressor and other material including chemicals, temporary blocking etc required for satisfactory completion of cleaning/flushing/blowing, testing shall be arranged by the contractor.

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2.5.15.23	All completely erected piping systems shall be subjected to the hydrostatic tests. Air piping system shall be subjected to pneumatic tests. Test pressure of hydrostatic test of piping shall not be less than 1.5 times the working pressure or as per the quality plans. The test pressure of pneumatic test of piping shall be 110% of maximum working pressure or other specification used inside the plant by EIL/HPCL . All other lines of atmospheric pressure shall be tested hydrostatically at 2 kg/cm ² .
2.5.15.24	Testing shall include making all arrangements required for testing and restoring back the system. Arrangement and calibration of pressure gauge, temporary blanking, pressuring and depressuring shall also be done by the contractor. Necessary provision for the venting, blanking and draining shall be provided in piping system by the contractor.
2.5.15.25	During above testing of piping systems, some direct online instruments, control valves, safety valves, flow nozzles, orifices etc. may be required to be removed and re-installed after the tests by the contractor.
2.5.15.26	All temporary pipes, fittings, strainers, valves blanks, flanges, necessary supports, dummy plates, spool pieces and other accessories required for cleaning, pickling, flushing, hydro testing of the system and equipment shall be provided by the contractor.
2.5.15.27	The contractor shall carry out all general performance tests for the pumps and motors under supervision of BHEL. Alignment of pumps, compressor etc. shall be checked with their prime mover before test.
2.5.15.28	The supply of lube oils for engine, alternator and other auxiliaries and chemicals for engine jacket cooling water, emergency DG set are in BHEL scope.
2.5.15.29	The erection of electrical panels and other electrical works are not in the scope of this contract.
2.5.15.30	During erection and commissioning, for providing assistance the OEM vendor may be required to visit for supervision. Contractor shall have to adhere to his instructions and shall arrange all the resources so as to complete the work in all respects during the visit.
2.5.15.32	Technical Specification For Installation, Erection And Commissioning Of Structure Supported DG Chimney
2.5.15.32.1	This specification covers the storing, shifting, fabrication, erection, commissioning and handing over of the structure supported steel chimney for diesel engine exhaust gases.
2.5.15.32.2	The supplies of foundation bolts / nuts / washer, template, shear plates etc. and the grouting of bolts shall be done by civil contractor. Chimney contractor shall carefully check the foundations before /after grouting, grouted bolts to ensure that the stack shell and structure can be properly erected. In case of faulty erection all such dismantling re-erection required will be at Contractor's cost.

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2.5.15.32.3	All shim stock required to maintain the specified thickness of grout as well as for levelling of the structure during erection shall be of good mild steel plates and shall be supplied by Contractor.
2.5.15.32.4	The holding down bolts/foundation bolts shall be adequately tightened and shall be provided with a nut and a lock nut. After erection, the departure of axis of the stack/stack structure from the vertical at any level shall not exceed 1/1000 of the height at that particular
2.5.15.32.5	The 02 DG skids shall be directly transported to site from vendor works. The unloading of the DG skids and shifting to foundation with deployment of the required T&P has to be accordingly planned by the contractor based on availability of the foundation. In case, the foundation is available at the time of supply of DG set skids, the skids shall be directly placed on the foundation. Other auxiliaries of DG sets shall be stored in the yard and accordingly transported to site by the contractor. The unloading of the heavy skids can be undertaken by jack and sleeper method or by crane of required capacity. The unloading/placement methodology has to be submitted to BHEL and got approved before start of erection/placement
2.5.16	Fire Protection system : Four types of fire fighting/protection systems are to be installed in the plant. Out of these, 03 types of fire fighting systems are to be erected under this contract: 1. Water (Hydrant) based Fire Fighting system 2. Erection of various type of Fire extinguishers and fire buckets 3. Inert Gas extinguishing System Fire detection and alarm system is not in this scope of works.
2.5.16.1	The preliminary Erection BOQ for the FPS system is indicated in Chapter X. The complete Erection & Commissioning of the above 03 FPS shall be carried out by Erection Agency at site.
2.5.16.2	The work includes material collecting from BHEL stores, cement lining of pipes, fittings, cutting, bevelling, mitre fabrication and thier cement lining, fitup & welding, erection, supply of consumables for cement lining, wrapping and coating- supply and application on underground piping, hydrotesting, holiday test m/c, DP test and NDT.
2.5.16.3	All civil jobs like excavation, pedestal, backfilling etc. for underground piping is in the scope of CIVIL contractor
2.5.16.4	Pipes will be supplied loose in available commercial lengths and shall be erected as per layout drgs. Cement lining of the Fire water Piping and valves will be in the scope of erection agency. For this supply of consumables for cement lining and other tools and tackles is in the scope of contractor. The contractor will have to carry out the cement lining of the piping as per the EIL Standard specification for Cement Lined Piping (6-44-0074 Rev. 0) attached with the TCC.
2.5.16.5	No bends/elbows are supplied for the cement lined piping and contractor will be required to fabricate mitre bends wherever required. After fabrication these will have to be cement lined and used.

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2.5.16.6	FPS pipes(200NB) road crossing is apprx. - 80 Mtrs . Hume pipe shall be supplied by CIVIL contractor. Contractor will have to coordinate with the civil contractor for the laying of its scope of underground piping and the erection of hume pipes.
2.5.16.7	TAC approval –Liasioing for the approvals of the total system after erection.
2.5.16.8	Above ground pipe (700 m approx.) shall be laid on pedestal of size 0.5 X 0.5 X 0.75 m
2.5.16.9	Pipe laid in trenches shall be approx. 500 mtrs , typical trench size is 1.1m x 1.3 m approx. Sand Filling to be provided for Fire trenches. All civil works related to above ground piping including valve chambers foundations etc. is included in Civil BOQ separately.
2.5.16.10	Supervision of Tests to be conducted, inspection & TAC approval on the system will be in Power sector Scope of work.
2.5.16.11	The quantities of FPS mentioned in Chapter X may change during the detailed engineering. Contractor will have to erect the same within the lumpsum cost.
2.5.16.12	Quantity of wrapping & coating material for FPS Underground piping (apprx. -1000 sqmt) has to be supplied by the vendor.
2.5.16.13	Consumables like rawl plugs, screws, check nuts, nuts & bolts, saddles, saddle bars, cable (nylon) ties, washers,cable tags(strips), etc. which may be required for successful completion of above erection activity and not supplied are to be supplied by the contractor.
2.5.16.14	Surface preparation and base coat of primer shall be carried and final painting shall be done after completion of structural steel erection.
2.5.16.15	Painting along with primer for Fire water Piping.
2.6	SITE VISIT
2.6.1	Contractor should visit site and acquire full knowledge and information about site conditions. The bidder must visit site, to acquaint themselves with the conditions prevailing at site and in and around the plant premises, together with all statutory, obligatory, mandatory requirements of various authorities before submission of bid.
2.7	BUILT CLEAN CONCEPT
2.7.1	Contractor shall ensure at all times that the work area & approach/ access roads are free from accumulation of scrap/ water etc. so that the materials are safe and the erection/ progress schedule are not affected. Contractor shall return/dispose scrap in line with conditions of contract and No separate claim in this regard shall be admitted by BHEL.
2.8	Contractor shall ensure the following:
2.8.1	Contractor has to maintain contact with local hospital having ambulance facility, scanning and other ultramodern medical facilities required during emergency.
2.8.2	Contractor has to ensure pre-employment medical check for all staff & workers

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2.8.3	Contractor has to ensure that adequate First Aid facilities with trained nurse are available at work site for emergency purpose. This emergency set-up should include, but not limited to, following
2.8.4	Male nurse (in shifts) Oxygen set up Breathing apparatus Eye wash facility Stretcher Trauma blanket Medicines.
2.8.5	Ambulance: Contractor against this contract is required to maintain an emergency vehicle/ ambulance arrangement on round the clock basis during work execution of this contract scope. Vendor may tie up with other BHEL vendors maintaining ambulance/emergency vehicle at site for the provision of round the clock ambulance/emergency vehicle availability at site during work execution. Such arrangement shall be informed to BHEL in writing and shall have approval of BHEL and customer. The availability of the ambulance/emergency vehicle has to be in accordance with the site working schedule. As the project is having a very tight timeline, round the clock working is envisaged for achieving and meeting the targets. Thus round the clock availability of ambulance has to be ensured. If ambulance is not provided/ deployed/ arranged by the contractor, BHEL may hire ambulance at risk and cost of the contractor. In case customer insists BHEL to arrange ambulance then BHEL may also provide an ambulance on sharing basis with other contractors. This ambulance shall be made available to the contractors on chargeable basis. The charges shall be informed at the time of this provision and shall be shared among the contractors. Other conditions for maintaining ambulance, Male nurse shall be as per the HSE requirements of BHEL and EIL.
2.9	The contractor shall comply with following towards Social Accountability;
2.9.1	The contractor shall not employ any child labour in pursuant to ILO convention. If any child labour were found to have been engaged, the Contractor shall be levied with expenses of bearing his education expenditure which will include stipend to substantiate appropriate education or employ any other member of family enabling to bear the child education expenditure.
2.9.2	The contractor shall not engage Forced/ Bonded Labour and shall abide by abolition of Bonded Labour System (Abolition) Act, 1976.
2.9.3	The contractor shall maintain Health & safety requirement as stipulated in the Contract and Contract Labour (Regulation & Abolition) Act, 1970.
2.9.4	The Contractor shall abide by UN convention w.r.t. Human Rights and shall be liable for Discrimination / Corporal punishment for failure in meeting with relevant requirements.
2.9.5	The Contractor shall abide the requirement of Contract Labour (Regulation & Abolition) Act, 1970 for working hours.

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2.9.6	The Contractor shall abide by the Statutory requirement of Minimum Wages Act 1948, payment of Wages Act 1936.
2.9.7	The Contractor shall arrange potable drinking water to its employees & workers.
2.10	SITE ORGANISATION
2.10.1	The contractor shall provide adequate staffing in the following areas in addition to the staffing requirements of execution as instructed/informed by BHEL: 1. Overall planning, monitoring & control – The person responsible shall be responsible for submitting weekly/monthly work schedules with resource) (material , manpower &T&P) planning to achieve the weekly /monthly targets as derived from WRM/MRM between customer /EIL and BHEL over and above any other commitments of BHEL with customer. 2. Quality control and quality assurance- These are very important aspects of the work. The persons deployed shall be subject experts with previous site/construction experience in NDT. 3. Materials management. 4. Safety, fire & security- The persons deployed shall have a diploma/degree in safety with previous experience of handling safety function in construction. 5. Industrial relations and fulfilment of labour laws and other statutory obligations.
2.10.2	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organization shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent resident construction manager having sufficient authority to take decisions at site.
2.10.3	On award of contract, the contractor shall submit to BHEL site organization chart indicating the various levels of experts to be deployed on the job. BHEL reserves the right to reject or approve the list of personnel proposed by the Contractor. The persons, whose bio-data have been approved by BHEL, will have to be posted at site and deviations in this regard will not generally be permitted.
2.10.4	The contractor should also submit to BHEL for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities in consultation with BHEL. These tools & tackles shall not be removed from site without written permission of BHEL
2.10.5	The organization chart for site should indicate the various levels of experts to be posted for supervision in the various fields in erection, commissioning etc. as applicable. For proper supervision of the work, the contractor shall ensure providing one qualified supervisor against deployment of 15 workmen.
2.11	ERECTION SCHEDULE
2.11.1	Contractor shall submit within 07 days of LOI date, detailed program of construction / erection / commissioning along with matching resources T&P Deployment and manpower deployment schedule for approval to Site In-Charge/Project Manager-Noida. This schedule shall be the working level document demonstrating contractor's ability and methods of completing the work within the key milestones identified in the tender specification These program would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling program with the first month's program being tentative based on the site conditions would be prepared based on these program. The Contractor shall also be involved along with the

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	Customer/BHEL to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.
2.11.2	The program would be jointly finalised by the site in-charge of the contractor with BHEL/Customer's project coordinator as well as the site planning representative. The erection program will also identify the sequential erectable tonnages
2.11.3	Contractor shall submit daily work program based on above schedule. Deferment of above schedule is not acceptable. Contractor will adhere to schedule & augment resources to ensure completion as per schedule.
2.11.4	Bidder shall note that as the place of work is inside operational refinery campus, being manned by CISF, all necessary system related to entry of men, vehicle, material, safety & security systems, work permit system etc. as applicable will have to be followed by the contractor. Accordingly contractor shall deploy responsible person for getting permissions/gate passes who is well versed with the system in place and there are no hindrances in achieving work progress, due to lack of knowledge of the system or non-compliance leading to delays in approvals etc. CONTRACTOR shall abide by all safety regulations of the plant. The work shall be carried out inside the plant as per safety practices enforced by BHEL/EIL/HPCL safety section and instructions of Engineer-in-charge issued from time to time.
2.12	General details regarding the scope of work
2.12.1	These are the general details of the work and it is not the intent to specify herein all details of material/scope of work. 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.
2.12.2	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
2.12.3	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. 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.
2.12.4	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.
2.12.5	Contractor shall co-ordinate and be responsible 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/customer requirements and also to meet system specification.
2.12.6	The work shall be executed under the usual conditions prevailing in power plant construction in refineries 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-

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	ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
2.12.7	All necessary certificates and licenses required to carry out this work from competent authority like Boiler Inspector/ IBR verifications/ PESO/ TAC are to be arranged by the contractor expeditiously at his cost.
2.12.8	Contractor shall take delivery of item, materials, from the storage yard / stores/ sheds of BHEL within/outside plant premises after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer. Contractor shall make arrangements for, safe custody, watch and ward of equipment after it has been issued 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.
2.12.9	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.
2.12.10	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
2.12.11	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 outside the plant (in BHEL store yard at BHVP). 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.
2.12.12	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.
2.12.13	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.
2.12.14	Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances.
2.12.15	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.
2.12.16	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.

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2.12.17	Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer and no compensation shall be payable in case fault of contractor.
2.12.18	All the Fixtures including omega lugs etc., scaffolding materials, concrete block supports, steel structures required for temporary supporting, preassembly, installation, welding, lifting and handling or checking etc. during pre-assembly and erection shall be arranged by contractor at his cost.
2.12.19	All works such as cleaning, checking, levelling, blue matching, aligning, assembling, welding, temporary erection for alignment, dismantling of certain equipment for checking / cleaning, surface preparation, fabrication at site, cutting, grinding, straightening chamfering, filing, chipping, drilling, reaming, scrapping, machining, surface grinding, shaping, fitting up including NDT & PWHT etc. as may be applicable in such erection works are to be treated as incidental to erection and necessary to complete the work satisfactorily and shall be carried out by the contractor as part of the work
2.12.20	Preparation of erection scheme and rigging procedure and obtaining its approval from EIL wherever necessary.
2.12.20	The rigging procedure shall include the following as a minimum: Location of equipment from where it will be lifted, location of crane(s), details of crane(s) (like configuration, boom length, operating radius, boom point elevation, clearance underside the boom and the equipment, lifting capacity, counter weights to be deployed, holds on any neighbouring foundations, structures, equipment etc.), the load chart of the crane(s), design of the lifting tackles like spreader beam, D-shackles, wire rope slings etc. Unless the erection scheme and rigging procedures are approved by the EIL, erection of equipment shall not be undertaken in any case by the EC.
2.12.21	The test certificates of all the T&P involved in the rigging/lifting procedure shall be submitted to BHEL for onwards submission to EIL . These will be required for vetting of the lifting procedure.
2.12.22	It shall be the responsibility of the contractor to provide prefabricated ladders including materials at his cost on columns for initial work till such time stairways are completed. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL. All ladders, handrails and walkways shall be as per OSHA requirements. All safety requirements of OISD and other safety regulations shall be complied with.
2.12.23	BHEL will provide vendor's technical support for commissioning of various proprietary type special instruments/systems like Analysers etc. The contractor shall carry out the works as per instructions of BHEL/ Vendor Engineer.
2.12.24	No members of the ladder/structure/platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL/ customer without any additional cost.
2.12.25	The contractor is strictly prohibited in using the erectable plant material like angles, channels, hand rails etc. for any temporary supporting or scaffolding works. In case of such misuse a sum as determined by BHEL Engineer will be recovered from contractor's bills.
2.12.26	Normally the valves will have prepared edges for welding. But, if it becomes necessary, the contractor will prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes/ pipes within finally accepted rates.
2.12.27	All fittings like 'T' pieces, weld neck flanges, reducers etc. shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection/ after chemical cleaning and during commissioning within finally accepted rates.

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2.12.28	Adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of piping to suit the layout shall be considered part of the work and the contractor is required to carry out such work within the finally accepted price / rates as per instructions of BHEL, which shall include specified heat treatment & NDT procedures etc.
2.12.29	Steel for suspensions for piping, ducting etc. will be supplied in running lengths. These are to be cut to suitable sizes and adjusted as per requirement.
2.12.30	Pipes sent in running lengths shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to 80 mm NB will have to be fabricated and tested at site within the finally accepted rates.
2.12.31	Not applicable
2.12.32	Fittings and welding of necessary instrumentation tapping points, thermocouples pads, valves, root valves, condensing vessels, flow nozzles, Orifice plates and control valves etc. will also be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer within finally accepted rates. The erection, welding / NDT of all the above items will be contractor's responsibility even if the: • Product groups, under which these items are released, are not covered in the scope of this tender. • Items are supplied by any agency other than BHEL.
2.12.33	All the valves including motorized valves, flap valves, dampers, actuators etc. shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning also. Welding / jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the finally accepted rates.
2.12.34	The contractor shall be responsible for correct orientation of all valves so that seats, stems and hand wheels will be in desired location. It will be the responsibility of the contractor to obtain the information regarding orientation of valves not fully located on drawings before the same are installed.
2.12.35	The contractor shall dismantle the valves & actuator for overhauling, servicing & lubrication wherever required as advised by the Engineer. The contractor shall also lap or grind valve seats for ensuring the satisfactory performance of valves at no extra cost. All parts such as gaskets, gland packing which form the permanent part of equipment shall be supplied by BHEL free of cost
2.12.36	No temporary supports should be welded on the pressure parts or piping. Welding of temporary supports / cleats etc., on main columns should be avoided. In case of absolute necessity prior approval from BHEL Engineer will be obtained by contractor.
2.12.37	All hangers, supports and anchors shall be installed as per drawing to obtain safe and reliable and complete pipe installation as per instructions of Engineer. Any additional support as called for by Engineer shall have to be fabricated and erected by the contractor within the quoted price. The raw materials required for fabricating such supports shall be supplied by BHEL free of cost.
2.12.38	The contractor shall ensure that all supporting elements, anchors & restraint have been installed and adjusted in accordance with the drawings / sketches & other written instructions of the Engineer. The contractor shall inspect the hangers associated with the piping systems as follows: Piping in the hot position with the unit operating at the maximum load.

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	Piping in the cold position during the first complete shutdown.
2.12.39	Spring suspensions/ constant load hangers have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Any adjustments, removal of temporary arrestors / lockers etc., have to be carried out as and when required.
2.12.40	
2.12.41	All attachments welding including those for insulation works coming on pressure parts / non-pressure parts which the contractor has erected shall have to be done by the contractor within finally accepted rates only.
2.12.42	The calibration of skid mounted instruments shall be arranged by BHEL through other agency engaged for C&I. Contractor will be informed by BHEL engineer about the details of C&I agency. The contractor shall coordinate with the C&I agency for removal, calibration and re-installation of the instruments. Though C&I agency will remove and reinstall the instruments after calibration, the contractor for this package will maintain the list of all the instruments removed & reinstalled. Instruments prior to removal and after reinstallation shall be considered in custody of the contractor for this package. All instruments such as pressure gauges / temperature gauges, switches etc. forming part of product group (PG) are under the erection scope of this contract and shall be installed and commissioned by the contractor of this package at no extra cost to BHEL, however the calibration of these instruments shall be done by C&I agency as above
2.12.43	Layout of small bore piping in GT, STG, DG set and Firefighting system etc. as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipe lines even after completion of erection or from aesthetic point of view. Contractor at no extra cost to BHEL should carry this out. Bends up to 80 mm NB will have to be fabricated and tested at site within the finally accepted rates. As built drawings shall also be made by the contractor and submitted to BHEL after final execution of respective small bore piping work with in the final accepted tonnage rate.
2.12.44	All the shafts of rotating equipment should be properly aligned to those of the matching equipment to as perfect and as accurately as practicable. The equipment shall be free from excessive vibrations so as to avoid over heating of bearings or the conditions which may tend to shorten the life of equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.
2.12.45	The contractor shall carry out trial run of all motors including checking the direction of rotation in the uncoupled condition, Checking alignment and re-coupling the motor to the driven equipment as per instructions of BHEL engineer and to their satisfaction.
2.12.46	Forced lub oil system of motors or rotating equipment form parts of the work under this specification.
2.12.47	All the motors and equipment shall be suitably doweled after alignment of shafts with taper / parallel machined dowels as per the direction of the Engineer. Dowel pins required are be machined by the contractor at his own cost. However the materials for dowel pins shall be issued by BHEL free of cost.
2.12.48	The contractor, at no extra cost to BHEL, shall carry out servicing and realignment of skid mounted equipment, if required by BHEL.
2.12.49	All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR value, before they are energized. Bearings, slip rings commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected.
2.12.50	Contractor shall carry out kerosene testing of all bearing housing of various rotating equipment like pumps, fans etc. as per BHEL engineer's instructions. Performance of hydro

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	test of oil coolers of rotating machines and other equipment as per BHEL engineer's instructions is included in the scope of work.																		
2.12.51	Certain rotating machinery after, initial runs and commissioning of the equipment, have to be hot aligned as per the instructions of BHEL engineer. Cleaning fans, ducting etc., free of extraneous steel, scaffolding materials, electrodes, all foreign materials etc. before trial run of rotating machinery, and at various stages of pre-commissioning activities as per BHEL engineer's instruction, is within the scope of work.																		
2.12.52	All the bearings, gear boxes, shaft and other rotating parts etc. of the equipment and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer, for cleaning the bearing, gears etc. with kerosene or some other reagent, if necessary, by dismantling some of the parts of the equipment during erection and shall arrange for re-greasing / lubricating them with recommended lubricants and for assembling back the dismantled parts, within the finally accepted rates. Lubricants will, however, be supplied free of cost by BHEL.																		
2.13	<u>Insurance terms:</u> HPCL has taken comprehensive MCE (marine cum erection) Insurance Policy for total project supply & services including balance of plant package covering transit risks & loss, destruction or damage during handling at site, storage, civil works, erection, testing and commissioning up to trial operation completion of each unit including theft, sabotage, fire, lightning and other natural calamities. The insured amount under the Erection All Risk Cover Insurance shall be for full replacement value. The above cover for the material to be erected under this contract scope shall be subject to deductibles on account of excess, which shall be borne by the CONTRACTOR of this work scope and shall be as follows: <table><tr><td>1</td><td>Normal Period/Policy excess</td><td>5% of Claim amount subject to minimum Rs.50,00,000/-</td></tr><tr><td>2</td><td>Fire/Explosion excess</td><td>10% of Claim amount subject to minimum Rs. 1,50,00,000/-</td></tr><tr><td>3</td><td>Theft & Burglary excess</td><td>5% of Claim amount subject to minimum Rs.50,00,000/-</td></tr><tr><td>5</td><td>Testing Period excess</td><td>10% of Claim amount subject to minimum Rs. 1,50,00,000/-</td></tr><tr><td>6</td><td>AOG claims</td><td>10% of Claim amount subject to minimum Rs.1,50,00,000/-</td></tr><tr><td>7</td><td>Third Party Liability</td><td>Rs. 25,00,000 each occurrence</td></tr></table> The Excess shall be applicable per event per insured. In case the damage/loss/theft of materials are attributable to negligence/failure in discharging the duties and obligations by the bidder, the expenses incurred for repair/ replacement of such components by BHEL shall be recovered from the contractor as: a. If the expenses are less than the Normal Excess (Deductible Franchise as detailed above), the total expenses/loss to BHEL on replacement/repair shall be recovered from the bidder. b. For other cases, where the expenses are more than the excess amount, the expenses incurred for repair/replacement of such components in excess of the amount	1	Normal Period/Policy excess	5% of Claim amount subject to minimum Rs.50,00,000/-	2	Fire/Explosion excess	10% of Claim amount subject to minimum Rs. 1,50,00,000/-	3	Theft & Burglary excess	5% of Claim amount subject to minimum Rs.50,00,000/-	5	Testing Period excess	10% of Claim amount subject to minimum Rs. 1,50,00,000/-	6	AOG claims	10% of Claim amount subject to minimum Rs.1,50,00,000/-	7	Third Party Liability	Rs. 25,00,000 each occurrence
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6	AOG claims	10% of Claim amount subject to minimum Rs.1,50,00,000/-																	
7	Third Party Liability	Rs. 25,00,000 each occurrence																	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter II: SCOPE OF WORKS

	realized from the underwriters, including the Normal Excess (Deductible Franchise) shall be recovered from the bidder. Contractor shall at his own cost and expense obtain suitable insurance policies to cover Workmen Compensation for all his employees, vehicles, and all his tools, tackles, construction equipment etc. as per extant rules.
2.14	Unloading of heavy or OD consignments directly from trailers by suitable crane or by jack and sleeper method at the location decided by BHEL Engineer shall be carried out by the contractor within the quoted rate. All T&Ps (except cranes as per chapter V) including hydraulic jacks and wooden sleepers required for sleeper/jack method of unloading shall be arranged by the contractor.
2.15	As per the site requirement, material may have to be shifted from originally unloaded /stacked locations to other locations within the project premises as per the instructions of the BHEL Engineer. This may involve loading of such material onto a trailer, shifted to a new location and unloading/stacking including proper inscription of identification marks if needed. No re-shifting/restacking of the material shall be allowed without prior approval of the BHEL Engineer. No claim in this regard is admissible.
2.16	Payment of all demurrage that are due to contractor's fault, would be the responsibility of contractor and to his account. If BHEL has to make payment of demurrage / along with freight, the amount so paid as demurrage, for the reasons stated above, shall be paid by the contractor forthwith or would be recovered from bills of the contractor.
2.17	If the contractor or his workmen shall break, deface injure or destroy any part of a building, road, Serbs, fenced enclosures, water pipes, cables, drains, electric or telephone posts or wires, trees, stored components or any other property or to any part of erected equipment etc., the contractor shall make the same good at his cost or in default the Engineer may cause the same to be made good by other workmen/agency or by other means and deduct the expense (of which the BHEL Engineer's decision is final) from any sum that may be then or at any time thereafter become due to the contractor or from his security deposit or any other money due.

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Chapter III: FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR

3.0	FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR			
S.No.	Description	Scope /to be taken care by		Remarks/ Conditions
		BHEL	Contr-actor	
3.1	ESTABLISHMENT			
3.1.1	FOR CONSTRUCTION PURPOSE			
3.1.1.1	Open space for office in HPCL Project site Premises	YES		Limited space (free of charge).As and where made available by BHEL for placement of Porta Cabin.
3.1.1.2	Open space for office outside Project site		YES	Vendor has to hire/ lease a office, outside plant for its operations at his cost.
3.1.1.3	Open space for storage cum Fabrication yard		YES	Vendor has to hire/lease a storage area for its material/T&P, outside plant for its operations at his cost. These T&P/ material can only enter plant as per their requirement on Just in Time (JIT) concept.
3.1.2	FOR LABOUR COLONY			
3.1.2.1	Open space		YES	Contractor have to make their own arrangement
3.2	ELECTRICITY			
3.2.1	Electricity for construction purposes (chargeable)			
3.2.2	Single point source		YES	Contractor will have to arrange for DG sets of adequate capacity for meeting its Power requirement. All the provisions as per HPCL/EIL requirement for setting up of DG sets and further distribution of power are to be adhered to by the contractor.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter III: FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR

3.2.3	Single point source by BHEL	YES		If available, BHEL may supply excess power or single point source on chargeable basis as per the prevailing rates of power provided by HPCL (Rs. 12 per KW hour) or as decided by BHEL in case the same is provided from BHEL DG sets. This provision will only be exercised in case of availability with BHEL. BHEL is not liable to provide any power.
3.2.4	Further distribution for the work to be done which include supply of materials & execution.		YES	HPCL/EIL guidelines to be adhered to for such works inside refinery
3.2.5	Electricity for the office, stores, canteen etc. of the bidder which include:		YES	
3.2.6	Distribution from single point including supply of materials & service		YES	HPCL/EIL guidelines to be adhered to for such works inside refinery
3.2.7	Supply, Installation & connection of material of energy meter including operation & maintenance		YES	HPCL/EIL guidelines to be adhered to for such works inside refinery
3.2.8	Duties & deposits including statutory clearances for above		YES	
3.2.9	Demobilization of the facilities after completion of works		YES	
3.2.10	Electricity for living accommodation of the bidder's Staff, engineers, supervisors etc. on the above lines		YES	Contractor has to make its own arrangement.
3.3	WATER SUPPLY			
3.3.1	FOR CONSTRUCTION			
3.3.1.1	Making the water available at single point		YES	Contractor will have to make his own arrangements for supply of water for construction. All pumping installations, piping connections, storage facility are to be carried out by the Contractor at his own cost.
3.3.1.2	Further distribution as per the requirement of work including supply of materials & execution		YES	
3.3.1.3	Potable water for the workers at site		YES	To be arranged by Contractor

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter III: FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR

3.3.2	FOR HYDRO TEST/ PRE- COMMISSIONING			
3.3.2.1	DM water and water for Hydro Testing			DM Water & Water Required during Pre-Commissioning, Hydro testing may be provided by HPCL based on the availability of these utilities on chargeable basis. Charges shall be as: i. Raw Water : Rs. 35 per MT ii. DM Water : Rs. 68 per MT
3.3.3	FOR LABOUR COLONY			
3.3.3.1	Making the water available at single point		YES	Contractor has to make its own arrangement
3.4	LIGHTING			
3.4.1	For construction work 1. At site office 2. At construction site/area		YES	Related HPCL/EIL instruction and norms to be followed
3.4.2	At office cum storage area outside plant premises.		YES	
3.4.3	Providing the necessary consumables like bulbs, tube lights, Switches, etc. for maintaining the lighting system		YES	
3.5.0	Communications facilities for site operations of the bidder			
3.5.1	Telephone/mobile, fax, internet, email etc.		YES	Contractor shall visit site and accordingly arrange for suitable communication devices as permitted inside HPCL Visakh Refinery
3.6.0	Compressed Air for Construction work			
3.6.1	Supply of compressor and all other equipment required for compressor & compressed air system including pipes, valves, storage system etc.		YES	
3.6.2	Installation of the above system and operation & maintenance of the same		YES	
3.6.3	Supply of all the consumables for the above system during the contract period.		YES	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter III: FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR

3.7.0	ERECTION FACILITIES			
3.7.1	Providing erection drawings for all the Equipment's covered under this scope	YES		
3.7.2	Drawings for construction method	YES	YES	
3.7.3	As-built-drawings-where ever deviations observed & executed and also based on Decisions taken at site.	YES	YES	Inputs to be provided by Contractor
3.7.4	Shipping lists etc. for reference & planning the activities	YES		In consultation with BHEL
3.7.5	Preparation of site erection schedules/ procedures and other input requirements	YES	YES	Contractor to submit erection schedule based on L3 schedule/ customer milestone dates.
3.7.6	Review of performance & revision of site erection schedules in order to achieve the end dates & commitments	YES	YES	Contractor to revise erection schedule based on review of progress and customer milestone requirements.
3.7.7	Weekly erection schedule		YES	To be submitted on last day of previous week.
3.7.8	Daily erection/work plan		YES	Submitted by EOD for next day.
3.7.9	Preparation of facilities for preassembly		YES	Preassemblies to be done in their own pre-fab yard.
3.8.0	Notes:			
3.8.1	BHEL will not Provide Construction Power. Contractor has to make arrangement of adequate Diesel Generator for which no separate payment shall be made by BHEL In case, construction power is provided by customer, 415V construction Power shall be provided at one point within 100 metres from the erection site on chargeable basis. Bidder has to make his own distribution arrangement to draw electricity. BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of power supply / variation in voltage level and no compensation for delay in work can be claimed by the contractor due to such non-supply on the grounds of idle labour, machinery or any other grounds. The bidder will have to procure & install adequate area illumination system during construction right from start of his work. This system will include temporary pole lighting, portable lighting towers with sufficient DG back-up for area lighting at different working areas for execution of the work & safety of workmen within the quoted rate. The illumination should be such that minimum illumination requirement as specified in specification or as per refinery/EIL working standard shall be maintained. Contractor will have to get the illumination verified with the Lux- meter.			
3.8.2	The contractor should ensure that the work in critical areas is not held up in the event of power breakdown. In the event of breakdown in the electric supply, if the progress of work is hampered, it			

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter III: FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR

	will be the responsibility of the contractor to step up the progress of work after restoration of electric supply so that overall progress of work is not affected.
3.8.3	The bidder shall have to provide earth leakage circuit breaker at each point wherever human operated electrical drives / T&Ps are deployed.
3.8.4	BHEL will not be responsible for any loss or damage to the contractor's equipment as a result of variation in voltage or frequency or interruptions in power supply.
3.8.5	The Contractor shall be responsible for providing all necessary facilities like residential accommodation, transport, electricity, water, medical facilities etc. at his own cost as required under various labour laws and statutory rules and regulations framed there under to the personnel employed by him.
3.8.6	Provision of distribution lines of both electrical power and water from the central points to the required place with proper distribution boards observing the safety rules laid down by the electrical authorities and HPCL/EIL guidelines for such work in the refinery shall be taken care by the contractor. Supply of all the materials like cables, distribution board, switch boards, TPN, CBS, ELCBS/ MCCBS/ Copper / Brass clamps, copper conductor, change over switches pipes etc. at his own cost. If any failure is caused in supply of the power and water, it is the responsibility of the contractor to make alternate arrangements at his cost. The contractor shall adjust his working shifts / hours accordingly and deploy additional manpower if necessary so as to achieve the targets. The energy meter to be installed by the contractor & shall be tested and certified by State Electricity Board or any other agency approved by HPCL/EIL at his cost.
3.8.7	The contractor while drawing construction power supply from Distribution Board should strictly adhere to following points.
3.8.7.1	All electrical installations should be as per Indian Electricity rules.
3.8.7.2	All distribution Boards installed by the contractor should be constructed with fireproof materials viz. Steel frames, Bakelite sheets etc.
3.8.7.3	Connection for single phase should be taken from phase and neutral. Nowhere the connection should be taken with earth as neutral.
3.8.7.4	All electrical connections should be made through connectors, nuts and bolts, switches, plug and sockets. Loose connections or hooking up of wires shall not be permitted.
3.8.7.5	Contractor has to make their own earthing arrangement for their equipment / DB earthing.
3.8.7.6	All electrical equipment / tools and plants should be properly earthed. DBs to be earthed diagonally opposite at two points.
3.8.7.7	Contractor should use "MCCB" and "ELCB" either on incoming or outgoing connections to the DBs.
3.8.7.8	Contractor should ensure that all the CBs / TPNs/ Fuses/ MCCB / ELCB cables etc. should be of adequate rating/ capacity.
3.8.7.9	For permission of supply connections contractor has to submit a test report of their installations with a single line diagram of connected/ proposed loads.
3.8.7.10	ELCB will be tested once in a week or as directed by BHEL/HPCL/EIL by actually simulating the earth leakage for all installations and the same shall be recorded in the logbook to be maintained by the contractor.
3.8.7.11	The CONTRACTOR shall ensure that the Electrical equipment installed by him are such that an average power factor does not fall below 0.90 at his premises. In case power factor falls below 0.90

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter III: FACILITIES IN THE SCOPE OF BHEL/CONTRACTOR

	in any month, contractor will reimburse to the BHEL/HPCL at the penal rate determined by the M/s HPCL for all units consumed during the month.
3.8.7.12	In case, power is supplied by the OWNER/ BHEL to the CONTRACTOR ; it shall be entirely at the risk of the CONTRACTOR as to the continuity and regularity of supply, maintenance of voltage and adequacy of load and frequency without any warranty by or liability of the OWNER in respect thereof and without entitlement to the CONTRACTOR for any compensation, damages, extension of time or otherwise on ground of grid disturbances, discontinuance, fluctuation of voltage or inadequacy of load or frequency or any other cause whatsoever.
3.8.7.13	All electrical installation shall be as per the safety guidelines for working in refineries and as per M/s EIL/ HPCL guidelines for such work. No deviation in this regard shall be acceptable.
3.8.7.14	In case of power cuts / load shedding no compensation for idle labour or extension of time for completion of work will be given to contractor.
3.8.7.15	On completion of work or as and when required by BHEL, 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 Engineer will get it done and expenses incurred shall be recovered from the contractor along with prevailing overheads. The decision of BHEL Engineer in this regard shall be final.
3.8.8	WATER
3.8.8.1	No water is available inside the plant. Contractor has to bring construction & drinking water required for their work from outside. BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of water supply. Contractor may make standby arrangement for water for which no separate payment shall be made by BHEL.
3.8.8.2	Contractor will have to arrange for storage of water to meet the day-to-day requirement. Bidder will ensure adequate supply of construction water to meet the requirement.
3.8.8.3	To reduce the water requirement, vendor may use approved curing compound instead of traditional water curing in concrete & other work involving cement and maintain a joint register as a proof.
3.8.9	Site Office cum Storage Yard.
	Contractor has to hire /lease a plot of land(adequate size for development of the facilities) within 20 km of HPCL VRMP site, for development of office cum store yard(for his T&P and facilities) Some of the material after being issued to the vendor by BHEL may require some operations (depending on the erection philosophy), to be carried out on the material, before erecting them at site. Such material may be stored temporarily by the vendor at this store cum fabrication yard with due permission from BHEL. It is advisable to the contractor to have this plot on the route from BHEL store yard at BHVP and the plant material gate.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter IV: INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR

4.0	INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR				
S. No.	EQUIPMENT /T&P	Capacity	Tentative deployment schedule	Indicative Qty.	Remarks for deployment schedule and quantity
4.1	Tyre/Crawler mounted mobile crane with telescopic boom	40 T	As Per Requirement	01 No.	The same has to be arranged by the contractor as per erection requirement as decided by BHEL.
	The crane may be required to be deployed on continuous basis, based on erection requirement of this work scope.				
4.2	Hydra Mobile Cranes with Front Mounted Cabins	20 MT	1 st – From start of Work till Unit Commissioning	01 No.	1. Following type of Hydra cranes of reqd. capacity shall be used. For ex. Ace make Mobile Cranes such as F-160, FX-210, SX-150, Escorts make F-15, F-20. 2. Similar type of cranes of any make may be deployed by vendor but of minimum 20 MT capacity. 3. Rear mounted Cabins type pick n carry hydros are not allowed inside plant premises.
		15/20 MT	APR	01 No.	
4.3	Trailer with pulling unit	30 MT	Within 01 month from Zero date till Completion of work	1 No.	First Trailer to be deputed within 01 month from Zero Date. Additional trailer if required for material shifting has to be deputed by the contractor. After Barring Gear, contractor to arrange suitable capacity trailer on APR basis till material reconciliation.
		20 MT	APR	1 No.	
4.4*	Low Bed Trailer with pulling Unit	APR of weights to be handled as per Chapter X.	APR	APR	Only as per requirement
	* Explanatory Notes 1. The scope of shifting of material from BHEL yard (at BHVP Colony), or any other place of storage in HPCL site to place of erection is in the scope of Contractor. 2. Contractor has to arrange for the trailer for the material stored at above places. 3. For any shifting of material within HPCL VRMP site, contractor has to arrange for its trailers, crane and other T&P (beyond which are provided by BHEL as per chapter V) of appropriate capacity, as per the requirement of shifting of the material from place of unloading to site and vice versa (in case of material reconciliation and return to stores). 4. The trailers/cranes are to be arranged as per handling requirement for the equipment detailed in chapter X (of TCC Part-1).				

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter IV: INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR

4.5	Air compressor (electric or diesel operated)	APR	APR	APR	As per requirement for ATT, air blowing of pipes, painting and other site requirements
4.6	Hydraulic Jacks	25/50/100T	APR	APR	
4.7	Screw Jacks	5/10/25/50T	APR	APR	
4.8	Chain Pulley blocks	APR	APR	APR	
4.9	Slings of various capacity	APR	APR	APR	For handling of equipment of chapter XI
4.10	Wire Rope, D-Shackles, Belt Slings, Hook Chooks	APR	APR	APR	For handling of equipment of chapter XI
4.11	Electric winch with wire rope 2T/ 3T etc.	APR	APR	APR	
4.12	Theodolite of required accuracy	APR	APR	APR	
4.13	Dumpy level	0 to 350 mm(LC-0.01)	APR	APR	
4.14	Bolt Tension Calibrator	APR	APR	APR	
4.15	Hydraulic Pipe Bending Machine (Manual & Motorized)	APR	APR	APR	
4.16	Weld Gauge, Temperature Gun/chalk, Taper Gauge	APR	APR	APR	
4.17	Welding Generators, Rectifiers & TIG Welding Machine and ovens for welding backing and holding of electrode	APR	APR	APR	
4.18	Sleeper Jack arrangement	APR	APR	APR	Deployment as per requirement of loading/unloading
4.19	Radiography arrangement with radioactive isotope source	IRIDIUM-192(of adequate strength not less than 10 curie)	APR	APR	1.As per BARC specification for radioactive material, its storage and operating personnel. 2.Radiography by X-ray, within quoted prices, will be insisted upon if Radiographs by Gamma Rays does not meet required quality standards.
4.20	SAFERAD machine for radiography	APR	APR	APR	This has to be used for digital radiography to reduce radiography time .
4.21	Air Conditioned Dark Room	APR	APR	APR	With facilities like running water and those required for developing and viewing radiographs

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter IV: INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR

4.22	Radiography film viewer	APR	APR	APR	
4.23	NDT test kits (DPT/MPT)	APR	APR	APR	
4.24	Pre heating / stress relieving set (heating control panel, cables, heating elements, thermometers, thermal chinks etc.)	APR	APR	APR	If required only.
4.25	b.) UT kit as per requirement	APR	APR	APR	Recordable UT test Equipment suitable to meet the requirements (KRAUTKRAMMER MODEL USN 50 or EQUIVALENT)
4.26	DG set	APR	APR	APR	As specified in Chapter#3, DG set of adequate capacity has to be deployed for meeting construction Power requirement.
4.27	Surface plate	Up to 1.0 Sq. Mtr	Grade 1,2,3	1 No	
4.28	Temporary Bolts for alignment and coupling of GT with generator and ST with generator	APR	APR	APR	Required for reaming and honing and fitment of final bolts. If not supplied by BHEL MU, these are to be provided by the contractor with material spec. as informed by BHEL.
4.29	The material of the temporary bolts and its machining are in the scope of the contractor.				
4.30	Vacuum Cleaner (Industrial type)& Blowers	APR	APR	APR	
4.31	Hand tools, cutting Tools, grinding machines	APR	APR	APR	
4.32	Tube/ Pipe chamfering machine	APR	APR	APR	
4.33	Torque Tension Wrench (Hydraulic)	APR	APR	APR	
4.34	Surface Grinder and other Workshop Equipment	APR	APR	APR	
4.35	Ratchet Square insert (MM size and Inch size)	APR	APR	APR	
4.36	Nibbling machine	APR	APR	APR	
4.37	Shearing machine, Profile making M/C	APR	APR	APR	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter IV: INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR

4.38	Portable grinding m/c	APR	APR	APR	
4.39	Anchor fasteners with anchoring machines	APR	APR	APR	For supports, platforms for erection, preassembly etc.
4.40	Portable drilling m/c	APR	APR	APR	
4.41	Self-drilling cum tapping machine for fixing of sheeting work screws	APR	APR	APR	
4.42	Allen Key sets, Tape and die sets	APR	APR	APR	
4.43	Inside - Outside Calipers, Precision Depth Gauges	APR	APR	APR	Valid calibration certificates
4.44	Straight Edge (Up to 2 mtr. Long)	(Grade 1,2,3)	APR	APR	Valid calibration certificate
4.45	Taper Pin and straight Pin Reamers	APR	APR	APR	
4.46	Double End, Single End, Ring, Box, Hammering spanners	APR	APR	APR	
4.47	Magnetic Base Drilling Machines, Cutting Machines, Argon Sets, Gas Cutting Machines	APR	APR	APR	
4.48	Hand operated Megger (500V/1000V)	Up to 200 MOhms	APR	APR	
4.49	Digital Multi-meter (4½ / 3½ digit) Tong tester (AC and DC)	APR	APR	APR	
4.50	Micro-meter (both inside and outside) Three Pin Micro-meters	APR	APR	APR	(With Calibration certificates and LC-0.01mm)
4.51	Hardness tester	APR	APR	APR	
4.52	Pressure gauge	0-40 Kg/cm ² , 20-400 Kg/cm ² etc.	APR	APR	For hydro test, with calibration certificate
4.53	Fire retardant Tarpaulins		APR	APR	
4.54	Fire Extinguisher	APR	APR	APR	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter IV: INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR

4.55	3-phase distribution board with complete set up for drawl of construction power & fitted with energy meter and Maximum Demand Meter	APR	APR	APR	Energy meters and maximum demand meter shall be calibrated
4.56	Power cable for drawl of construction power	APR	APR	APR	From start of contract
4.57	Scaffolding materials scaffolding pipes with Clamps etc.	APR	APR	APR	APR of the site
4.58	DFT measurement (Elcometer)		APR	APR	
4.59	Luxmeter/ Photometer		APR	APR	
4.60	Hydro Test Pump	APR	APR	APR	
	The arrangement for Hydro Test of piping etc. (Calibrated pressure gauges and hydro test pump) has to be arranged by the contractor.				
4.61	<u>“APR” is defined as :-</u> Contractor has to deploy T&P AS PER REQUIREMENT of BHEL site as decided by BHEL Engineer In-charge. The capacity, quantity, duration of deployment shall be decided by Package In-charge as per site requirement in view of the front availability and monthly erection program. Decision of BHEL Engineer In-charge in this regard shall be final and binding on the contractor.				
4.62	<u>Notes</u> The above list specifies only major T&P/MMD (may not be complete) to be deployed by the contractor for this package This list is only indicative and neither exhaustive nor limiting. All the tools and plants required for this scope of work, except the tools & plants provided by BHEL are to be arranged by contractor within the quoted rates. The list is suggestive in nature. Any additional T&P required to be arranged by the contractor has to be done by the contractor within the quoted rates. In case the progress of work suffers due to non-deployment of above T&Ps, whenever and wherever required, BHEL will deploy required T&P's at the risk and cost of the vendor.				
4.62.1	Any special testing kit/ MME/ T&P/ precision equipment, other than supplied by the MU/manufacture (in case of BOI's/BOPs) as special equipment for erection/testing or provided by BHEL, has to be arranged by the contractor within final accepted rates.				
4.62.2	All additional/ other tools and plants which are required for satisfactory & timely completion of work of this package shall also be deployed by the contractor within finally accepted rate/ price. If works gets delayed due to non-availability of T&P and MMD, BHEL				

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter IV: INDICATIVE LIST OF T&P/MMD TO BE DEPLOYED BY THE CONTRACTOR

	reserves the right to procure/hire the equipment/T&P and get work done at the risk & cost of contractor without prejudice to right of BHEL as in GCC.
4.62.3	Contractor has to submit the Calibration certificates of all the precision equipment and Load test certificates of all material handling equipment from TPI of all the precision equipment to BHEL. BHEL may ask for recalibration of the MME's /precision equipment/ Material handling cranes and equipment for ensuring quality and safety at work.
4.62.4	Other terms and conditions regarding above items shall be as per T&P clause in SCC.
4.62.5	If any of the T&P (excluding major T&P i.e. from 4.1 to 4.3) mentioned above is not needed for proper execution of scope of work, no recovery from contractor shall be applicable for non-deployment of the T&P, provided contractor has not utilized BHEL free issued T&P for completing such work.
4.62.6	T&P Deployment schedule shall be finalized at site on monthly basis in consultation with BHEL Engineer based on the work fronts/work requirement. BHEL decision shall be final and binding regarding the T&P deployment schedule.
4.62.7	In case deployment of T&P w.r.t requirement/schedule, is delayed or deployed for a shorter period or abnormal down time of T&P or ii) in case T&P w.r.t requirement was not deployed by the contractor as per instruction of BHEL and BHEL had to deploy either its own T&P or iii.)BHEL had to deploy the T&P from outside agency, then recovery shall be done from the contractor as under: In case the contractor does not deploy or delays deployment or major T&P with reference to schedule specified or T&P deployed is out of service for continuous more than 5 days, BHEL will recover non-refundable penalty per day in the following manner- In respect of each 40MT crane - @ Rs. 5000/- per day In respect of each hydra Crane 20MT- @ Rs. 3500/- per day In respect of each trailer 30 MT - @ Rs. 2500/- per day For the daily recovery rate for other T&P/IMTEs. BHEL Engineer decision shall be final and binding on the contractor
4.62.8	In case BHEL had to deploy its own T&P, hire charges of T&P applicable for outside agencies as per extant guidelines for "Hire Charges on issue of Capital Tools & Plants" shall be recovered.
4.62.9	In case BHEL had to deploy the T&P from outside agency, actual hiring cost plus applicable overheads shall be recovered
4.62.10	If the work related to T & Ps mentioned above is completed then, BHEL can release that T & P during contract period / extended period if any. However, written permission shall be taken by contractor from BHEL construction Manager for releasing the T&P.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter V: T&Ps and MMEs to be deployed by BHEL

5: LIST OF T&P TO BE PROVIDED BY BHEL ON SHARING BASIS

S. No	Description and capacity of T&P	Quantity	Remarks
5.1	135 MT Crane	1	Free issue and on sharing basis depending on availability - For erection & loading/unloading of material: (As per requirement in line with clause No. 5.6.7 and 5.6.8 of chapter 5, TCC part 1).
5.2	EOT Crane in TG Hall (Capacity 20/5 MT)	1	- For handling and erection of equipment in the respective halls as per availability. - The contractor will have to arrange for qualified experienced operators for EOT - The power for EOT is on chargeable basis.
5.3	EOT Crane in GT Hall (Capacity 35/5 T)	1	
5.4	EOT Crane in DG Hall (Capacity 10 MT)	1	
5.5	PMI M/C	APR	To be Provided by BHEL as and when required.
5.6	Notes:		
5.6.1	Cl.4.2.2.16.c) of SCC shall be read as “Day to day upkeep and running maintenance like filling topping up of lubricants, changing filters, etc. including repair of self-starter, batteries and dynamo of these cranes shall be excluded from the scope of the contractor. In case of breakdown of crane, contractor shall provide the necessary manpower for maintenance of the crane to maintenance agency, failing to do so BHEL will get the job done at the risk and cost of contractor. BHEL may also provide cranes through crane hiring agencies in which case the day-to-day upkeep and running maintenance shall be excluded from scope of contractor.”		
5.6.2	Cl.4.2.2.16. e) of SCC shall be read as “The operator and helper for BHEL's 100 MT & above capacity cranes shall be provided by BHEL free of cost. The operators for cranes, below 100 MT capacity cranes, shall be in contractor's scope. Further, fuel for operation of all BHEL cranes and for cranes arranged / hired (through Crane hiring agencies) by BHEL for carrying out work of this contract scope, shall be provided by contractor within the final accepted rates.”		
5.6.3	The contractor shall make necessary arrangement like laying of steel plates, assembly & dismantling of heavy lift attachment, boom, jib etc. for movement and operation of crane.		
5.6.4	Any other special T&P if supplied by the manufacturer and available with the customer will also be provided to the contractor free of hire charges as and when made available. Special tools and tackles are to be used only for the purpose for which these are meant		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter V: T&Ps and MMEs to be deployed by BHEL

	and to be returned in good condition. However low height jack may not be made available and will have to be arranged for by the contractor
5.6.5	For T&P other than cranes, mentioned above and any other provided by BHEL for erection and commissioning purposes, contractor shall transport from BHEL stores, install, operate, carry out maintenance, dismantle after use and return to BHEL stores in working condition.
5.6.6	Other terms and conditions regarding above items shall be as per T&P clause in SCC
5.6.7	Cranes / Handling arrangement other than that which are provided by BHEL as per this chapter and are required for loading, transportation and erection of the equipment under scope of this contract, has to be arranged/brought by the contractor as per the site requirement at no extra cost to BHEL.
5.6.8	The 135MT crane shall be provided to the contractor for erection and unloading, for only those items (Eligible items). which are beyond the capacity of contractor's 40 MT crane The capacity of the crane for erection/handling of any item is governed by weight of the item, height for erection and position available for placement of the crane i.e. capacity, radius available and boom length required. The decision of BHEL package In-charge, regarding the eligibility of an item to be erected by BHEL135 MT crane, shall be final and binding on the contractor. For non-eligible items (items within capacity of 40MT crane), BHEL may allow the contractor for erection of such items on chargeable basis by its crane (based on availability of BHEL crane). The charges against such hiring shall be deducted from the contractor RA bill, as per the BHEL circular dated 01.06.2017 for revision of hire charges for Tools and Plants. This circular is valid till 31.05.2019. After 31.05.2019, the rates at the time of usage shall be deducted depending on the circular applicable at that time.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VI: TIME SCHEDULE

6.0	TIME SCHEDULE	
6.1	The contractor is required to commence the work within 15 days from the date of issue of letter of intent (LOI) unless BHEL decides to fix any other later date. However, the actual date of start of work, to fix up the zero date of the contract, will be certified by BHEL Engineer after adequate mobilization of manpower and T&Ps(as required for finalisation of Zero date) by the contractor.	
6.2	Entire work as detailed in the tender specifications shall be completed within 14 months from the Zero date as per programme / milestones indicated by BHEL Engineer. Contractor has to mobilise adequate resources to meet BHEL's commitments to their customer as indicated from time to time.	
6.3	Entire work shall be carried out in accordance with the broad schedule for the unit as furnished below, within the stipulated completion period. This schedule will undergo review on regular basis by HPCL/EIL and BHEL. Based on achieved progress vis-à-vis project requirement, contractor shall be provided with the revised Erection schedule by BHEL/ HPCL. The contractor will have to submit a program for E&C to meet the revised project schedule and accordingly augment his manpower/T&P at no extra cost to BHEL.	
6.4	Schedule of Work	
	Milestone	Schedule
6.4.1	STG Erection start	1 st Month
6.4.2	GT Erection start	2 nd Month
6.4.3	DG Set Erection Start	3 rd Month
6.4.4	GT Oil Flushing Start (M1)	8 th Month
6.4.5	STG Lube Oil Flushing Start (M2)	9 th Month
6.4.6	DG set erection Completion	9 th Month
6.4.7	GT Cranking and FSNL	10 th Month
6.4.8	GTG Synchronization	10 th Month
6.4.9	STG Barring Gear	10 th Month
6.4.10	STG Rolling and Synchronization	11 th Month
6.4.11	Handing Over and completion of facilities	12 th to 14 th Month
6.5	Provision of Penalty in case of slippage of Intermediate Milestones:	
6.5.1	M1& M2 are the intermediate LD milestone. Milestones LD shall be applicable if the delay in achieving the milestone is solely attributable to the contractor.	
6.5.2	In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones	
6.5.3	In case delay in achieving M1 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*, limited to maximum 2% of executable contract value, will be withheld.	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VI: TIME SCHEDULE

6.5.4	In case delay in achieving M2 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*, limited to maximum 3% of executable contract value , will be withheld.
6.5.5	Amount already withheld, if any against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 Milestone.
6.5.6	Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment (corresponding RA Bill) and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
6.5.7	Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion/ closure of contract. Withheld amount, if any due to slippage of identified intermediate milestone(s) shall be adjusted against LD or released as the case may be.
6.5.8	In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted into recovery
6.5.9	* Executable Contract Value - Value of work for which inputs/ fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.
6.6	Contractor shall plan their work in such a manner so as to meet the above project schedule, in consultation with BHEL/ customer. To achieve the above schedule contractor shall work in the all the available fronts concurrently and be prepared for working in the shift operation as per the instruction of BHEL Engineer. All formalities regarding permissions/gate passes for shift working are to be applied in time in line with HPCL/EIL requirements.
6.7	Completion of facilities shall be completed in all respects only when on successful erection, trial run of individual equipment's and successful commissioning, trial operation, attending punch points ,handing over of the unit to the customer.
6.8	The work under the scope of this contract shall be deemed to have been completed in all respects only when so certified by BHEL. The decision of BHEL shall be final and binding on the contractor.
6.9	If the completion of work as detailed in the scope of work gets delayed beyond the contract/ completion period, the contractor shall request for an extension of the contract and BHEL at its discretion may grant time extension for the contract as per GCC clause 2.11
6.10	Commencement of performance Guarantee- The commencement of guarantee period for workmanship shall start from the date of trial operation acceptance of facilities/handing over of the Unit to the customer. Other conditions for the guarantee period shall be as per clause no.2.24 (Performance Guarantee for Workmanship) of General Conditions of Contract.
6.11	Completion of Facilities- It is defined as handing over to the customer after area cleaning, removal of temporary structures and return of scrap, submission of As-built drawings and Completion of contract closure formalities like HR clearance/ No dues from various dept./ Statutory authorities etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Terms of Payment

7.0	TERMS OF PAYMENT		
7.1	The 'Engineer' will certify the actual work executed in the measurement books and bills, which shall be accepted by the contractor in measurement book.		
7.2	Contractor shall submit bills for the work completed under the specification, once in a month detailing work done during the month. The format for billing and detailed billing breakup shall be approved by BHEL before raising invoices.		
7.3	The payments are subject to any deduction, which BHEL may be authorized to make under the Contract. Payments shall be released within 30 days of receipt of Bill complete in all respects.		
7.4	Contractor on certificate of the Engineer at site shall be entitled for progressive and milestone payment as explained here under.		
7.5	Progressive and Milestone Payment of the works of ETC of GT, STG, DG set, Auxiliaries and BOP shall be regulated as given below:		
	Sl. No.	Item	% Billing
	7.5.1.	Gas Turbine, Generator and its auxiliaries and associated integral piping	24
	7.5.2	Steam Turbine, Generator and Auxilliaries and integral piping	22
	7.5.3	DG sets and Auxilliaries and integral piping	18
	7.5.4	Rotating and Static Auxilliaries	13
	7.5.5	Fire Fighting System	8
	7.5.6	Milestones	15
		Total	100
The billing breakup for above individual items is subdivided as mentioned below.			
S. No.	Activity / Milestone		Payment Percentage
7.5.1	Gas Turbine, Generator and its auxiliaries and associated integral piping		24%
7.5.1.1	GAS TURBINE, DUCTING, AUXILIARIES AND INTEGRAL PIPING (19 %)		
7.5.1.1.1	Preparation and chipping of Foundation		0.50%
7.5.1.1.2	Placement, levelling, centering & grouting of Gas Turbine with accessories on foundation		3.00%
7.5.1.1.3	Placement , levelling of Load Gear Box, Alignment and Grouting		0.50%
7.5.1.1.4	Installation of GT load coupling, alignment with Gear box and coupling		0.50%
7.5.1.1.5	Erection of GT enclosure with exhaust blowers and ducting		2.00%
7.5.1.1.6	Erection, Alignment and Grouting of Accessory module(Lube Oil/Gas Module) with enclosure		0.50%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Terms of Payment

7.5.1.1.7	Placement, Erection, alignment and grouting of LDO filtering and Forwarding skid, off base coolers equipments, cooling fan modules, L.O. centrifuge/Oil Filtering Skid	0.50%
7.5.1.1.8	Placement, Erection and alignment of Liquid fuel, Atomising Air and Water Injection module, compressor water wash skid, APU skids	0.50 %
7.5.1.1.9	Erection , Alignment of GT vent Fans with enclosure, mist eliminator with ducting etc.	0.50%
7.5.1.1.10	Erection of GT Firefighting System, CO ₂ protection systems with GT CO ₂ rack and Gas heater	1.00%
7.5.1.1.11	Erection of GT Inlet Filter Unit with ducting, silencers, expansion joints, Supports structure, static elements etc.	3.00%
7.5.1.1.12	Erection of Exhaust diffuser assembly with insulation , exhaust ducting with silencers, Bypass Stack with Support structure, Aviation lamp & Lightening arrestors etc.	1.50%
7.5.1.1.13	Erection of diverter damper with accessories & Aux.	0.50%
7.5.1.1.14	Erection of Guillotine dampers with accessories & Aux.	0.50%
7.5.1.1.15	Erection of Off Base skids(05 Nos.) for Natural Gas Conditioning Skids	0.50%
7.5.1.1.16	Erection of Off Base skids(04 Nos.) for HSD system	0.50%
7.5.1.1.17	Erection of Off Base skids(06 Nos.) for Naptha fuel system	0.50%
7.5.1.1.18	Erection of Integral and interconnecting Piping of GT and other skids(Onbase and Offbase)	2.00%
7.5.1.1.19	Completion of balance works of GT and associated auxiliaries	0.50%
	Sub Total	19.00%
7.5.1.2	GAS TURBINE GENERATOR & AUX (5%)	
7.5.1.2.1	Preparation of foundation and levelling of base plates & packers etc.	0.50%
7.5.1.2.2	Placement of generator on foundation, centering & levelling	2.25%
7.5.1.2.3	Erection of Generator Acoustic Enclosure	0.25%
7.5.1.2.4	Alignment of Generator Rotor with load gear box and coupling	0.50%
7.5.1.2.5	Erection alignment of brushless exciter	0.50%
7.5.1.2.6	Setting of erection clearances of Generator and Exciter	0.25%
7.5.1.2.7	Grouting of Generator and auxiliaries foundation	0.25%
7.5.1.2.8	Erection of Terminal box, bushings and Generator coolers etc.	0.25%
7.5.1.2.9	Completion of Balance Works of GT Generators and Auxiliaries	0.25%
	Sub Total	5.00%
7.5.2	Steam Turbine, Generator and Auxiliaries and integral piping	22%
7.5.2.1	Steam Turbine & Auxiliaries	14 %
7.5.2.1.1	Preperation of Foundation and setting of Turbine Axis	0.5%
7.5.2.1.2	Placement, alignment and grouting of base plates of Turbine and bearing pedestals	0.5%
7.5.2.1.3	Placement of Turbine, lowering of Rotor on bearings and checking of clearances, coupling etc.	2.50%
7.5.2.1.4	Erection of Gear box	0.25%
7.5.2.1.5	Alignment of all Rotors (ST, GB, Generator)	1.50%
7.5.2.1.6	Coupling including reaming, honing and fixing of final coupling bolts	0.75%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Terms of Payment

7.5.2.1.7	Erection of Lube Oil console package (Tank), Lube Oil console package (Pump Assy) including Jacking Oil, Emergency Oil Pumps, Oil Accumulators, filters, purification Unit etc	1.00%
7.5.2.1.8	Erection of Turbine ESV, Injection Stop, respective control Valves, servomotor assemblies	1.00%
7.5.2.1.9	Erection of Lube Oil and control Oil Piping	1.50%
7.5.2.1.10	Erection of Integral Piping of STG	1.50%
7.5.2.1.11	Erection of Governing console and Assembly of regulation system	0.50%
7.5.2.1.12	Final boxing up of Pedestals after turbovisory	0.50%
7.5.2.1.13	Erection of Miscellaneous items and skids of STG	0.50%
7.5.2.1.14	Erection of Turbine Enclosures	1.00%
7.5.2.1.15	Completion of Balance works of Steam Turbine and auxilliaries	0.50%
	Sub Total	14.00%
7.5.2.2	Steam Turbine Generator	8.00%
7.5.2.2.1	Preparation of foundation	0.50%
7.5.2.2.2	Placement, levelling and centering of Generator Stator on foundation.	2.50%
7.5.2.2.3	Erection of brushless Exciter	0.50%
7.5.2.2.4	Setting of clearances of Generator and exciter	0.50%
7.5.2.2.5	Alignment of Generator Rotor with Gear Box and foundation grouting.	1.50%
7.5.2.2.6	Bearing boxup of Generator and exciter	0.50%
7.5.2.2.7	Erection of Air cooler assembly	1.50%
7.5.2.2.8	Completion of all balance works of Generator	0.50%
	Sub Total	8.00%
7.5.3	2X6750 KVA DG sets and auxilliaries	18 %
7.5.3.1	Preperation of Foundation and setting of axis	2 X 0.25%
7.5.3.2	Placement of DG set Skid	2X 2.25%
7.5.3.3	Erection of Cooling Water System	2X1.00%
7.5.3.4	Erection of Fuel System	2X0.75%
7.5.3.5	Erection of Charge/Intake Air System	2X1.00%
7.5.3.6	Erection of Exhaust System including Steel Chimneys	2X2.00%
7.5.3.7	Erection of Compressed Air system	2X1.00%
7.5.3.8	Erection of Integral and interconnected Field Piping of DG sets such as Air, Water and fuel etc.	1.00%
7.5.3.9	Completion of all balance works of DG sets	0.5%
	Sub Total	18.00%
7.5.4	Erection of Rotating and Static Auxiliaries	13%
7.5.4.1	Erection of Rotating Auxiliaries	8.00%
7.5.4.1.1	VVHP Boiler Feed Pump-VFD Driven -02 Nos.	2X 1.00%
7.5.4.1.2	VHP Export Boiler Feed Pump-VFD Driven -02 Nos.	2X 0.75%
7.5.4.1.3	MP Export Boiler Feed Pump – 02 Nos.	2X 0.50%
7.5.4.1.4	Condensate Transfer Pump -02 Nos.	2X 0.25%
7.5.4.1.5	Dump Condensate Transfer Pump- 02 Nos.	2X.0.125%
7.5.4.1.6	Blowdown Transfer Pump for HRSG- 02 Nos.	2X.0.125%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Terms of Payment

7.5.4.1.7	Blowdown Transfer Pump for GSC- 02 Nos.	2X.0.125%
7.5.4.1.8	Gas Condensate Transfer Pump- 02 Nos.	2X.0.125%
7.5.4.1.9	DM GT ACC Pump- 02 Nos.	2X 0.25%
7.5.4.1.10	Erection of Naptha Forwarding Pump Skids-02 Nos.	2X 0.25%
7.5.4.1.11	Erection of HSD Forwarding Pump Skids-02 Nos.	2X 0.25%
7.5.4.1.12	Completion of balance works of rotating auxiliaries	2X 0.25%
	Sub Total	8.00%
7.5.4.2	Erection of Static Auxiliaries and Hoists etc.	5.00%
7.5.4.2.1	Erection, Alignment , Welding, NDT, Insulation etc. of FST and Deaerator Tank	3.00%
7.5.4.2.2	Erection of PHE -01 Nos.	0.10%
7.5.4.2.3	Erection of Electrical Hoists -10 Nos.	10X0.15%
7.5.4.2.4	Completion of balance works of static auxiliaries	0.4%
	Sub Total	5.00%
7.5.5	Fire Protection System	8 %
7.5.5.1	Water/Hydrant based Fire Protection System:	6.0%
7.5.5.1.1	Hydrant System(Cement Lined Piping system)	4.00%
7.5.5.1.2	MVW Spray System for Fuel skids	1.00%
7.5.5.1.3	MVW Spray System for Cable galleries of Control Building & GIS Building	1.00%
7.5.5.2	Inert gas Extinguishing System	1.00%
7.5.5.3	Fire Extinguishing System(Fire extinguishers and Fire Buckets etc.)	0.50%
7.5.5.4	Completion of balance works of Fire Protection System	0.50%
	Sub Total	8.00%
7.5.6	Milestones	
7.5.6.1	Oil flushing completion of GT system	0.50%
7.5.6.2	Cranking of GT	1.00%
7.5.6.3	Full speed no load Run of GT	0.75%
7.5.6.4	Synchronisation and Full Loading of GT set	1.00%
7.5.6.5	Oil Flushing of STG	1.00%
7.5.6.6	Barring Gear of STG	1.00%
7.5.6.7	STG Synchronisation	1.00%
7.5.6.8	Full Load of STG	1.00%
7.5.6.9	Commissioning of 2x6750KVA DG sets	1.00%
7.5.6.10	Trial operation - Combined cycle	1.00%
7.5.6.11	Commissioning of Water based Fire Protection System	0.50%
7.5.6.12	Completion of Painting (Supply and Application of paints)	3.00%
7.5.6.13	Punch List points/pending points liquidation	0.50%
7.5.6.14	Material Reconciliation and completion of contractual Obligation	0.75%
7.5.6.15	Completion of Facilities	1.00%
	Sub Total	15.00%
	Grand Total of 7.5.1. to 7.5.6	100 %

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Terms of Payment

7.6	Notes:															
7.6.1	If the commissioning activities could not be carried out due to no fault of contractor, BHEL Site in-charge, at his discretion, after recording reasons for exercising such option, can split and release payment up to 50% of milestone payment on completion of work, to the extent possible, required for carrying out that particular milestone/ commissioning activity.															
7.6.2	In line with GCC clause 2.23.1 to facilitate part payment, BHEL Site Engineer at his discretion may further split the contracted rates/percentages to suit site conditions, cash flow requirements according to the progress of work . BHEL Package In-charge and Contractor may further detail the above Billing breakup. The same shall be finalised and agreed upon before raising of first RA bill by the contractor.															
7.6.3	Payment of retention amount and final bill shall be as per clause No. 2.22 and 2.23.2 of GCC respectively.															
7.6.4	PAYMENT FOR SUPPLY AND APPLICATION OF PAINTS The payment for supply and application of paints shall be released as per the completion of finish painting and labelling of all equipment, systems of each package of this contract scope, as certified by BHEL Engineer. The payment for this milestone 7.5.6.12(Completion of Painting) may be regulated as:															
	<table><tr><td>Payment Term Item No.</td><td>Description of partial milestone of 7.5.6.12</td><td>Payment to be released on completion</td></tr><tr><td>7.5.6.12.1</td><td>Completion of Painting of GT and Auxilliaries Package</td><td>0.75 %</td></tr><tr><td>7.5.6.12.2</td><td>Completion of Painting of STG and Auxilliaries Package</td><td>0.75 %</td></tr><tr><td>7.5.6.12.3</td><td>Completion of Painting of DG set and Auxilliaries Package</td><td>0.75 %</td></tr><tr><td>7.5.6.12.4</td><td>Completion of painting and Labelling of complete contract scope</td><td>0.75 %</td></tr></table>	Payment Term Item No.	Description of partial milestone of 7.5.6.12	Payment to be released on completion	7.5.6.12.1	Completion of Painting of GT and Auxilliaries Package	0.75 %	7.5.6.12.2	Completion of Painting of STG and Auxilliaries Package	0.75 %	7.5.6.12.3	Completion of Painting of DG set and Auxilliaries Package	0.75 %	7.5.6.12.4	Completion of painting and Labelling of complete contract scope	0.75 %
	Payment Term Item No.	Description of partial milestone of 7.5.6.12	Payment to be released on completion													
	7.5.6.12.1	Completion of Painting of GT and Auxilliaries Package	0.75 %													
	7.5.6.12.2	Completion of Painting of STG and Auxilliaries Package	0.75 %													
	7.5.6.12.3	Completion of Painting of DG set and Auxilliaries Package	0.75 %													
7.5.6.12.4	Completion of painting and Labelling of complete contract scope	0.75 %														

There is no separate provision for release of payments based on supply of paints and primer etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VIII: TAXES AND DUTIES

8.1	TAXES AND DUTIES:
8.1.1	Price quoted should be inclusive of all applicable Taxes/charges but <u>Excluding GST and BOCW cess.</u> The Contractor shall pay all other taxes, fees, royalty, commission etc. which may be levied on the contractor in executing the contract. In case BHEL is forced to pay any of such taxes, it shall be recovered from Contactor's bills or otherwise as deemed fit. GST Shall be payable extra as per following :
8.1.2.	Contractor/Vendor has to issue invoice indicating HSN/SAC code, Description, Value, Rate, applicable tax and other particulars in compliance with the provisions of relevant GST Act and Rules made thereunder. With the implementation of e way bill provisions, contractor shall comply with same as applicable.
8.1.3	Vendor has to submit GST compliant invoice within seven days from the due date of invoice as per GST Law. In case of delay, BHEL reserves the right of denial of GST payment if there occurs any hardship to BHEL in claiming the input thereof. In case of goods, vendor has to provide scan copy of invoice & GR/LR/RR to BHEL before movement of goods starts. Special care should be taken in case of month end transactions.
8.1.4.	GST amount claimed in the invoice shall be released on fulfilment of all the following conditions by the Contractor : - a. Supply of goods and/or services have been received by BHEL. b. Original Tax Invoice has been submitted to BHEL. c. Respective invoice has appeared in BHEL's GSTR - 2A for the month corresponding to the month of invoice. Alternatively, BG of appropriate value may be furnished which shall be valid at least one month beyond the due date of confirmation of relevant payment of GST on GSTN portal or sufficient security is available to adjust the financial impact in case of any default by the contractor.
8.1.5	TDS under GST law as applicable shall be deducted.
8.1.6	Contractor shall be solely responsible for discharging his GST liability according to the provisions of GST Law and BHEL will not entertain any claim of GST/interest/penalty or any other liability on account of failure of contractor in complying the provisions of GST Law or discharging the GST liability in a manner laid down thereunder
8.1.7	In case declaration of any invoice is delayed by the vendor in his GST return or any invoice is subsequently amended/altered/deleted on GSTN portal which results in any adverse financial implication on BHEL, the financial impact thereof including interest/penalty shall be recovered from the Contactor's due payment.
8.1.8	Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of GST Law by the Contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the Contactor.
8.1.9	The admissibility of GST, taxes and duties referred in this chapter or elsewhere in the contract is limited to direct transactions between BHEL & its Contractor. BHEL is not responsible for any liability that may arise due to any transaction beyond the direct transaction between BHEL & its Contractor.
8.1.10	<u>Variation in Taxes & Duties:</u> Any upward variation in GST shall be considered for reimbursement provided supply of goods and services are made within schedule date stipulated in the contract or approved extended

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VIII: TAXES AND DUTIES

	schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual GST applicability. In case the Government imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to the direct transaction between BHEL and its contractor only and within the contractual delivery period only. In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.
8.1.11	<u>Modalities of Tax Incidence on BHEL:</u> Where GST law permits more than one option or methodology for discharging liability of tax/levy/ duty; the contractor shall approach BHEL before choosing any option to discharge his tax liability. BHEL shall have the right to direct the contractor to adopt the appropriate option considering the amount of tax liability on BHEL as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the contractor for discharging the obligation of BHEL in respect of the tax liability to the contractor.
8.2	<u>BUILDING & OTHER CONSTRUCTION WORKERS WELFARE CESS:</u> BUILDING & OTHER CONSTRUCTION WORKERS (REGULATION OF EMPLOYMENT AND CONDITIONS OF SERVICE) ACT, 1996 (BOCW Act) AND RULES OF 1998 READ WITH BUILDING & OTHER CONSTRUCTION WORKERS CESS Act, 1996 & CESS RULES, 1998.
8.2.1	In case Building & Other Construction Workers welfare Cess is applicable, the applicable cess will be paid extra at actual against the documentary proof of submission of BOCW to relevant authority.

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9.0	<u>Important milestones and their definitions which are applicable during this contract execution</u> These are as per terms of contract between BHEL and HPCL, but for the work of this contract scope, BHEL contractor shall be responsible for executing/assistance in execution/compliance of the same:
9.1	MECHANICAL COMPLETION Mechanical Completion of systems mean that all installation works of the unit is completed and hydro tested in accordance with approved construction drawings, approved specification, applicable code(s) as defined in the bid package, accepted international good engineering practice and all the pre-commissioning activities are completed in a comprehensive manner by the Contractor, except mutually agreed minor leftover such as insulation, painting etc. which may be completed during pre-commissioning phase. Contractor shall fill certificate as per FORMAT-I, stating system/sub-system, which is mechanically completed along with test certificates connected with the system/sub systems viz. hydro test reports, NDT reports, inspection certificates, certificates of various statutory bodies etc. HPCL/ PMC representatives will check the system and shall issue FORMAT- II which includes deficiencies / modifications, intimation of deviations from P&IDs, requirement of safety, start-up, Operation and Maintenance required for the portion of the work that is declared by the Contractor as mechanically complete. Contractor shall liquidate all the checklist points agreed between Contractor/HPCL /PMC and issue certificate in form of FORMAT – III. All the coordination for resolution of P&ID issues, alarm/trip values, interlocks and complex loop issues shall be closed by CONTRACTOR. Contractor shall get the approval or acceptance of FORMAT-III to carry out pre-commissioning activities as mentioned in section 2.2 under the guidance / supervision of Owner / PMC.
9.2	Pre-commissioning activities will include but will not be limited to the following: These are general specs for pre-commissioning and contractor responsibility shall be to execute works corresponding to this contract scope.
9.2.1	Opening & box-up of piping, valves, instruments, spool pieces etc. as per pre-commissioning procedure.
9.2.2	Air blowing, cardboard blasting, water flushing, Air drying and steam blowing of pipes, vessels, columns, equipment for clearance of box-up & maintain records for commissioning activities. In case sufficient pressure during water flushing is not available, contractor to make necessary temporary arrangement for getting the required pressure. (Inspection of all equipment shall be jointly done by HPCL/ PMC)
9.2.3	Manual cleaning in compressor's suction lines as per requirement.
9.2.4	Fabrication and supply of temporary facilities, for example, temporary bypasses, spools, blinds, jump overs, vents, strainers, screens etc.

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9.2.5	Fabrication / Purchase of valve keys/blinds and other pre-commissioning /commissioning related consumables as required.
9.2.6	Carry out leak test/ tightness test. Carry-out integrated leak test & maintain records. Attending leaks by tightening to the required torque/replacement of faulty gaskets where necessary.
9.2.7	Receiving material required as per requisite format approved by EIC from owner's store / warehouse / designated area or any other location within plant premises including loading , unloading and maintain the records.
9.2.8	Contractor to ensure that Gaskets etc. used are strictly as per piping material specification for the pipe class specified for that line.
9.2.9	Carrying out RIGGING JOBS including dismantling/ erection of structure/ equipment, piping,bearings, Gearbox, flanges etc. as per the instructions of the Engineer-in-charge.
9.2.10	Opening & Box Up Of Static Equipment / column/Vessel / Man ways and Pipe Line
9.2.11	Flanges/Heat Exchangers, Isolation, removal & re-fixing of instruments mounted on Static Equipment, Heat Exchangers bundle pulling and re-fixing.
9.2.12	Opening and Re-Fixing of all Type of Valves including PSVs & control valves, line mounted
9.2.13	SCAFFOLDING ERECTION AND DISMANTLING JOBS including supply and erection of temporary scaffolding & staging, making temporary platforms using pipes, pipe clamps, beam clamps etc. in conformance with established safety codes, BIS codes etc. inside/ outside of equipment like Columns, Vessels, structures etc.
9.2.14	Carrying out FILTERS, STRAINERS, STEAM TRAPS, DEMISTER PADS related jobs including removal of auxiliary connections, dropping assemblies, cleaning, finally boxing up the complete assembly with proper alignment, flushing, draining, cleaning and filling up of hydraulic oil consoles / tanks of rotary equipment, removing and cleaning all types of filters and strainers, Cleaning of area / oil spillage, after the job, Cleaning of all types of steam traps, Dropping, cleaning and re-fixing the de-mister pads after inspection, Cleaning and lubrication of fasteners, etc.
9.2.15	To obtain necessary safety / work permits and comply with all safety norms & regulations.
9.2.16	CONTRACTOR to coordinate and confirm compliance regarding completion of all, mechanical installation work of this contract scope.
9.2.17	CONTRACTOR to ensure during Pre Commissioning, all the accessories /equipment required for availability of utilities for carrying out commissioning works shall be ready at least three months before start of Commissioning activities.
9.2.18	Removal of scrap to identified area, maintain housekeeping, & return material after the job completion.
9.2.19	Supplying safety appliances & suitable PPEs to all workers
9.2.20	Supply & Installation of barricading tape.
9.2.21	Maintenance & repairing of valves by a skilled valve repair mechanic, in case of any issues in functioning of the valves. Technical experts to be deployed by BHEL, contractor to assist during overhauling.
9.2.22	To remove insulation from insulated piping, Valves, flanges etc. in such a way so that these can be reused and re-fix the same after the job is completed.
9.2.23	CONTRACTOR to take trial run of Fire Water system, and other safety system and obtain approval of the same from OWNER/PMC/EIL.
9.3	DECLARING READY FOR COMMISSIONING

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9.3.1	The unit shall be considered 'Ready for Commissioning' (FORMAT-IV) when all the facilities have been completed along with their auxiliaries and support facilities in every respect including charging of lubes, chemicals, preparation of solution, last minute modifications, if any, as recommended by HPCL/EIL. All temporary structures, scaffolding etc. used for carrying out pre-commissioning activities shall be removed, all the blinds shall be placed into position as per P&IDs
9.3.2	Contractor shall ensure that all safety devices like pressure safety valves (PSV), emergency shutdown valves are tested, witnessed and certified by representative of BHEL/EIL. These certificates are to be handed over to prior to start-up of the UNIT.
9.3.3	Once the Unit has been declared "Ready for Commissioning", the Contractor shall not carry out any erection related work including hot work without prior permission of the BHEL/EIL.
9.4	COMMISSIONING
9.4.1	Commissioning of the Unit will be carried out by Contractor once mechanical completion is over successfully, all pre- commissioning activities are carried out and system is ready for commissioning under necessary guidance and overseeing of HPCL/EIL. Representative from process designer will provide necessary co-ordination during start up and related technical clarifications shall be furnished by them.
9.4.2	Commissioning of the Unit means taking the feed in, passing it through the normal route; establishing the process control parameters first at turn down & then at design throughput stipulated in the process package (guarantee parameters as per bid document) with supplementary instructions if any from HPCL/EIL.
9.4.3	Contractor will provide necessary assistance during commissioning of the unit.
9.4.4	The Unit shall be considered to be commissioned successfully once all the system with instrumentation / control systems and support systems have been on uninterrupted stable operation for not less than 72 hours. Any interruption of duration up to 30 minutes during the commissioning run of 72 hrs shall be ignored. However for interruptions greater than 30 minutes, the commissioning run period shall be extended by the time equal to the interruption plus the time taken to stabilize the Unit back to the normal operating conditions. Whether the 72 hours operation has been successful or not, shall be decided by the HPCL/EIL based on the observations recorded during 72 hours. The countdown for 72 hours operation shall start only after Unit has been on stable operation with all controls and safety system in normal operation for a period of not less than 48 hours.
9.4.5	The CONTRACTOR shall also be required to provide on the job training to OWNER's operation personnel by associating them in all the day to day pre-commissioning, commissioning, maintenance activities and UNIT operations.
9.4.6	After successful commissioning of the process Unit same shall be handed over to the HPCL for operation. In case of any constraint in achieving the above process parameters in the Unit by the CONTRACTOR, the same shall be communicated by the CONTRACTOR to the BHEL/HPCL/EIL in writing. This will be reviewed jointly by HPCL/EIL to arrive at a decision on whether the constraint is on account of reasons attributable to the CONTRACTOR or not. The action in either case will be according to the relevant provisions / provided elsewhere in the contract.
9.4.7	CONTRACTOR in some cases may be required to do part commissioning of the mechanically completed sections of the UNIT as per directives from the OWNER.

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9.4.8	Upon successful commissioning of the Units the same shall be taken over by the OWNER for day to day operation and maintenance only, the final take-over shall be subject to compliance to all the contractual obligations by the CONTRACTOR. Once the Unit is successfully commissioned CONTRACTOR will issue the format-V to OWNER for takeover of the Unit from CONTRACTOR.
9.5	OTHER REQUIREMENTS
9.5.1	The Contractor shall also provide 'No Smoking' boards & Do's and Dont's, boards for other designated instructions in unit areas.
9.5.2	Contractor shall also ensure implementation of all recommendations arising out of audits viz. internal pre-commissioning audit and audit by statutory bodies like PESO, OISD etc., as and when required.
9.5.3	Before startup of unit, safety audit shall be conducted by Owner/PMC. All such check lists/ deficiency report generated by safety audit team shall be liquidated by the Contractor. The safety audit shall cover aspects such as floor opening, trip hazards, bump hazards, electrical safety concerns, mechanical safety concerns etc.
9.5.4	Correct support, vibration and thermal expansion problems detected during commissioning.
9.6	HOUSE KEEPING
9.6.1	Provide continuous clean-up of the construction and operational area.
9.6.2	Remove excess materials, temporary facilities and scaffolding and pick-up trash.
9.6.3	Perform washing for further clean-up as required.
9.7	FINAL INSPECTION BEFORE START OF COMMISSIONING
9.7.1	OWNER/Contractor /PMC or any other Third party (Like OISD) shall carry out a final inspection of the UNIT before starting the commissioning activity.
9.7.2	Record of liquidation of checklist point, test record etc. shall be submitted by the Contractor to OWNER/PMC. Any deficiency/ changes required in the offered system shall to be liquidated by the Contractor.
9.7.3	It shall be the Contractor's responsibility to repair any damage to the system occurred during storage, installation, pre-commissioning and commissioning stage.
9.8	UTILITIES REQUIREMENT
	All the utilities like air, cooling water, raw water, DM water, steam, power, instrument air etc. shall be provided by client for pre-commissioning and commissioning. However, temporary piping/ fittings required to be done for drawing these utilities shall be in the scope of Contractor.

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9.9	<u>Health, Safety And Environment (HSE) Management / Safety Norms to be followed during execution of work</u> In addition to the, OISD Guidelines-192, OISD Guideline-207, EIL specifications on Health, Safety and Environment (HSE) Management and OWNER prescribed work permit system and job safety analysis procedure shall be followed before under taking any work inside OWNER's premises. Considering the above, the CONTRACTOR shall establish, document and maintain an effective Health, Safety and Environment (HSE) management system.
9.9.1	The guidelines released by the Oil Industry Safety Directorate (OISD), Govt. of India, Ministry of Petroleum & Natural Gas has to be adhered to during execution of the work of this contract scope at project site. OISD - GDN 192 and OISD- Guidelines -207 may be downloaded from the ministry/directorate website for reference. The same may also be obtained from BHEL PSNR HQ or site during execution.
9.9.2	A Health, safety and Environment (HSE) Plan for HPCL Visakhapatnam site dated 19.05.2018 (Doc no.: HSEP:PSER 14-HPCLBHEL REV: 02) has been approved at site. This document shall be followed by BHEL and its sub-contractors at HPCL-Visakhapatnam site. This shall be read along with HSE plan of EIL, OISD standard-192 & 207. In case of any conflict of clauses, the more stringent one shall apply. The copy of this document shall be provided at the start of execution of the contract.
9.9.3	The Contractor shall follow OWNER's safety practices during execution of pre-commissioning / commissioning works. Contractor is required to maintain and follow all safety practices equivalent or better than those being practiced by OWNER for the complex during pre-commissioning and commissioning
9.9.4	Necessary Hot/ cold work permit shall be obtained to carryout jobs once declared mechanically completed. (Refer OISD-STD-105, work Permit System).
9.9.5	The documents mentioned above in this head whether annexed or referred will be considered integral part of this contract.
9.9.6	Recoveries from RA/Final Bills on account of safety lapses during contract execution at HPCL Any recoveries/deduction/penalties effected/levied on BHEL by EIL/HPCL for non-compliance of practices/guidelines for safety at site due to negligence/lapses in safety at project site premises by the contractor of this work scope shall be recovered from the contractor's monthly RA bills, in line with BHEL rules. These recoveries shall be in addition to the penalties levied on pro-rata basis by BHEL on contractor for non-compliance of the safety protocols at site during working as per the clause no.16 of HSEP-14 document (Part of SCC) for safety non-compliances and respective penalties.
9.9.7	Guidelines for settlement of claims for compensation on accidents applicable to BHEL are annexed in TCC Part -II and shall be applicable for this project.

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10.0	Common Notes for this Chapter
10.1	Weights and quantities mentioned in this chapter are tentative only and based on the engineering completed as on date of NIT. These quantities and weights are liable for upward and downward variations as per the final engineering and site requirement. The contractor will have to erect the actual quantities required for respective systems in particular and complete scope of works in general , within the contract lumpsum price. No claim shall be admissible for the contractor in any case of downward and upward variation. After final engineering, differences may occur in weights and quantities of individual items and also for a particular subgroup(such as fire protection, DG sets etc.), as these are tentative and based on information received at the time of NIT. On detailed engineering, weights of subgroups, individual items are liable to change.
10.2	The contractor is required to erect actual tonnage and quantities (irrespective of any variation plus or minus) which may be necessary to complete their work and commissioning of the GT,STG, DG sets, Pumps, Deaerator and piping etc. in all respects as detailed in tender specifications and as per the drawings/ documents within the lumpsum contract value.

The tentative list of the material with approx. weights and corresponding sub-group are as given below.

10.3 Equipment and BOPs supplied by PESD Hyderabad

Sl. No.	Equipment /Package Description	Qty. (No.)	Dimension (each) L x B x H (M)	Weight MT (each)	Total Weight (MT)	Remarks
1.	Pumps with Motors					
a.	VVHP Boiler Feed Pump-VFD Driven	2	For Pump & Drive assembly: 8.5X2.6X4.0 For LO skid: 3.5X2X1.5	20	40	BFP assembly consists of Pump, Motor, LO skid. 20 Ton is weight of entire BFP assembly.
b.	VHP Export Boiler Feed Pump-VFD Driven	2	For Pump & Drive assembly: 6.5X2.6X3.0 For LO skid: 3.5X2X1.5	15	30	BFP assembly consists of Pump, Motor, LO skid. 15 Ton is weight of entire BFP assembly.
c.	MP Export Boiler Feed Pump	2	For Pump & Drive assembly: 5.0X2.0X2.0	7.5	15	BFP assembly consists of Pump and Motor. 7.5 Ton is weight of entire BFP assembly.

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Sl. No.	Equipment /Package Description	Qty. (No.)	Dimension (each) L x B x H (M)	Weight MT (each)	Total Weight (MT)	Remarks
d.	Condensate Transfer Pump	2	3.0X1.75X2.0	5	10	Pump assembly consists of Pump and Motor.5 Ton is weight of entire Pump assembly.
e.	Dump Condensate Transfer Pump	2	2.5X1.5X1.5	3	6	a) Pump assembly consists of Pump and Motor. 3 Ton is weight of entire Pump assembly.
f.	Blowdown Transfer Pump for HRSG	2	0.9X0.7X4.5	1	2	Vertical, installed in pit.
g.	Blowdown Transfer Pump for GSC	2	0.9X0.7X4.5	1	2	Vertical, installed in pit.
h.	Gas Condensate Transfer Pump	2	2.5X1.5X1.5	2	4	Pump assembly consists of Pump and Motor. 2 Ton is weight of entire Pump assembly.
i.	DM GT ACC Pump	2	2.5X1.5X1.5	2	4	Pump assembly consists of Pump and Motor. 2 Ton is weight of entire Pump assembly.
Total Weight					113	

10.3.1 HT Motors to be erected in this contract scope (Not included in above weight):

Sl. No.	Item Description	Approx. Dimension L(mm)xB(mm)xH(mm)	Quantity	Approx. Weight in Kg for each	Approx. Total Weight in (MT)
1.	BFP Motor	3725 X 2840 X 1820	2	12000 Kg per motor	24
2.	Feed water export pumps	2880 X 2110 X 1430	2	7300 Kg per motor	14.6
Total Weight					28.6

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10.3.2 Following 4 skids of total weight approx. 5 MT are to be erected and commissioned for fuel forwarding system. These pumps shall be supplied by customer and contractor will have to transport the same to site.

Sl. No.	Pump Skids (EIL supply)	Quantity	Dimension
1	HSD forwarding Pump skids	02	2M X 3.8 M
2	Naptha forwarding Pumps	02	2M X 3.8 M

10.3.3 Hoists and PHE

Sl. No.	Equipment /Package Description	Qty. (No.)	Dimension (each) Lx B x H (M)	Weight MT (each)	Remarks
a)	Electric Hoist for VVHP BFPs (2 Nos.)	2	1.5X1.5X1.5	3	These are to be erected /commissioned by the contractor
b)	Electric Hoist for VHP BFPs (2 Nos.)	2	1.5X1.5X1.5	3	
c)	Electric Hoist for MP BFPs (2 Nos.)	2	1.5X1.5X1.5	3	
d)	Electric Hoist for Air Compressor (2 Nos.)	2	1.5X1.5X1.5	3	
e)	Manual / Electrical hoist for BFPs of 2 tons capacity	2	1.0 x 1.0 x 1.0	1.0	- Travel length 6m
f)	Plate Heat Exchanger	1	2.5 x 1.5 x 3	3.5	

10.3.4 Fuel conditioning skids for GT & HRSG

Fuel Systems					
1	OFF-Base Natural Gas system for GT & HRSG				
i	Gas Conditioning Skid(Natural Gas Scrubber)	1	3.7M x 3.0M X 4.5M	4.5	
ii	Gas Conditioning Skid(Natural Gas Electric Heater)	1	11.3M x 1.7M X 4.5M	4.5	

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iii	Gas Conditioning Skid(Natural Gas Filter Separator)	1	4.8M x 4.6M X 4.5M	10	
iv	Gas Condensate KOD	1	4.8M x 4.6M X 4.5M	3	Horizontal Vessel

2	OFF-Base Natural Gas system for HRSG				
i	Scrubber Skid	1	3.7M x 3.0M X 4.5M	4.5	
3	HSD Systems Conditioning Skids				
i	Accumulator	1	0.6M x 0.4M X 2.7M (LxBxH)	4.5	
ii	25 micron Filter skid	1 no Duplex type	2.1M x 3.5M X 2.7M (LxBxH)	1.5	
iii	6 micron Filter skid	1 no Duplex type	2.2M x 3.8M X 2.7M (LxBxH)	1.6	
iv	Gas Condensate drain tank 2.0 M3 with Drain Transfer Pumps	1	Horizontal Vessel Pit Dimention : 2.4MX6.0MX2.4M(LXBXH)	1.83	
4	Naphtha System				
i	Accumulator	1	0.6M x 0.4M X 2.7M	4.5	
ii	magnetic Filter	1	2.6M x 1.5M x 2.7M	0.75	
iii	25 micron Filter skid	1	2.1M x 3.5M X 2.7M	1.5	Duplex type
iv	6 micron Filter skid	1	2.2M x 3.8M X 2.7M	1.6	Duplex type
v	Gas Condensate drain tank 2.0 M3 with Drain Transfer Pumps	1	2.4MX6.0MX2.4M	1.83	Horizontal Vessel
vi	Lubricity Additive Skid	1	1.75M x 2.8M X 2.7M	1	

10.3.5 Fire Protection System (Hydrant /water based)

Sl.No.	Description	Unit	Quantity	Dimension	Unit Weight in Kg.	Total Weight

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						in Ton
I	Hydrant System					
1	CS PIPES AS PER ASTM A106GRB with Cement lining (Annexure 8.5)			In Inches	Kg/m	
1.1	200 NB	Mts.	450	8"	43	38
1.2	150 NB	Mts.	600	6"	28	
1.3	100 NB	Mts.	60	4"	16	
1.4	80 NB	Mts.	60	3"	12	
1.5	50 NB	Mts.	20	2"	9	
2	CS Gate Valve				Kg/unit	
2.1	200 NB	Nos.	6	8"	126	5.0
2.2	150 NB	Nos.	58	6"	76	
2.3	100 NB	Nos.	2	4"	44	
2.4	80 NB	Nos.	2	3"	27	
3	SS Hydrant valves (external)	Nos.	20	63 NB	15	4
4	SS Hydrant valves (internal)	Nos.	54	63 NB	15	
5	RRL Hoses Type A (internal) 15 m long	Nos.	148		5	
6	MS Hose boxes 18 Guage (internal)	Nos.	54	0.75x0.6x 0.25	10	
7	MS Hose boxes 18 Guage (external)	Nos.	20	0.75x0.6x 0.25	10	
8	Water monitor (75 mm size, nozzle hose 38 mm) along with branch pipe and an isolation valve	Nos.	6	75 mm	50	
9	Branch pipe, nozzle & coupling (internal)	Nos.	54		10	
10	Misc. for painting, primers, other finishes etc.	Ltrs	550		550 Ltrs	
11	Pipe Fittings	Lot	1		1.5	1.5
12	Structural steel(plates, ISMC 75)	Lot	1		50	0.05
II	MVW Spray System for Fuel skids					
1	Automatic Deluge valve assembly with all accessories					
	100 NB	Nos	4	63 NB	55	29

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2	Isolation Valve for Deluge valve (Gate valves)					
	100 NB	Nos	12	6"	44	
3	Y - Type strainer					
	150 NB	Nos	4	6"	45	
4	Piping (Over Ground Pipe)					
4.1	100 NB G.I. Pipe	Mts	288	4"	16	
4.2	80 NB G.I. Pipe	Mts	288	3"	12	
4.3	65 NB G.I. Pipe	Mts	400	2.5"	10	
4.4	50 NB G.I. Pipe	Mts	300	2"	9	
4.5	40 NB G.I. Pipe	Mts	528	1.5"	5	
4.6	25 NB G.I. Pipe	Mts	960	1"	2.5	
4.7	Spray Nozzles	Nos	800		0.5	
6	Q B Detector	Nos	252		0.25	
7	Pressure Switches	Nos	8			
8	Local push button station	Nos	4			
9	Cabling (2 C x 1.5 mm2)	Mtrs	450		0.25	
10	Pylon Supports					
10.1	80 NB - MS	Mts	350		12	
10.2	50 NB - MS	Mts	400		9	
III	MVW Spray System for Cable galleries of Control Building & GIS Building					
1	Automatic Deluge valve assembly with all accessories					
	100 NB	Nos	12		55	
2	Isolation Valve for Deluge valve (Gate valves)					
	100 NB	Nos	36		44	
3	Y - Type strainer					
	100 NB	Nos	12		44	
4	Piping (Over Ground Pipe)					
4.1	80 NB G.I. Pipe	Mts	60	3"	12	
4.2	65 NB G.I. Pipe	Mts	749	2.5"	10	
4.3	50 NB G.I. Pipe	Mts	360	2"	9	
4.4	40 NB G.I. Pipe	Mts	117	1.5"	5	
4.5	32 NB G.I. Pipe	Mts	252	1.25"	4	
4.6	25 NB G.I. Pipe	Mts	918	1"	2.5	
4.7	Spray Nozzles	Nos	450		0.25	
6	Pressure Switches	Nos	24		0.5	

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7	Local push button station	Nos	5		5	
8	Cabling (2 c x 1.5 mm2)	Mtr.	300		0.25	
9	Local control panel for Deluge valve	Nos	12	1.5x0.5x1.5	15	
10	Structural steel(plates, ISMC 75)	Lot	1		50	0.05

Fire Extinguishing System

Sl.No	SYSTEM DESCRIPTION	Unit	Qty	Weight of Each unit (Kgs)	Total Weight (T)
1	CO2/Clean agent type type Fire Extinguishers (4.5kg)	No.'s	52	17.5	0.91
2	Pressurized water type (operated by CO2 cartridge type) - 9 Lit.	No.'s	3	15	0.05
3	DCP/Clean agent type Fire Extinguishers (6kg)	No.'s	31	10.5	0.33
4	Mechanical Foam type Fire Extinguishers (9 Lit.)	No.'s	13	12.3	0.16
5	Fire Buckets	No.'s	9	3	0.03

Inert Gas Fire fighting system

Sl.No.	Detailed Description	Unit	Quantity	Weight of Each unit (Kgs)	Total Weight (MT)
1	Inert Gas Cylinder with pneumatic valve	Nos.	52	255	13.26
2	Discharge Hose	Nos.	52	0.9	0.0468
3	Check Valve	Nos.	52	0.2	0.0104
4	Contact Pressure Gauge Unit	Nos.	48	0.7	0.0336
5	Release Unit with Solenoid, CPG & Actuator	Nos.	4	2.5	0.01
6	Leak / Bleeder unit	Nos.	4	0.08	0.00032
7	Non Return Valve	Nos.	2	0.1	0.0002
8	Hi-flex hoses	Nos.	56	0.32	0.01792
9	Ball Valve with dual action pneumatic actuator	Nos.	2	17	0.034
10	Pressure Relief device	Nos.	1	0.37	0.00037
11	Pressure Gauge	Nos.	1	0.6	0.0006

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12	Discharge Nozzle	Nos.	40	0.67	0.0268
13	Pressure Regulator	Nos.	1	4	0.004
14	Solenoid valve	Nos.	2	0.3	0.0006
15	Restrictor	Nos.	2	3.6	0.0072
16	T-Piece for Pilot Line	Nos.	48	0.125	0.006
17	Cros for Pilot Line	Nos.	4	0.2	0.0008
18	Pipes	Mtrs.			
i	100 NB	Mtrs.	12	16.07	0.19284
ii	80 NB	Mtrs.	206	11.3	2.3278
iii	65 NB	Mtrs.	10	8.63	0.0863
iv	50 NB	Mtrs.	124	5.44	0.67456
v	40 NB	Mtrs.	82	4.05	0.3321
vi	25 NB	Mtrs.	24	2.5	0.06
vii	20 NB	Mtrs.	15	1.69	0.02535
viii	15 NB	Mtrs.	15	1.3	0.0195
19	Pipe Fittings	Lot	1		0
20	Pipe Supports	Lot	1	3500	3.5
21	Cylinder Manifolds 100NB(ASTM A 106 Gr.B SCH-XXS)	Mtrs.	14	42.2	0.5908
22	DV manifold	Nos.	1	10	0.01
23	Pilot Line Manifold	No.	1	9000	9
24	Structural Steel for Cyl. Mounting Frame Bracket	kg			0

10.4 Gas Turbine and Generator, Exhaust System and related Auxilliaries

Sl.No.	ITEM DESCRIPTION	LENGTH CM	WIDTH CM	HEIGHT CM	NET WEIGHT KG	GROSS WEIGHT KG
10.4.1	GT UNIT	990.00	364.00	469.00	92,200.01	94,200.01
10.4.2	ACCESSORY MODULE	910.00	400.00	395.00	33,000.00	34,000.00
10.4.3	SKID, LIQ FUEL & ATOM AIR	650.00	403.00	340.00	25,000.00	26,000.00
10.4.4	LOAD GEAR	350.00	330.00	339.00	20,000.00	22,000.00
10.4.5	ENCLOSURE TO BASE ARR	1,212.00	244.00	259.00	18,953.00	22,983.00
10.4.6	DUCT ARR, INLET	620.00	435.00	410.00	14,618.00	15,618.00

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10.4.7	INLET SUPPORTING STRUCTURES	1,058.00	225.00	186.00	12,411.40	14,350.00
10.4.8	GEN ACOUSTIC PROTECTION	1,212.00	244.00	259.00	11,442.00	15,472.00
10.4.9	INLET SUPPORTING STRUCTURES	1,058.00	225.00	156.00	10,020.20	11,885.00
10.4.10	GT GAS FUEL SUPPLY	626.00	342.00	402.00	9,800.00	12,565.00
10.4.11	INLET COMPARTMENT ARR, AIR	1,000.00	300.00	450.00	8,670.00	9,500.00
10.4.12	INLET SUPPORTING STRUCTURES	846.00	244.00	175.00	8,326.00	10,099.00
10.4.13	INLET COMPARTMENT ARR, AIR	1,042.00	250.00	501.00	6,900.00	9,965.00
10.4.14	INLET COMPARTMENT ARR, AIR	1,005.00	150.00	450.00	6,690.00	7,000.00
10.4.15	ENCLOSURE TO BASE ARR	606.00	244.00	259.00	6,118.00	8,418.00
10.4.16	OFF BASE PIPING INTERCO PRELIM	720.00	160.00	125.00	5,580.00	6,165.00
10.4.17	INTC PIPING, PIPING	725.00	155.00	210.00	5,579.99	6,320.00
10.4.18	OFF BASE PIPING INTERCO PRELIM	630.00	140.00	150.00	5,534.00	6,064.00
10.4.19	ANCHORING	352.00	238.00	118.00	5,483.00	6,218.00
10.4.20	CONTAINER	610.00	250.00	260.00	4,385.00	6,685.00
10.4.21	ENCLOSURE, POWER PLANT	606.00	244.00	259.00	4,072.00	6,372.00
10.4.22	INLET COMPARTMENT ARR, AIR	888.00	289.00	236.00	3,454.00	5,482.00
10.4.23	EXHAUST SYSTEM	403.00	448.00	263.00	3,344.00	5,009.00
10.4.24	COMPRESSOR/TURBINE WASHING	473.00	288.00	346.00	3,260.00	4,665.00
10.4.25	DUCT ARR, INLET	545.00	215.00	195.00	3,108.00	4,108.00
10.4.26	DUCT ARR, INLET	520.00	305.00	115.00	3,100.00	3,275.00
10.4.27	DUCT ARR, INLET	520.00	305.00	115.00	3,100.00	3,275.00
10.4.28	ENCLOSURE WATER INJ PUMP MODUL	630.00	230.00	100.00	3,056.00	3,906.00
10.4.29	EXHAUST SYSTEM	403.00	423.00	253.00	3,000.00	4,586.00
10.4.30	ENCLOSURE TO BASE ARR	710.00	300.00	160.00	2,878.00	4,376.00
10.4.31	ENCLOSURE TO BASE ARR	405.00	238.00	138.00	2,743.00	3,497.00
10.4.32	GT - VARIOUS ITEMS	435.00	225.00	185.00	2,703.00	3,439.00
10.4.33	ENCLOSURE TO BASE ARR	510.00	240.00	160.00	2,658.00	3,627.00
10.4.34	DUCT ARR, INLET	535.00	205.00	275.00	2,650.00	3,650.00
10.4.35	DUCT ARR, INLET	310.00	155.00	90.00	2,630.00	3,030.00
10.4.36	INTC PIPING, SUPPORT	640.00	115.00	115.00	2,478.50	2,710.00
10.4.37	GENERATOR ACCESSORY COMPARTMEN	383.00	243.00	299.00	2,422.00	3,420.00
10.4.38	ENCLOSURE, POWER PLANT	600.00	238.00	245.00	2,366.30	3,684.00
10.4.39	GENERATOR ACCESSORY COMPARTMEN	288.00	203.00	346.00	2,292.00	3,089.00
10.4.40	GT UNIT FIRE FIGHTING SYSTEM	120.00	120.00	200.00	2,240.00	2,290.00

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10.4.41	GT UNIT FIRE FIGHTING SYSTEM	120.00	120.00	200.00	2,240.00	2,290.00
10.4.42	GT UNIT FIRE FIGHTING SYSTEM	120.00	120.00	200.00	2,240.00	2,290.00
10.4.43	DUCT ARR, INLET	620.00	205.00	200.00	2,220.00	3,220.00
10.4.44	GEN ACOUSTIC PROTECTION	315.00	238.00	138.00	2,124.00	2,735.00
10.4.45	GEN ACOUSTIC PROTECTION	530.00	250.00	138.00	2,069.00	3,010.00
10.4.46	INLET COMPARTMENT ARR, AIR	1,023.00	183.00	94.00	2,047.00	3,301.00
10.4.47	INTC PIPING, SUPPORT	635.00	75.00	95.00	2,037.00	2,340.00
10.4.48	ENCLOSURE, POWER PLANT	560.00	238.00	230.00	2,021.93	3,424.00
10.4.49	EMBEDDED PIECES	352.00	188.00	93.00	2,019.00	2,624.00
10.4.50	TEMPLATE	538.00	158.00	121.00	1,990.00	2,705.00
10.4.51	GT UNIT FIRE FIGHTING SYSTEM	120.00	120.00	200.00	1,960.00	2,010.00
10.4.52	LIGHT DIST OIL FILTERING SKID	245.00	190.00	300.00	1,900.00	2,500.00
10.4.53	OFF BASE PIPING INTERCO SUPPOR	650.00	95.00	105.00	1,888.00	2,252.00
10.4.54	DUCT ARR, INLET	310.00	155.00	90.00	1,870.00	2,270.00
10.4.55	GT EXHAUST DUCT - SUPPORT STRU	449.00	158.00	112.00	1,845.00	2,434.00
10.4.56	GEN ACOUSTIC PROTECTION	329.00	238.00	138.00	1,769.00	2,395.00
10.4.57	INTC PIPING, INSULATION	624.00	243.00	214.00	1,723.64	2,904.00
10.4.58	ENCLOSURE TO BASE ARR	600.00	250.00	180.00	1,714.00	2,968.00
10.4.59	ENCLOSURE TO BASE ARR	710.00	200.00	168.00	1,626.00	2,776.00
10.4.60	HALO STEAM TURBINE CONTROL PAN	513.08	114.30	261.62	1,600.73	2,106.48
10.4.61	GEN ACOUSTIC PROTECTION	365.00	238.00	138.00	1,586.00	2,266.00
10.4.62	DUCT ARR, INLET	350.00	200.00	195.00	1,560.00	2,060.00
10.4.63	ENCLOSURE TO BASE ARR	354.00	225.00	138.00	1,556.00	2,193.00
10.4.64	ENCLOSURE WATER INJ PUMP MODUL	374.00	230.00	116.00	1,537.00	2,167.00
10.4.65	ENCLOSURE TO BASE ARR	485.00	238.00	205.00	1,506.00	2,520.00
10.4.66	FUEL GAS, SSOV & VENT MODULE	231.00	181.00	247.00	1,500.00	1,800.00
10.4.67	INTC PIPING, INSULATION	234.00	128.00	192.00	1,493.00	1,823.00
10.4.68	ENCLOSURE WATER INJ PUMP MODUL	490.00	245.00	180.00	1,459.00	2,557.00
10.4.69	GEN ACOUSTIC PROTECTION	365.00	238.00	138.00	1,450.00	2,130.00
10.4.70	ENCLOSURE, POWER PLANT	313.00	238.00	138.00	1,436.62	2,039.00
10.4.71	ENCLOSURE TO BASE ARR	600.00	250.00	188.00	1,306.00	2,544.00
10.4.72	ENCLOSURE TO BASE ARR	400.00	238.00	110.00	1,305.00	1,966.00
10.4.73	LIGHT DIST OIL FORW SKID	240.00	150.00	240.00	1,300.00	1,900.00
10.4.74	ENCLOSURE WATER INJ PUMP MODUL	320.00	165.00	138.00	1,296.00	1,776.00
10.4.75	ENCLOSURE TO BASE ARR	303.00	155.00	138.00	1,087.00	1,527.00
10.4.76	COOLING FAN MODULE	240.00	170.00	170.00	1,000.00	1,320.00

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10.4.77	DUCT ARR, INLET	255.00	130.00	80.00	989.00	1,289.00
10.4.78	ENCLOSURE TO BASE ARR	480.00	180.00	138.00	928.00	1,670.00
10.4.79	ENCLOSURE, POWER PLANT	403.00	225.00	105.00	903.10	1,529.00
10.4.80	LIGHT FUEL OIL HEATER	375.00	145.00	165.00	900.00	1,300.00
10.4.81	INLET COMPARTMENT ARR, AIR	560.00	230.00	177.00	873.40	1,510.00
10.4.82	GT MAINTENANCE TOOLS - EPE	506.00	83.00	180.00	865.00	1,265.00
10.4.83	TEMPLATE	927.00	63.00	60.00	806.00	1,886.00
10.4.84	ENCLOSURE TO BASE ARR	545.00	238.00	165.00	790.00	1,938.00
10.4.85	ENCLOSURE TO BASE ARR	233.00	204.00	115.00	780.00	1,175.00
10.4.86	INTC PIPING, INSULATION	534.00	150.00	222.00	765.00	1,510.00
10.4.87	GT - VARIOUS ITEMS	121.00	81.00	65.00	739.00	837.00
10.4.88	INSULATION, TURB/DUCT-EXTERNAL	274.00	228.00	177.00	720.00	1,241.00
10.4.89	FG, CHROMATOGRAPH	307.00	143.00	267.00	720.00	1,234.00
10.4.90	ENCLOSURE TO BASE ARR	600.00	200.00	228.00	674.00	2,050.00
10.4.91	STATIC FILTER ELEMENT	390.00	205.00	215.00	651.00	1,275.00
10.4.92	STATIC FILTER ELEMENT	390.00	205.00	215.00	651.00	1,275.00
10.4.93	GENERATOR ACCESSORY COMPARTMEN	229.00	158.00	165.00	640.00	957.00
10.4.94	GT UNIT FIRE FIGHTING SYSTEM	200.00	200.00	240.00	615.90	903.90
10.4.95	ENCLOSURE TO BASE ARR	245.00	117.00	145.00	610.00	930.00
10.4.96	ENCLOSURE WATER INJ PUMP MODUL	245.00	117.00	145.00	563.00	888.00
10.4.97	ENCLOSURE TO BASE ARR	365.00	60.00	55.00	551.00	686.00
10.4.98	ENCLOSURE TO BASE ARR	456.00	238.00	188.00	525.00	1,481.00
10.4.99	ENCLOSURE TO BASE ARR	435.00	238.00	169.00	517.00	1,386.00
10.4.100	GT UNIT FIRE FIGHTING SYSTEM	300.00	200.00	150.00	510.00	630.00
10.4.101	COUPLING, FLEXIBLE-OUTPUT	230.00	61.00	71.00	505.00	595.00
10.4.102	PAINTING	160.00	116.00	103.00	489.00	630.00
10.4.103	GT UNIT FIRE FIGHTING SYSTEM	350.00	130.00	150.00	484.00	584.00
10.4.104	INTC PIPING, PIPING	635.00	125.00	140.00	483.00	2,100.00
10.4.105	GENERATOR ACCESSORY COMPARTMEN	199.00	158.00	161.00	480.00	750.00
10.4.106	COOLING FAN MODULE	180.00	150.00	170.00	460.00	700.00
10.4.107	GT - VARIOUS ITEMS	162.00	111.00	96.00	426.00	576.00
10.4.108	GEN ACOUSTIC PROTECTION	245.00	117.00	110.00	416.00	714.00
10.4.109	GT - VARIOUS ITEMS	192.00	101.00	89.00	406.00	546.00
10.4.110	ENCLOSURE TO BASE ARR	606.00	244.00	259.00	390.00	3,134.00
10.4.111	STATIC FILTER ELEMENT	270.00	160.00	230.00	370.00	471.00
10.4.112	LIFTING BEAM POWER GEAR	231.00	128.00	107.00	361.00	576.00

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10.4.113	GENERATOR ACCESSORY COMPARTMEN	249.00	173.00	153.00	360.00	740.00
10.4.114	GT UNIT FIRE FIGHTING SYSTEM	150.00	150.00	150.00	341.10	453.10
10.4.115	PAINTING	160.00	116.00	111.00	340.00	488.00
10.4.116	INTC PIPING, EXPANSION JOINTS	164.00	113.00	78.00	335.00	463.00
10.4.117	DUCT ARR, INLET	175.00	115.00	50.00	321.00	471.00
10.4.118	ENCLOSURE TO BASE ARR	353.00	146.00	100.00	296.00	932.00
10.4.119	PAINTING	132.00	124.00	96.00	288.00	411.00
10.4.120	OFF BASE PIPING INTERCO HEAT I	214.00	125.00	201.00	243.87	500.00
10.4.121	TOO KIT LOAD COUPLING HARDWARE	134.62	68.58	86.36	217.72	238.14
10.4.122	TOO KIT LOAD COUPLING HARDWARE	144.78	81.28	106.05	217.72	308.44
10.4.123	COMPRESSOR/TURBINE WASHING	120.00	80.00	110.00	207.00	227.00
10.4.124	GT GAS FUEL SUPPLY	386.00	81.00	122.00	200.00	439.00
10.4.125	GT GAS FUEL SUPPLY	391.00	166.00	101.00	200.00	602.00
10.4.126	STATIC FILTER ELEMENT	370.00	220.00	165.00	200.00	740.00
10.4.127	GT VARIOUS ITEMS	141.00	111.00	95.00	192.00	339.00
10.4.128	EXHAUST SYSTEM	305.00	78.00	63.00	190.00	345.00
10.4.129	STATIC FILTER ELEMENT	390.00	235.00	215.00	182.00	860.00
10.4.130	GT - VARIOUS ITEMS	122.00	102.00	77.00	162.00	284.00
10.4.131	GT - VARIOUS ITEMS	130.00	80.00	126.00	158.00	175.00
10.4.132	GT - VARIOUS ITEMS	122.00	102.00	77.00	154.00	276.00
10.4.133	GT - VARIOUS ITEMS	130.00	80.00	126.00	147.00	164.00
10.4.134	INLET COMPARTMENT ARR, AIR	460.00	170.00	160.00	143.20	763.20
10.4.135	HARDWARE, LOAD COUPLING	83.82	63.50	64.77	139.71	203.21
10.4.136	ENCLOSURE WATER INJ PUMP MODUL	310.00	60.00	55.00	136.00	253.00
10.4.137	ENCLOSURE, POWER PLANT	320.00	60.00	55.00	135.67	256.00
10.4.138	DUCT ARR, INLET	530.00	30.00	30.00	134.00	334.00
10.4.139	OFF BASE PIPING INTERCO COMPLE	620.00	35.00	43.00	115.00	230.00
10.4.140	GENERATOR ACCESSORY COMPARTMEN	154.00	103.00	65.00	104.00	212.00
10.4.141	GENERATOR ACCESSORY COMPARTMEN	154.00	103.00	65.00	90.00	198.00
10.4.142	GT - VARIOUS ITEMS	86.00	49.00	87.00	76.20	107.20
10.4.143	GT UNIT FIRE FIGHTING SYSTEM	100.00	100.00	100.00	36.20	116.20
10.4.144	PAINTING	80.00	80.00	80.00	21.00	79.00
10.4.145	NEXT GEN. FIRE WALL	83.82	58.42	81.28	13.00	77.56

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10.4.146	TRANSPORTATION COSTS	128.02	82.91	73.15	12.50	63.00
10.4.147	FG, CHROMATOGRAPH GAS BOTTLE	21.00	21.00	122.00	10.00	45.00
10.4.148	PAINTING	80.00	80.00	80.00	6.00	64.00
10.4.149	PAINTING	80.00	80.00	80.00	6.00	64.00
10.4.150	FG, CHROMATOGRAPH GAS BOTTLE	24.00	24.00	153.00	1.00	55.00
10.4.151	FG, CHROMATOGRAPH GAS BOTTLE	24.00	24.00	153.00	1.00	55.00
10.4.152	UNIT GENERATOR	900.00	350.00	475.00	1,30,000.00	1,35,000.00
10.4.153	INLET DUCTING INCLUDING SILENCER	1,000.00	350.00	300.00	80,000.00	--
10.4.154	EXHAUST DUCT & BYPASS DUCT	1,000.00	450.00	45.00	1,30,000.00	--
10.4.155	DIVERTER DAMPER	550.00	350.00	40.00	40,000.00	--
10.4.156	GUILLOTINE DAMPER	470.00	470.00	80.00	20,000.00	--

10.5 Steam Turbine , Generator and Auxilliaries

SL	ITEM DESCRIPTION	QTY.	WT (MT)	DIMENSIONS (mm) LxWxH
1	Turbine	1	40.00	4200 x 3000x 3200
2	Generator	1	64.33	6200 x 2900 x 2600
3	Input Coupling Assembly	1	0.15	Dia 400 x 1100
4	Oil purification unit	1	1.00	900x900x1500
5	Lube Oil accumulators	1	0.85	1350x700x2500
6	Governing Oil accumulators	1	0.85	1300x700x2500
7	Turbine enclosure	1	8.00	8160x6500x4000(assembled condition)
8	Over Head Oil Tank	1	2.20	Dia 2750 x height 2500mm
9	Lube Oil Pump assy	1	4.50	3200x2800x1000
10	Emergency lube oil pump assy	1	1.00	1000x2500x1000
11	Oil separator	1	0.04	350x300x300
12	Y-strainer for lube oil pumps	3	0.10	450x300x450

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13	JOP (AC) Assembly	1	0.35	2000x1000x500
14	Oil Vapor Exhaust fan	2	0.10	500x500x600
15	Governing Console Board	1	0.50	1700(H)x1500(W)x450(D)
16	Control Valves*	1	0.15	368x1145x355
17	Governing Console	1	0.68	1500X1500X2000
18	Turbine ESV Assly	1	0.98	700X700X1200
19	HP Servomotor Assly	1	0.32	1300X600X400
20	Injection Stop Valve Assly.	1	0.55	1100X600X1200
21	Lube Oil Console Assembly-I (Empty Lube Oil Tank & Duplex Filter with Piping)	1	8.00	4500X3000X3800
22	QCNRV	2	2.19	1600x1500x1500
23	Gearbox for STG		13.50	3100 x 2400 x 2400
24	GENERATOR AIR FILTER	1	3.5	
25	BED PLATE (TURBINE SIDE)	1	0.53	
26	BED PLATE (GENERATOR SIDE)	1	0.53	
27	HEATER SUPPORT	2	0.514	
28	25 MM THK, 128 KG/CUM CERAMIC INSULATION	150	0.480	
29	CHNL CS 150,8*3550.00MM	477.12	0.477	
30	PLT CS 8 CHQD,1*1250.00*5000.00MM	2	0.450	
	Total		92.5	

10.6 Heat Exchangers of STG

SL	Equipment	Overall Dimensions (LxBxH in mm)	Quantity	Weight (in MT)
1	Gland Steam Condenser			
a.	Complete Assly.	L 4750 x W 1200 x H 1600	1 no.	5.6 (Dry) 7 (Flooded)

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2	Spray cum tray deaerator			
a.	Sec 1 & 3	L 8720 x W 4000 x H 4212	2 no.s	18.735 (Dry)
b.	Sec 2	L 9260 x W 4000 x H 4212	1 no.	20.79 (Dry)
c.	Header	L 7625 x W 2600 x H 3000	1 no.	10 (Dry)
		Total Assembly		64 (Dry) 350 (Flooded)
3	ST Oil Cooler			
a.	Per Cooler	L 5100 x W 520 x H 2000	1 nos.	5.4 (Dry) 6.95 (Flooded)
4	Gas Heater			
a.	Per Cooler	L 5000 x W 600 x H 1000	1 nos.	2.7 (Dry) 3.55 (Flooded)
		Total		77.7

10.7 Miscellaneous items of STG, GT, Deaerator etc. (Approx. Weight = 330 MT)

Sl. No.	Material Description	Qty	UOM	Total Weight
10.7.1	TURBINE OIL-ISOVG:46-T (GEARED TURBINE)	41,160.00	L	41,160.00
10.7.2	SILENCER ASSLY FR6FA-SL1	1	EA	13,598.00
10.7.3	SILENCER ASSLY FR6FA-SL2	1	EA	9,937.00
10.7.4	TRANS. DUCT ASSLY (FR6FA-D2)	1	EA	9,740.00
10.7.5	TRANS. DUCT ASSLY (FR6FA-D3)	1	EA	9,165.00
10.7.6	TURBINE ENCLOSURE AS PER TC64327-73	1	EA	9,000.00
10.7.7	LOC-PIPING ALONG WITH PUMP ASSEMBLY	1	EA	8,014.87
10.7.8	TOP COLUMN 6FA-TC-1 (E 350 MATL.)	4	EA	7,604.00
10.7.9	BOTTOM COLUMN 6FA-BC-1	4	EA	7,412.00
10.7.10	LOC-PIPING ALONG WITH L.O RESERVOIR	1	EA	7,365.25
10.7.11	HOR.DUCT ASLY.LOWER HALF H1BL.(FR6FA)	1	EA	6,875.00
10.7.12	SILENCER PANEL, SP6F-1	5	EA	6,500.00
10.7.13	HOR.DUCT ASLY.UPPER HALF H1BU.(FR6FA)	1	EA	6,459.00

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10.7.14	SILENCER PANEL, SP6F-2	5	EA	6,400.00
10.7.15	WALKWAYS,STAIRCASE &SUPPORT STRUCTURE	1	EA	6,000.00
10.7.16	HOR.DUCT ASLY.LOWER HALF H1AL(FR6FAHPCL	1	EA	5,610.00
10.7.17	LOC-TWIN OIL COOLER WITH VENT & DRAIN PI	1	EA	5,506.05
10.7.18	VERT. DUCT ASSLY (FR6FA -D9)	1	EA	5,398.00
10.7.19	HOR.DUCT ASLY.UPPER HALF H1AU(FR6FAHPCL)	1	EA	5,373.00
10.7.20	VERTICAL DUCT ASSEMBLY (FR6FA-D8L)	1	EA	5,213.00
10.7.21	PRE FAB MATERIAL FOR LUBE OIL PIPING	1	EA	5,000.00
10.7.22	HOT AIR DUCT	1	EA	5,000.00
10.7.23	VERT DUCT ASSLY (FR6FA-D8M)	1	EA	4,274.00
10.7.24	VERT DUCT ASSLY (FR6FA-D8U)	1	EA	4,274.00
10.7.25	VENT DUCTING FOR FR-6FA HPCL VIZAG	1	EA	4,000.00
10.7.26	GENERATOR AIR FILTER	1	EA	3,500.00
10.7.27	HPR. DUCT ASSLY (FR6FA - H2)	1	EA	2,865.00
10.7.28	PRE FAB MATERIAL FOR CHIMNEY STEAM PIPG	1	EA	2,500.00
10.7.29	GLAND STEAM CONDENSER ASSLY	1	EA	2,500.00
10.7.30	HOR.DUCT ASLY.(FR6FA-H3)	1	EA	2,312.00
10.7.31	OVER HEAD TANK CAP 7000LTS HPCL CCPP 75	1	EA	2,028.00
10.7.32	GUIDE BRACKET	4	EA	2,006.40
10.7.33	OIL PURIF UNT,TROLLY,2400LPH W/O HEATER	1	EA	1,800.00
10.7.34	BEAM B3 (E 350 MATL.)	2	EA	1,709.60
10.7.35	BEAM B8 (E 350 MATL.)	2	EA	1,638.00
10.7.36	BEAM B9 (E 350 MATL.)	2	EA	1,635.60

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10.7.37	BEAM B10 (E 350 MATL.)	2	EA	1,616.00
10.7.38	CHNL CS 250,6*7500.00MM	1,539.00	KG	1,539.00
10.7.39	PHASE AND NEUTRAL SIDE TERMINAL BOX	1	EA	1,500.00
10.7.40	EXPANSION JOINT, EJ6F-3A	1	EA	1,500.00
10.7.41	EOP ASSEMBLY	1	EA	1,492.59
10.7.42	PLATFORM PF-1 (E 350 MATL.)	5	EA	1,460.00
10.7.43	EXPANSION JOINT, EJ6F-4A	1	EA	1,450.00
10.7.44	CONDENSATE COLLECTING TANK	1	EA	1,350.00
10.7.45	EXPANSION JOINT EJ6FA-1	1	EA	1,350.00
10.7.46	PACKER PLATE (PL40 THK)	4	EA	1,240.00
10.7.47	SET OF OIL ACCUMULATOR 3X55LTS, S.S 316	2	EA	1,200.00
10.7.48	PLATFORM (SPF-3)(E350 MATERIAL)	1	EA	1,101.00
10.7.49	PLATFORM (SPF-2)(E350 MATERIAL)	1	EA	1,043.70
10.7.50	M30 FOUNDATION STUD ASSEMBLY	48	EA	1,008.00
10.7.51	THERML INSULATION,MIN.MATTRS+CAT9	1	EA	1,000.00
10.7.52	LOCAL CONTROL PANEL HPCL VIZAG CCP	1	SET	1,000.00
10.7.53	3CX2.5COPPER PVC/FRLSPVC ARMOURED CABLE	2,000.00	M	1,000.00
10.7.54	BEAM B6 (E 350 MATL.)	2	EA	996.00
10.7.55	BOLT HEATING EQUIPMENT (ELECTRICAL)	1	EA	900.00
10.7.56	BEAM B4 (E 350 MATL.)	2	EA	895.20
10.7.57	PLATFORM (SPF-1)(E350 MATERIAL)	1	EA	811.40
10.7.58	STOP VALVE ASSY	1	EA	802.69
10.7.59	3CX6COPPER PVC/FRLSPVC ARMOURED CABLE	1,000.00	M	800.00
10.7.60	BEAM B7 (E 350 MATL.)	2	EA	788.00
10.7.61	CHNL CS 250,4*5730.00MM	783.864	KG	783.86
10.7.62	GOVERNING OIL CONSOLE	1	EA	780.00
10.7.63	PLATFORM (SPF-4)(E350 MATERIAL)	1	EA	760.00
10.7.64	BAR GRATING WIDTH=755, LENGTH=2500	10	EA	750.00
10.7.65	BEAM B5 (E 350 MATL.)	2	EA	745.48
10.7.66	JO PUMP+AC MOT AS A CONS 30LPM,150KSC(G)	1	EA	700.00
10.7.67	BEAM CS 200,1*24000.00MM	609.6	KG	609.60
10.7.68	GOV.VALVES ASSY-3(PIPE MTD)	1	EA	550.00
10.7.69	BED PLATE (TURBINE SIDE)	1	EA	530.00

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10.7.70	BED PLATE (GENERATOR SIDE)	1	EA	530.00
10.7.71	HEATER SUPPORT	2	EA	514.00
10.7.72	SERVOMOTOR ASSY	1	EA	494.74
10.7.73	DOWN STREAM OF DUPLEX FILTER PIPING LINE	1	EA	486.09
10.7.74	25 MM THK, 128 KG/CUM CERAMIC INSULATION	150	M2	480.00
10.7.75	CHNL CS 150,8*3550.00MM	477.12	KG	477.12
10.7.76	GSC EJECTOR SILENCER 4"/6"-2360	2	EA	450.00
10.7.77	PLT CS 8 CHQD,1*1250.00*5000.00MM	430.625	KG	430.63
10.7.78	LADDER ASSY(SLD-4)VAR.NO.12 (E350 MATL.)	1	EA	424.20
10.7.79	EXCITER ASSY	1	EA	400.00
10.7.80	PLATFORM PF-2 VAR.NO.02 (E 350 MATL.)	2	EA	392.00
10.7.81	PIPE(SMLS) 323.9X 8.38 CS SA106 GR B	6	M	391.24
10.7.82	PLATFORM SUPPORT ITEM 01&02(E 350 MATL.)	19	EA	385.70
10.7.83	BEAM CS 250,1*10000.00MM	373	KG	373.00
10.7.84	HANDRAIL	12	EA	368.40
10.7.85	PIPE(SMLS) 273.1X 9.27 CS SA106 GR B	6	M	361.89
10.7.86	PIPE(SMLS) 273.1X 9.27 CS SA106 GR B	6	M	361.89
10.7.87	PIPE(SMLS) 273.1X 9.27 CS SA106 GR B	6	M	361.89
10.7.88	Mechanical Package items for Intrcnn PPG	1	EA	350.00
10.7.89	PIPE(SMLS) 33.4X 4.55 AS SA335 GRP22	108	M	349.60
10.7.90	CS PLATE 5,1*150.00*58000.00MM	348	KG	348.00
10.7.91	ANGLE CS 50X50X6,1*75000.00MM	337.5	KG	337.50
10.7.92	ANGLE VAR.NO.01 (E 350 MATL.)	4	EA	316.32
10.7.93	ANGLE VAR.NO.02 (E 350 MATL.)	4	EA	310.64
10.7.94	2X100% EJECTOR ASSLY	1	EA	310.00
10.7.95	CHNL CS 150,2*9200.00MM	309.12	KG	309.12
10.7.96	HANDRAIL (SHR-5) POS.NO.19 (E 350 MATL.)	9	EA	306.00
10.7.97	CHNL CS 150,1*18000.00MM	302.4	KG	302.40
10.7.98	CHNL CS 150,11*1600.00MM	295.68	KG	295.68
10.7.99 -106	ANGLE VAR.NO.06,07,08,13,14,15,16 (E 350 MATL.)	20	EA	2240
10.7.107	PLATE	16	EA	268.32
10.7.108	BEAM B11 (E 350 MATL.)	4	EA	268.00
10.7.109	CHNL CS 200,1*12000.00MM	267.6	KG	267.60
10.7.110	HANDRAIL (SHR-4) POS.NO.18 (E 350 MATL.)	8	EA	256.00
10.7.111	PIPE(SMLS) 168.3X10.97 AS SA335 GRP11	6	M	255.38
10.7.112	PIPE(SMLS) 219.1X 8.18 CS SA106 GR B	6	M	255.29
10.7.113	PIPE AS, HTS 219.1 X 8.18 S/L A335 P22	6	M	255.29
10.7.114	SPLICE PLATE (E 350 MATL.)	8	EA	251.20
10.7.115	LIFTING EQUIPMENT OF ROTOR	1	EA	250.00
10.7.116	BOLT HEX M20X60 P8.8 ELE GAL	1,200.00	EA	248.40
10.7.117	BRACKET ASSY POS.NO.12&13 (E350 MATL.)	4	EA	246.00

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10.7.118	BRACKET ASSY POS.NO.12&44 (E350 MATL.)	4	EA	246.00
10.7.119	ANGLE VAR.NO.05 (E 350 MATL.)	4	EA	244.56
10.7.120	FOUNDATION BOLT M56X2600	4	EA	241.60
10.7.1	FOUNDATION BOLT M56X2600	4	EA	241.60
10.7.2	CHNL CS 150,4*3470.00MM	233.184	KG	233.18
10.7.3	CONNECTING RETAINER (VD-CR1)	72	EA	230.40
10.7.4	BAR GRATING WIDTH=755, LENGTH=2500	3	EA	225.00
10.7.5	PIPE SS 323.8 X 4.6 WELDED	6	M	221.42
10.7.6	GLV CS NB 6"-PRCL 150 FLNG RF ASMEB16.34	2	EA	220.00
10.7.7	TUBE CS 48.8 X 3.25 GALV	60	M	219.06
10.7.8	BAR GRATING 755 WX3000 L (GAL),EF,TS bar	2	EA	216.00
10.7.9	ANGLE CS 75X75X8,1*24000.00MM	213.6	KG	213.60
10.7.10	LADDER ASSY(SLD-2)VAR.NO.10 (E350 MATL.)	1	EA	213.50
10.7.11	CLAMP AS WITH 3 BOLTS DIA.274	9	EA	209.52
10.7.12	PIPE ASSEMBLY EB1(LEFT SIDE)	1	EA	207.00
10.7.13	GLOBE VALVE, CS, NB 3" BW	6	EA	204.00
10.7.14	ANGLE CS 75X75X6,1*30000.00MM	204	KG	204.00
10.7.15	OIL VAPOUR FAN WITH IE2 Mtr 0.11M3/S	2	EA	200.00
10.7.16	TUBE CS 48.8 X 3.25 ERW/SAW NB40	54.5	M	198.98
10.7.17	LADDER ASSY.VD-LD1 VAR.NO.01(E350 MATL.)	1	EA	198.30
10.7.18	PIPE(SMLS) 88.9X3.05 S.S SA312 GRTP321	30	M	197.43
10.7.19	BLOWING DOWN EQUIPMENT	1	EA	194.00
10.7.20	TUBE CS 34.2 X 3.25 GALV	78	M	193.52
10.7.21	CHNL CS 150,2*5750.00MM	193.2	KG	193.20
10.7.22	PACKING PLATE 160X100X28	54	EA	190.08
10.7.23	TUBE CS 42.9 X 3.25 ERW/SAW NB32	58	M	184.32
10.7.24	PIPE(SMLS) 88.9X 7.62 CS SA106 GR B	12	M	183.29
10.7.25	BOTTOM PLATE (FOR SLIDING SUPPORT)	1	EA	182.00
10.7.26	BOTTOM PLATE (FIXED SUPPORT)	1	EA	182.00
10.7.27	BOTTOM PLATE (FOR SLIDING SUPPORT)	1	EA	182.00
10.7.28	GATE VLV CS(A216WCB)6" CL150 FLNGD RF	2	EA	180.00
10.7.29	CHNL CS 125,12*1140.00MM	179.208	KG	179.21
10.7.30	ASSEMBLY FIXTURE	1	EA	175.00
10.7.31	ANGLE VAR.NO.09 (E 350 MATL.)	4	EA	174.52
10.7.32	ANGLE VAR.NO.12 (E 350 MATL.)	4	EA	174.52
10.7.33	LADDER ASSY.VD-LD3 VAR.NO.03(E350 MATL.)	1	EA	172.20
10.7.34	PIPE SS 273 X 4.2 WELDED	6	M	170.24
10.7.35	PIPE(SMLS)168.3X 7.11 CS SA106 GR B	6	M	169.58
10.7.36	PIPE SS 33.4 X 3.4 A312 TP321	66	M	169.22
10.7.37	ANGLE VAR.NO.11 (E 350 MATL.)	4	EA	166.52
10.7.38	ANGLE VAR.NO.10 (E 350 MATL.)	4	EA	166.04

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10.7.39	BASE PLATE 36MM	16	EA	163.20
10.7.40	ANGLE VAR.NO.04 (E 350 MATL.)	2	EA	160.84
10.7.41	PIPE ASSEMBLY EB1	1	EA	160.00
10.7.42	COUPLING COVER	1	EA	160.00
10.7.43	FOUNDATION BOLT (M48X3-- 2800)	4	EA	160.00
10.7.44	CHNL CS 150,2*4750.00MM	159.6	KG	159.60
10.7.45	ANGLE VAR.NO.03 (E 350 MATL.)	2	EA	158.90
10.7.46	PIPE(SMLS) 88.9X3.05 S.S SA312 GRTP321	24	M	157.94
10.7.47	FOUNDATION BOLT M 48 X2600	4	EA	157.52
10.7.48	PIPE(SMLS)- 33.4X 4.55 CS SA106 GR B	48	M	155.38
10.7.49	M20 FOUNDATION STUD ASSEMBLY	64	EA	154.88
10.7.50	CLAMP AS WITH 3 BOLTS DIA.324	6	EA	153.78
10.7.51	PLATE	8	EA	152.00
10.7.52	TOP ASSY(TROLLEY)50LPM,4KG/CM2,IE2 SAFE	1	EA	150.00
10.7.53	GWR LVLTX IS-EXP CC-2300MM 2"300RF	1	EA	150.00
10.7.54	DEAERATOR STANDPIPE ASSLY-I	1	EA	150.00
10.7.55	DEAERATOR STANDPIPE ASSLY-II	1	EA	150.00
10.7.56	BEAM CS 150,1*10000.00MM	150	KG	150.00
10.7.57	FOUNDATION BOLT - M48X3----- 2500	4	EA	140.00
10.7.58	PIPE SS 33.4 X 3.4 A312 TP321	54	M	138.46
10.7.59	PLT CS 8,1*880.00*2500.00MM	138.16	KG	138.16
10.7.60	GLOBE VALVE, CS, NB 3" BW	4	EA	136.00
10.7.61	PACKING PLATE 160X100X10	108	EA	135.65
10.7.62	PLATE (E 350 MATL.)	4	EA	134.52
10.7.63	PLT BQ 10,2*400.00*2027.00MM	127.296	KG	127.30
10.7.64	MOP & SBP SUC. BRANCH LINE	1	EA	125.73
10.7.65	OUTPUT COUPLING COVER	1	EA	125.00
10.7.66	PIPE SS 21.3 X 2.8 A312 TP321	96	M	124.99
10.7.67	PIPE SS 219.1 X 3.76 A312 TP321	6	M	122.09
10.7.68	STRAINER Y TYPE SS 6" CL150RF	2	EA	120.00
10.7.69	PLATE (E 350 MATL.)	4	EA	118.00
10.7.70	BOLT HEX M16X50 P8.8 GAL	490	EA	112.70
10.7.71	SUPPORT BKT.SPF-1(E 350 MATL.)	2	EA	110.40
10.7.72	CHNL CS 100,1*12000.00MM	110.4	KG	110.40
10.7.73	CHNL CS 150,2*3270.00MM	109.872	KG	109.87
10.7.74	SPOOL PIECE	2	EA	108.80
10.7.75	SUSPENSION DEVICE	1	EA	108.00
10.7.76	ANGLE CS 50X50X6,1*24000.00MM	108	KG	108.00
10.7.77	ANGLE CS 50X50X6,1*24000.00MM	108	KG	108.00
10.7.78	CLAMP AS WITH 3 BOLTS DIA.115	25	EA	103.95
10.7.79	ANGLE VAR.NO.17 (E 350 MATL.)	2	EA	103.42

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10.7.80	ANGLE VAR.NO.17 (E 350 MATL.)	2	EA	103.42
10.7.81	NUT HEX P M20 P8 ELEGAL	1,600.00	EA	102.40
10.7.82	PIPE SS 114.3 X 3.05 A312 TP321	12	M	102.34
10.7.83	CHNL CS 125,7*1100.00MM	100.87	KG	100.87
10.7.84	GSC EJECTOR SILENCER 4"/6"-2360+G44DD26:G144	2	KG	450.00
10.7.85	Miscellaneous items of GT, STG, Integral piping ,deaerator etc.		MT	37
	Total		MT	330

10.8 2X6750 KVA DG sets

S.N.	DESCRIPTION OF EQUIPMENT	QTY	UNIT	Dimensions (LxBxH) (mm)	Appx. Weight Each (kg)	Total weight(Kg)
1	Diesel Engine Generator & Accessories	2	Nos	13000x3800x5000	110000	220000
	Cooling water system					
1	Radiators	4	Nos	10000x3000x4000	3800	15200
2	Expansion Tank with broughtout item	2	Nos	800x750x900	250	500
3	Maintenance water Pump	1	Nos	350x160x185	15	15
4	Maintenance water tank	1		Φ1100x1225	60	60
5	Piping/valves/fittings	1	Lot			
6	HT Wateer Pre Heater Unit	2	Nos	1300x300x1500	250	500
7	HT Water Thermostatic Valve	2	Nos	300x300x600	60	120
	Fuel System					
1	Fuel supply unit	2	Nos	2000x1850x1000	1000	2000
2	HSD Day tank 990 ltrs with broughtout item	2	Nos	1250x750x1250	300	600
3	Leak oil tank 600 ltrs	1	Nos	800x800x1000	250	250
4	Leak oil pump	1	Nos	480x280x300	65	65
5	Pipe/valves/fittings	1	lot			
	Charge / Intake Air system					
1	Air intake Unit	2		2800x1950x2750	2500	5000
2	Charge air ducting with supports (15 metre)	2	lot	IdΦ1000xOdΦ1006		
	Exhaust System					
1	Exhaust Silencer	2	Nos	5000xΦ2010x2250	3100	6200
2	Exhaust duct bellows	6	Nos	ID950x300	25	150
3	Exhaust ducting with supports	2	Lot	ID950xOD962x12000		
4	Exhaust Stack with derrick (Two stacks in single derrick)	1	Lot	TWO stack ID1200xOD1212	30000	30000

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5	Safety Insulation for exhaust system	1	Lot			
	Compressed air system					
1	Air receiver with brought items	4	Nos	Φ800x3100	700	2800
2	Air compressor motor driven	2	Nos	1380x805x813	250	500
3	Air compressor Engine driven	2	Nos	1520x875x1041	565	1130
4	Pipe/valves/fittings	1	Lot			

Piping systems of DG sets

Fuel Line					
SR.	Description	Size	Appx. Length	Spec./Standard	Material
1	Pipe for Oil Vapour	6"	30m	Schedule STD, B36.10	ASTM A106 GR.B, BE SEAMLESS
2	Pipe	5"	2m	Schedule STD, B36.10	ASTM A106 GR.B, BE SEAMLESS
3	Pipe	2"	100m	Schedule XS, B36.10	ASTM A106 GR.B, BE SEAMLESS
4	Pipe	1 1/2"	100m	Schedule XS, B36.10	ASTM A106 GR.B, PE SEAMLESS
5	Pipe	1"	80m	Schedule XS, B36.10	ASTM A106 GR.B, PE SEAMLESS
6	Pipe	1/2"	10m	Schedule S160, B36.10	ASTM A106 GR.B, PE SEAMLESS
7	Pipe Fittings as MTO		Lot		
Water Line					
SR.	Description	Size	Appx. Length	Spec./Standard	Material
1	Pipe	6"	300m	Schedule STD, B36.10	ASTM A106 GR.B, BE SEAMLESS
2	Pipe	5"	2m	Schedule STD, B36.10	ASTM A106 GR.B, BE SEAMLESS
3	Pipe	2"	100m	Schedule XS, B36.10	ASTM A106 GR.B, BE SEAMLESS
4	Pipe	1 1/2"	80m	Schedule XS, B36.10	ASTM A106 GR.B, PE SEAMLESS
5	Pipe	1"	30m	Schedule XS, B36.10	ASTM A106 GR.B, PE SEAMLESS
6	Pipe	1/2"	25m	Schedule S160, B36.10	ASTM A106 GR.B, PE SEAMLESS
7	Pipe fittings as per MTO		Lot		
AIR LINE					
SR.	Description	Size	Appx. Length	Spec./Standard	Material

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1	Pipe	2"	50m	Schedule XS, B36.10	ASTM A106 GR.B, BE SEAMLESS
2	Pipe	1 1/2"	25m	Schedule XS, B36.10	ASTM A106 GR.B, PE SEAMLESS
3	Pipe	1"	25m	Schedule XS, B36.10	ASTM A106 GR.B, PE SEAMLESS
4	Pipe	1/2"	25m	Schedule S160, B36.10	ASTM A106 GR.B, PE SEAMLESS
5	Pipe fittings as per MTO		Lot		

BOM FOR VALVES & Flexible hose of DG sets

Sl. No.	Description	Size	Spec./Standard	Piping Class	Tentative Quantity	Unit
1	BALL VALVE	1"	SW, B16.11, API-6D, 300#	A93A	2	Nos
2	BALL VALVE	1/2"	FLGD B16.5 R, API-6D, 300#	B1A	8	Nos
3	BALL VALVE	1"	FLGD B16.5 R, API-6D, 300#		8	Nos
4	BALL VALVE	1 1/2"	FLGD B16.5 R, API-6D, 300#		6	Nos
5	BALL VALVE	2"	FLGD B16.5 R, API-6D, 300#		4	Nos
6	GATE VALVE	1/2"	SW, B16.11, API 602/ ISO 15761, 800#	A23A	7	Nos
7	GATE VALVE	1"	SW, B16.11, API 602/ ISO 15761, 800#		1	Nos
8	CHECK VALVE	1 1/2"	SW, B16.11, API 602/ ISO 15761, 800#	B1A	2	Nos
9	GATE VALVE	1/2"	SW, B16.11, API 602/ ISO 15761, 800#	A93A	1	No
10	GATE VALVE	1"	SW, B16.11, API 602/ ISO 15761, 800#		16	Nos
11	GATE VALVE	1 1/2"	SW, B16.11, API 602/ ISO 15761, 800#		8	Nos
12	BUTTERFLY VALVE	6"	WAFL, B16.5 WAF, API-609, 150#		16	Nos
13	GLOBE VALVE	3/4"	SW, B16.11, API 602/ ISO 15761, 800#		17	Nos
14	BALL VALVE	1"	FLGD B16.5 RF, API-6D, 150#	A1A	6	Nos
15	BALL VALVE	1 1/2"	FLGD B16.5 RF, API-6D, 150#		9	Nos
16	CHECK VALVE	1"	SW, B16.11, API 602/ ISO 15761, 800#		3	Nos
17	BACK PRESSURE RELEASE VALVE	1 1/2"	FLGD B16.5 R, API-6D, 300#		2	Nos
18	Actuator Operated valve	1 1/2"	FLGD B16.5 R, API-6D, 300#		2	Nos.

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Chapter XI: RATE SCHEDULE

Annexure –A

UNPRICED RATE SCHEDULE

11	“WORK OF ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) and HANDING OVER OF 1X59.3 MW GTG, 1X15.5 MW STG, DEAERATOR SYSTEM, 11KV EMERGENCY DG SETS, HP and LP PUMPS, ASSOCIATED STATIC AND ROTATING AUXILIARIES of GTG and STG, FIRE FIGHTING SYSTEM ETC. AT 1X75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP), VISHAKAPATNAM, ANDHRA PRADESH.”				
S. No	DESCRIPTION OF WORK	UOM	Qty.	Rate per UOM in Rupees	Total Amount (Rate X Qty.)
1.0	“WORK OF ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) and HANDING OVER OF 1X59.3 MW GTG, 1X15.5 MW STG, DEAERATOR SYSTEM, 11KV EMERGENCY DG SETS, HP and LP PUMPS, ASSOCIATED STATIC AND ROTATING AUXILIARIES of GTG and STG, FIRE FIGHTING SYSTEM ETC. AT 1X75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP), VISHAKAPATNAM, ANDHRA PRADESH.” (Scope as per TCC)	Lump Sum	1		
	GRAND TOTAL PRICE FOR THIS WORK(Rs.)				
11.1	BIDDER'S QUOTED GRAND TOTAL PRICE AT SL NO 1.0 ABOVE SHALL BE TAKEN INTO ACCOUNT FOR EVALUATION AND AWARDING AND HENCE, SHALL BE COMPLETE IN ALL RESPECT FOR THE FULL SCOPE DEFINED IN SPECIFICATION AND IN ACCORDANCE WITH ALL TERMS & CONDITIONS OF TENDER.				
11.2	CONTRACTOR SHALL FULLY UNDERSTAND EQUIPMENT DESCRIPTION AND SCOPE OF WORK BEFORE QUOTING. THE SCOPE OF WORK AND RESPONSIBILITY OF THE CONTRACTOR AS MENTIONED UNDER THESE SPECIFICATIONS SHALL BE COVERED WITHIN THE QUOTED PRICE. THE CONTRACTOR HAS TO HANDLE / ERECT / COMMISSION ALL THE ITEMS INDICATED BY BHEL FOR ACHIEVING THE MILESTONES AND COMPLETION OF WORK.				
11.3	THE CONTRACTOR WHILE QUOTING THE ABOVE RATES, CATEGORICALLY CONFIRMS HAVING UNDERSTOOD THE FULLEST IMPLICATIONS OF PRICE ESCALATION PROVISIONS CONTAINED IN TENDER. ACCORDINGLY TAKING INTO CONSIDERATION ALL ASPECTS THEREOF QUOTED ABOVE RATES. FURTHER CONTRACTOR CONFIRMS THAT HE WILL NOT COME WITH ANY OTHER CLAIM/COMPENSATION ON ACCOUNT OF ANY INCREASE WHATSOEVER DURING THE ENTIRE PERIOD OF EXECUTION INCLUDING EXTENDED PERIOD IF ANY.				
11.4	THE TOTAL AMOUNT SHALL CONSIDER TAXES AND DUTIES AS PER CHAPTER VIII OF THE TCC.				
11.5	THE TENDERER SHALL QUOTE THE PRICE AS PER THE RATE SCHEDULE ONLY, IN PRICE BID (ORIGINAL). CONDITIONAL PRICE BIDS OR PRICE BIDS WITH ANY DEVIATION / CLARIFICATION ETC. ARE LIABLE TO BE REJECTED. NO CUTTING / ERASING / OVER WRITING SHALL BE DONE.				
11.6	THE ITEM RATE WILL REMAIN FIRM THROUGHOUT THE CONTRACT PERIOD				

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART-II

TECHINICAL CONDITIONS OF CONTRACT (TCC)

PART- II OF TCC

FOR

“WORK OF ERECTION, TESTING, COMMISSIONING, TRIAL RUN, PERFORMANCE GUARANTEE TEST RUN (PGTR) and HANDING OVER OF 1X59.3 MW GTG, 1X15.5 MW STG, DEAERATOR SYSTEM, 11KV EMERGENCY DG SETS, HP and LP PUMPS, FIRE FIGHTING SYSTEM, ASSOCIATED STATIC AND ROTATING AUXILIARIES of GTG and STG ETC. AT 1X75 MW HPCL VISAKH REFINERY MODERNISATION PROJECT (VRMP), VISHAKAPATNAM, ANDHRA PRADESH.”



Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)
Power Sector – Northren Region,
Plot No. 25 , Sector - 16A ,
Distt. Gautam Budh Nagar, NOIDA – 201 301 (INDIA)

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART-II

S.NO.	DESCRIPTION	Chapter No.	PAGES
	Part-II: Technical Specifications		
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2.	CIVIL WORKS, FOUNDATION, GROUTING	Chapter-II	95
3.	ERECTION	Chapter-III	96-102
4.	WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT	Chapter-IV	103-107
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TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-I: General

1.0	GENERAL
1.1	The intent of this specification is to provide services for execution of project according to most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for the proper and efficient services towards installation of the plant shall not relieve the contractor of the responsibility of providing such services / facilities to complete the work or portion of work awarded to him. The quoted / accepted rates / lump sum price shall deem to be inclusive of all such contingencies.
1.2	The contractor shall carry out the work in accordance with standard practices / codes / instructions / drawings / documents /specification/manuals supplied by BHEL/ EIL /HPCL from time to time.
1.3	The work shall conform to dimensions and tolerances given in various drawings and documents that will be provided during execution. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be affected from contractor's bills towards expenditure incurred including BHEL's usual overhead charges.
1.4	Following shall be the responsibility of contractor and have to be provided within finally accepted rates / prices.
1.4.1	Provision as required of all types of labour, supervisors, engineers, watch and ward, tools & tackles, calibrated inspection, measuring and test equipment as specified and otherwise required for the work, consumables for erection, testing and commissioning including material handling.
1.4.2	Proper out-turn as per BHEL's plan and commitment
1.4.3	Completion of work as per BHEL Schedule.
1.4.4	Good quality and accurate workmanship for proper performances of equipment.
1.4.5	Repair and rectification
1.4.6	Preservation / Re-conservation of all components during storage / erection till handing over.
1.5	The contractor shall carry out the work in accordance with standard practices / codes / instructions / drawings / documents / specification/manuals supplied by BHEL from time to time.
1.6	Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site in line with EIL/HPCL guidelines for refinery projects. BHEL engineer, depending upon the availability of materials, fronts etc, will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.
1.7	All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory/ local authorities are to be arranged by the contractor at his cost in time to ensure smooth progress of work.
1.8	The quantities indicated in the tender specification are approximate and are liable for variation and alteration at the discretion of BHEL. The quoted lumpsum rate shall be applicable for any additional product group also, if included at a later date integral to the main scope of work /package envisaged. There shall be no extra claim in such case.
1.9	The terminal points as decided by BHEL shall be final and binding on the contractor.
1.10	The work covered under this specification is of highly sophisticated nature requiring the best quality of workmanship, engineering and construction management. The contractor should ensure timely completion of the work. The contractor must have the adequate quantity of tools,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-I: General

	construction aids, equipment, etc. in this possession. He must also on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.
1.11	Contractor has to work in close co-ordination with other erection 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 erection program have to be planned in such a way that the milestone are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
1.12	CONTRACTOR may be required to erect and maintain barricades required in connection with his operation to guard or protect:- Areas adjudged hazardous by customer M/s EIL/HPCL , Hoisting areas, wherever as per requirement of customer.
1.13	HOUSE KEEPING-The contractor is supposed to carryout housekeeping of the work area on regular basis to keep the work place neat and tidy and available for the safe working. Scrap, generated daily during the execution activities, is to be dumped at designated area as decided by BHEL/ GAIL on daily basis. The erection materials issued to the contractor and kept near the work area should also be staged properly at site. Compliance report on above shall be submitted by the contractor to BHEL on Daily basis. In case the contractor fails to do so, BHEL have rights to carry out the same from the other party at the Risk and cost of the contractor. The cost applicable with BHEL overheads shall also be recovered from the monthly running bills of contractor

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-II: Civil Works, Foundation, Grouting

2.0	CIVIL WORKS, FOUNDATION, GROUTING
2.1	BHEL CIVIL vendor shall provide all equipment foundations. For the correctness of these foundations as per drawings, the contractor shall check the dimensions & locations of the foundations, pockets, anchor-bolt pitch. Further, top elevation of foundations shall be checked with respect to benchmark. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 50 mm, enlarging the pockets in foundations etc., as may be required for the erection of equipment / plants shall be carried out by the contractor.
2.2	While on the job, care is essential to avoid too much chipping and resultant lowering of level. In case of excess chipping, contractor has to arrange additional packing plates as per requirements provided BHEL Engineer allows it. When required by manufacturers, the embedded sub-sole plates shall be scraped and checked with Prussian blue to get the required contact with frames.
2.3	The contractor shall ensure perfect matching of packer plates including machining, scraping and blue matching with foundation by dressing the foundation, as well as perfect matching between the packer plates and the base plate of equipment to the satisfaction of BHEL Engineer. If required the packer plates may have to aligned and fixed on the foundations using special high strength, non-shrinking and quick-setting grouts. The minimum thickness below the packer plate should be 20 mm.
2.4	Entire grouting work of foundation bolt grouting, base plate grouting, equipment grouting etc. including materials shall be carried out by the civil work agency of BHEL. While grouting will be carried out by other agency, the contractor has to ensure that all the matching joints which are not to be grouted shall be kept free from the grouting mixture by applying tape or any other alternative method approved by Engineer. All assistance required has to be provided by the contractor. If required, decoupling of equipment has to be done for conducting the verification. In case any disturbance is noticed the cause, if any, shall be removed and re-alignment done as part of work. All the arrangement required for grouting such as arrangement of sand, pea gravel and any other material required for Anchor bolt pocket filling has to be done by the contractor of this work scope. The material for shuttering, supply of convextra GP2/ Pedigrout M10/ portland cement etc. shall be arranged by the CIVIL contractor at his cost.
2.6	The contractor shall check and verify the alignment of equipment, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during post grouting check up and verifications. Such pre and post grout records of alignment details shall be maintained by the contractor in a manner acceptable to the Engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-III: ERECTION

3.0	ERECTION
3.1	All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. The omission of specific technique /method/process does not absolve the contractor of his responsibility for the particular operation. These would include
3.1.1	Scaffolding and rigging operations.
3.1.2	Machining / flame / electric cutting, grinding, welding, radiography and stress relieving
3.1.3	Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, as cleaning, checking, levelling, blue matching, aligning and assembly.
3.1.4	Machining, surface grinding, drilling, dowering, shaping
3.1.5	Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication.
3.1.6	Insulation and painting
3.2	Any fixtures, scaffolding materials, approach ladder, concrete block supports, steel structures required for temporary supporting, pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost.
3.3	No members of any ladder / structure / platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / customer without any additional cost.
3.4	Contractor shall erect scaffolding / temporary platforms for erection. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site.
3.5	It shall be the responsibility of the contractor to provide ladders on columns for initial work till such time stairways are completed. For this, the ladder should not be welded on the column and should be pre-fabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL. In case it is absolutely necessary then the contractor shall cut the temporary structure and rectify the column as directed by the engineer.
3.6	The contractor is strictly prohibited in using the erection material for any temporary supporting or scaffolding works etc. In case of such misuse a sum equivalent to the material cost plus BHEL overheads will be recovered from contractor's bills.
3.7	Certain adjustment in length may be necessary while erecting Structure, pipelines / ducts / casings etc. The contractor should remove the extra lengths / add extra lengths to suit the final layout after preparing edges afresh by adopting specified heat treatment procedures within finally acceptance rates
3.8	Not Applicable
3.9	The contractor may be required to fabricate pipe, special bends etc., threading and welding as required for installing lube oil system and carry out the acid cleaning of the fabricated piping.
3.10	The contractor shall also service the lube oil system, carrying out the hydraulic test of oil coolers etc.
3.11	Suspensions for ducting will be supplied in running lengths, which shall be cut to size and adjusted as required. Ducts / expansion bellows are dispatched to site in loose walls plates /

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-III: ERECTION

	pieces and these are to be assembled and welded at site along with stiffeners etc., before erection within the finally accepted rates. All joints connecting duct expansion piece and dampers shall be seal welded on inside as well as on outside.
3.12	Mechanical erection works associated with the power cylinders, valves, valve actuators etc., coming under this work scope including testing and commissioning of all electrically operated valves, actuators and dampers is covered within the scope of this specification.
3.13	The contractor shall carry out trial run of all motors including checking the direction of rotation in the uncoupled condition. Checking of alignment and recoupling of the motor to the driven equipment as per instructions of BHEL engineer and to their satisfaction. All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. Vendor shall all necessary MMDs including the motorized insulation testers for the above test.
3.14	Contractor shall carry out kerosene testing of all bearing housings of various rotating equipment like pumps, fans etc., as per BHEL engineer's instructions. Performance of hydro test of oil coolers of rotating machines and hydro test of other equipment as per BHEL engineer's instructions is included in the scope of work. Forced lube oil system of motors or rotating equipment form parts of the work under this specification.
3.15	Certain rotating machinery after initial runs and commissioning of the equipment have to be hot aligned as per the instructions of BHEL engineer. Cleaning fans, ducting etc., free of extraneous steel, scaffolding materials electrodes, all foreign materials etc., before trial run of rotating machinery, and at various stages of pre-commissioning activities as per BHEL engineer's instruction, is within the scope of work.
3.16	Some of the rotating equipment and electrical motors are provided with protective greases only. Contractor shall arrange for cleaning of the same with kerosene or some other reagent. If necessary, dismantling some of the parts of the equipment would be necessary. He shall arrange for re-greasing / lubricating them with recommended lubricants and for assembling back the dismantled parts, at quoted rate. Lubricants will, however, be supplied free of cost by BHEL.
3.17	After initial trial of rotating equipment, control and power cabling for motors and other equipment / instrumentation shall have to be disconnected for checking alignment and re-setting / re-alignment / hot alignment. Contractor may be required to arrange for disconnecting control and power cabling as per BHEL engineer's instructions and clearance and reconnect the control and power cabling after realignment.
3.18	Packer plates supplied may have to be machined to the correct dimensions. It may also be necessary to blue match the same with each other/ with equipment / with foundations as per BHEL instructions
3.19	All attachments welding including those for insulation works coming on pressure parts / non-pressure parts which the contractor has erected shall be done by qualified tested welders only
3.20	Contractor shall arrange changing of preservative oil in the gearboxes, journal and other bearing assemblies of rotating equipment when in storage areas or after erection of equipment as the case may be as per the instructions of BHEL engineer. Necessary lubricants / oil will be supplied by BHEL and the same will be drawn by contractor from BHEL / customer's stores and transporting to site. Prior to the commissioning of the equipment, oil should be drained and collected in drums provided by BHEL and returned to BHEL / customer's stores.
3.21	The fans and other rotating machines shall be checked for clearances and other vital tolerances. Necessary assistance for balancing of equipment during trial run, if required, shall be provided by the contractor free of cost.
3.22	Whenever required the contractor shall arrange for pre-qualification of process task performers.

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Chapter-III: ERECTION

	Ducts/ expansion bellows (metallic & non-metallic) are normally supplied in loose wall plates/ segments and these are to be assembled and welded at site before erection. Correction of ovalities/ distortion of ducts, expansion bellows etc. occurred during transportation/ handling are to be carried before erection as part of work.
3.23	Erection of mechanical components of non-metallic joints is included in the scope of work. All joints connecting ducts, expansion pieces and dampers shall be seal welded. These welds have to be made leak proof and tested as per technical instruction / requirement.
3.24	Non specified jobs at the interface / terminal points like bolting welding, gasket changing etc. have to be done by the contractor within the quoted price.
3.25	Instrument tapping coming on the equipment and associated pipings to be welded/fitted by the contractor with in the quoted price
3.26	The terminal points decided by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.
3.27	Actuators / drives of dampers, gates, powered vanes etc. may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.
3.28	All rotating machines and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary by dismantling and refitting before erection. If, in the opinion of Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor within the quoted lumpsum price. There shall be no extra payment for this work.
3.29	All the shafts of rotating equipment shall be properly aligned to those of the matching equipment within design tolerances. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.
3.30	All the motors and equipment shall be suitably doweled after alignment of shafts with taper / parallel machined dowels as per the direction of the Engineer. Dowel pins required are be machined by the contractor at his own cost. However the materials for dowel pins shall be issued by BHEL free of cost.
3.31	The HT motor bearings shall be blue matched at site and checked for bearing clearances. The contractor if required shall carry out scraping of bearing housing. No extra claim for blue matching up to 1mm initial gap will be entertained.
3.32	The contractor at no extra cost to BHEL shall carry out servicing and realignment of skid mounted equipment.
3.33	Certain instruments like pressure gauges, pressure transmitters, temperature gauges, flow switches and indicators, etc., are received in assembled condition as integral part of equipment. Contractor shall be responsible for safe receipt, installation and custody of these instruments supplied mounted on skids / equipment. Contractor shall maintain the list of all the instruments removed & reinstalled. Instruments prior to removal and after reinstallation shall be considered in custody of the contractor.
3.34	All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR value, before they are energized. Bearings, slip rings commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected.
3.35	The contractor shall completely erect and test all the piping systems, covered in the specification including sampling lines up to and including sample coolers, hangers & supports, valves and accessories in accordance with the drawings furnished. This includes all necessary bolting, welding, pre-heating, stress relieving, testing, cleaning and painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged, screwed or other type

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	joints are specified or shown on the drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings.
3.36	Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends upto 65-mm nominal bore will have to be fabricated at site. Only cold cutting methods are to be employed for cutting of pipes and tubes irrespective of the size and material. Gas Cutting may not be allowed due to refinery working conditions.
3.37	The contractor shall ensure lowering of pipes in position with adequate precautions as to avoid any damage to either material or men. Only the anchoring points earmarked for the purpose of lowering the pipes are to be used.
3.38	It is possible that a few flanges may not be matching. The contractor shall be required to cut and re-weld the same as and when required without any additional cost.
3.39	Wherever piping erected by the contractor is connected to equipment / piping erected by the other agencies the joint at the connecting point shall be the responsibility of the contractor who is erecting the piping under this specifications.
3.40	Normally the high-pressure valves will have prepared edges for welding. But, if it becomes necessary, the contractor will prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes within the scope of the work.
3.41	All fittings like 'T'-pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection and during commissioning.
3.42	The contractor shall be responsible for correct orientation of all valves so that seats, stems and hand wheels will be in desired location. It is the responsibility of the contractor to obtain the information regarding orientation of valves not fully located on drawings before the same are installed.
3.43	Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
3.44	The adjustment of all hangers & supports erected in both cold & hot conditions for maintaining the proper slopes towards the drain pots and application of cold pull in the piping wherever required is also included in the scope of the contractor.
3.45	Spring suspensions / constant load hangers have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Any adjustments, removal of temporary arrests / locks etc., have to be carried out as and when required.
3.46	Contractor shall install piping in such a way that no excessive or destructive expansion forces exists in either the cold condition or under conditions of maximum temperature and pressure. All bends, expansion joints and any other special fittings necessary to take care of proper expansion shall be incorporated as per the advice of Engineer. During installation of expansion joints, anchors, care must be taken to see that full design movement is available at all times from maximum and minimum temperature.
3.47	The hanger assemblies shall not be used for attachment of rigging to hoist the pipes into position. Other means shall be used to securely hold the pipe in position till pipe supports are completely assembled and attached to the pipe and building structure.
3.48	Layout of small-bore piping, oil systems etc. as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost should carry this out. As built drawing is to be submitted by the contractor after erection completion.
3.49	All the valves, including motorized valves, flap valves, dampers, actuators, etc. shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-

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	commissioning also. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rates.
3.50	Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermowells, valves, battery of first root valves, condensing vessels, flow nozzles and control valves to be provided on, auxiliaries and pipe lines are covered within the scope of this specification. This will be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer. The welding of all the above items will be contractor's responsibility even if the: a. Product groups, under which these items are released, are not covered in the scope of this tender. b. Items are supplied by any agency other than BHEL.
3.51	The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The methods used the tools and the equipment deployed shall be subject to the approval of Engineer. The competent technicians shall carry out the bolting work.
3.52	The contractor shall prepare as built piping drawing & submit to BHEL Engineer for approval & verification of material used.
3.53	Overhauling of the ESV, IV, control valves and respective actuators for rectification of any issues is in the scope of the contractor. In such case, BHEL will provide supervision and contractor will have to make all arrangements for the work.
3.54	BHEL will provide free of cost only the shims and packer plates (either machined or plain) which go as permanent part of the equipment. Certain packer plates and shims over and above the quantity received as a part of supplies from manufacturing units of BHEL, will have to be cut out from steel plates / steel sheets at site to meet site requirement. Contractor shall cut and prepare packers and shims by gas cutting/chiseling / grinding/machining and de-burr the same. However, machining of the packers wherever necessary shall be arranged by the contractor.
3.55	All lifting tackles including wire-ropes slings, shackles, used by the contractor, shall be got approved by BHEL Engineer. It will be the responsibility of the contractor to ensure safe lifting of the equipment taking due precautions to avoid any accidents and damages to equipment and personnel. Calibration/fitness testing certificates from recognized agency are to be submitted to BHEL site office for equipment/instrument/appliances to be used, as per requirement of BHEL/ISO system. Expenditure on such works forms a part of the scope of work.
3.56	The contractor shall erect scaffoldings/Temporary platforms supports etc. required during erection before the permanent supports are erected. These should be of adequate capacity and shall never be overloaded. These should be replaced when not found suitable during erection work. All structure materials required for the above shall be arranged by the contractor at his own cost. No such material shall be supplied by BHEL in any case. Welding of temporary supports, cleats etc. on the columns shall be avoided. In case of absolute necessity, contractor shall take prior approval from BHEL Engineer. Further, any cutting or alteration of member of the structure or platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
3.57	Orientation of all foundations, elevations, lengths and disposition of anchor bolts and diameter of holes in the supports and saddles shall be checked by the CONTRACTOR well in advance of the installation. Rectifications, including chipping of foundations, shall be carried out where necessary in consultation with the Engineer-in-Charge.
3.58	If a structural member needs to be dismantled to facilitate the equipment erection, this shall be done by the CONTRACTOR after ensuring proper stability of the main structure, based on design calculations, safe workloads etc with the approval of Engineer-Incharge.

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	All such dismantled members shall be put back in position to the satisfaction of Engineer-in-Charge after the completion of the equipment erection .
3.59	During the performance of the work the CONTRACTOR shall at his own cost keep structures, materials and equipment adequately braced by guys, struts or other approved means which shall be supplied and installed by the CONTRACTOR as required till the installation work is satisfactorily completed. Such guys, shoring, bracing, strutting, planking supports etc. shall not interfere with the work of other agencies and shall not damage or cause distortion to other works executed by the CONTRACTOR or other agencies
3.60	The CONTRACTOR shall duly comply with manufacturer(s) recommendations and detailed specifications for the installation of the various equipment and machines.
3.61	Various tolerances required as marked on the drawings and/or in accordance with the specifications and/or instructions of the Engineer-in-charge shall be maintained. Verticality shall be verified with the Theodolite and shall be maintained.
3.62	CONTRACTOR shall comply to OWNER's work permit system before any erection activities.
3.63	For speedy execution of work, CONTRACTOR shall also ensure use of latest computer software for at least the following: a) Billing b) Planning & Scheduling c) Progress Reporting d) Material Control & Warehousing e) Safety Records f) Resource Deployment g) Communication
3.64	The CONTRACTOR shall without prejudice to his responsibilities to execute and complete the work as per the specifications and time schedule, progressively deploy minimum construction equipment, tools and tackles and further augment the same depending on the exigencies of work and as decided by the Engineer-in-Charge so as to suit the construction schedule within scheduled completion date without any additional cost to BHEL. The bidder shall submit a list of construction equipment he proposes to deploy for the subject work along with deployment schedule. No construction equipment shall be supplied by the BHEL, unless specified by BHEL specifically in the bidding document.
3.65	COORDINATION WITH OTHER AGENCIES Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the CONTRACTOR. Proper coordination with other agencies will be responsibility of the CONTRACTOR. In case of any dispute, the decision of Engineer-in-Charge shall be final and binding on the CONTRACTOR
3.66	All erection shall be carried out by deploying a crane(s) of suitable capacity. Erection by derrick shall not be permissible. The CONTRACTOR shall submit erection schemes for erection of critical equipment / Barricading to Engineer-in-Charge for his approval. No equipment /barricading shall be erected in the absence of an approved erection scheme for such
3.67	Movement of Hydra is not permitted inside the Refinery premises.
3.68	The Lump sum Price for hiring of the crane shall be deemed to include load testing of the crane as required to establish the lifting capacity of the crane. The load testing shall be witnessed and certified by competent authority.
3.69	SPECIAL REQUIREMENT TO BE MET DURING EXECUTION OF THIS JOB Job shall be carried out on round the clock 24 x7 basis with intermittent break as per agreement with BHEL/EIC.

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Chapter-III: ERECTION

	All materials, equipment, D.P. Test Kits, Equipment for Ultrasonic Testing (if applicable), etc. to carry out Radiography and other NDT .Radiography, if carried out by Gamma Ray (using IRIDIUM 192 Source) shall meet BARC's regulations including storage and operating personnel. Radiography by X-ray, within quoted Prices, will be insisted upon if Radiographs by Gamma Ray does not meet required quality standards. Contractor to use "SAFERAD" machine for radiography to reduce radiography time . Air Conditioned Dark Room with facilities like running water and those required for developing and viewing radiographs. CONTRACTOR should ensure testing of Construction materials used in Erection at local approved OWNER's authorized approved testing laboratory prior to starting of the job and get approval of CONSULTANT.
3.70	Maintenance personnel with all tools & tackles and spares should be available on round the clock basis for attending the breakdown of equipment , machinery, pump etc immediately after breakdown. Contractor shall use wire rope of reputed make only along with valid Test Certificate to avoid accidents. Spare wire rope shall be kept readily available to avoid downtime. Winch & Fly wheel to be provided with Safety Guard without which the rig shall not be allowed to be operated.100% PPE to be used by all workmen and personnel engaged for the job, otherwise penalty shall be imposed. The CONTRACTOR shall deploy and ensure availability of qualified supervisor including safety supervisor having full knowledge of jobs and safety on round the clock basis.
3.71	Dress code: All the CONTRACTOR's workers and officers should use uniform during working hours at site and reflecting jackets in night working hours .

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Chapter-IV: WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT

4.0	WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT
4.1	The equipment and piping shall be erected in conformity with the provisions of WPS , FQP and technical specifications in the drawings or as directed by BHEL as per any standard / specification in practice in BHEL. The method of welding (arc, gas, TIG or other method) may be indicated in the detailed drawings / schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements.
4.2	Welding of equipment, piping, high tensile structural steel shall be done by certified high pressure welders who possess valid certificate of CIB of the State in which the equipment is erected as per provision of IBR.(if applicable) The H.P. welder who possesses necessary certificate shall ensure re-validation as per relevant provisions of IBR and keep the certificate valid till the completion of work. The services of such welders, the validity of whose certificates have expired shall not be utilized for high-pressure works.
4.3	All welders including tack welders, structural and high pressure welder shall be tested as per relevant ASME sections and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid IBR certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor shall maintain the records of qualification of welders. BHEL Engineer will issue all the welders qualified for the work, an identity card. The welder will keep the same with him at work place at all times. He may be stopped from work if he is not found in possession of the same. All certified welders shall be required to fulfill HSE requirements for working as a welder in addition to the welder test at site in line with EIL/HPCL/refinery standards.
4.4	Engineer may stop any welder from the work if his performance is unsatisfactory for any reason or if there is a high percentage of rejection in the joints welded by him. The welder having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.
4.5	Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. The Engineer, prior to any repair being made, shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the engineer.
4.6	The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG welding method only. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.
4.7	All expenses for testing of contractor's welders including destructive and nondestructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of raw material required for making test pieces (PIPES) will be supplied by BHEL free of cost. However the plates required for welder test has to be arranged by contractor at his own cost.
4.8	The regulators used on welding machines shall be calibrated before putting these into use for work. The Contractor at his cost shall also arrange periodic calibration for the same.
4.9	Only BHEL/ CUSTOMER approved electrodes and filler wire are to be procured and used by the contractor in this scope of work, within the finally quoted price. Before procurement of electrode/filler wires by the contractor, contractor shall submit a request letter to BHEL for

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-IV: WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT

	approval of the proposed brands/make of electrodes/filler wire. Only after getting approval in writing the same may be procured and be used at site. Any deviation in this process may lead to rejection of whole lot of electrodes and the joints welded by them. These will have to be repaired at no extra cost to BHEL. BHEL reserve the right to test from the certified lab of approved electrode being used by the contractor. Testing charges for the same shall be borne by the contractor. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate should have a co-relation with the lot number/ batch number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved/ accredited test house traceable to National/ International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same.
4.10	All butt / fillet welds shall be subject to dye penetration test as per the instructions of the engineer at no additional cost.
4.11	The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld. He has to maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability or other wise of the welds shall be final.
4.12	The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. As the work is to be carried out in refinery, any gas cutting will require permit from BHEL/EIL. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer.
4.13	All welds shall be painted with anticorrosive red oxide paint once radiography and stress relieving works are over. Necessary consumables and scaffolding etc. including paints shall be provided by contractor at his own cost.
4.14	Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever necessary, are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.
4.15	Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor has to arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress relieving operations. The contractor should take a note of the following,
4.15.1	Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.

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Chapter-IV: WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT

4.15.2	All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost.
4.16	The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of SR operations.
4.17	The contractor shall also be equipped for carrying out other NDT like LPI / MPI/UT / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. For UT machine shall be used of recordable type.
4.18	The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.
4.19	Contractor for radiography work shall use iridium-192. The geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while carrying out radiography. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC).
4.20	Low speed high contrasts, fine grain films (D-7 or equivalent) in 10 cm width only be used for weld joint radiography. Film density shall be between 1.5 to 2.0.
4.21	All radiographs shall be free from mechanical, chemical or process marks, to the extent they should not confuse the radiographic image and defect finding. Penetrometer as per ASME or ISO must be used for each exposure.
4.22	Lead numbers and letters are to be used (generally 6mm size) for identification of radiographs. Contract number, joint identification, source used, welder's identification and SFD are to be noted down on paper cover of radiograph.
4.23	Lead intensifying screens for front and back of the film should be used as per the above-referred ASME specification.
4.24	The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld.
4.25	For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.
4.26	Radiography personnel with sufficient experience and certified by M/s BARC for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection only have to be deployed. These personnel should also be registered with DRP / BARC for film badge service.
4.27	All arrangements for carrying out radiography work including dark room and air conditioner and other accessories shall be provided by contractor within the space allotted inside at his cost. As an alternative the contractor may deploy an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL/EIL/HPCL before the actual deployment of agency for radiography work. In the event of non-mobilisation of radiography agency/resources within one week of the agreed date, penalty shall be imposed on the CONTRACTOR @ 0.2% of Contract Price per week of delay or part thereof subject to a maximum of 1% of Contract Price. This penalty shall be in addition to all other penalties / LD / specified in the Contract. Contract price for this purpose shall be final executed contract exclusive of ORC, Extra Works executed on Manday rate basis, Supplementary/Additional Items and PVC.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-IV: WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT

4.28	The contractor shall have a dark room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories.
4.29	Radiography inspection of welds shall be performed in accordance with requirements and recommendation of BHEL Engineer. The quantum of radiographic inspection shall be as per provision of ASME / BHEL/EIL/ HPCL approved documents. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out
4.30	All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL / customer.
4.31	Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work.
4.32	Radiography of joints shall be so planned after welding that the same is done either on the same day or next day of the welding to assess the performance of HP welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.
4.33	Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re- submitted for evaluation.
4.34	However, if the defect persists after first repair, further repair work followed with radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at contractor's cost.
4.35	If the contractor does not carry out radiography work due to non-availability of source / film / chemical / operator etc., BHEL will get the work done departmentally or through some other agency at the risk and cost of the contractor.
4.36	Heat treatment and radiography may be required to be carried out at any time (day and night) to ensure the continuity of progress. The contractor shall make all necessary arrangements including labour, supervisors/ Engineer required for the work as per directions of BHEL.
4.37	The contractor shall assist BHEL Engineer in preparing complete field welding schedule for all the field welding activities to be carried out in respect of piping and equipment erected by him involving high pressure welding at least 30 days prior to the scheduled start of erection work at site. The contractor shall strictly adhere to such schedules.
4.38	The pressure parts, equipment and piping shall be erected in conformity with the provisions of Indian Boiler Regulation and as may be directed by BHEL as per any standard / specification in practice in BHEL. The method of welding (arc, gas, TIG or other method) may be indicated in the detailed drawings / schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements.
4.39	Check shots as per the requirement of BHEL/ EIL will be taken at contractors cost.
4.40	CONTRACTOR shall appoint radiography/ NDT agency (ies) only after acceptance of such agency by BHEL/HPCL/EIL. However, acceptance of radiography/ NDT agency by BHEL shall not absolve the CONTRACTOR of his responsibility to execute radiography work as per requirements of the Contract.

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Chapter-IV: WELDING, HEAT-TREATMENT, RADIOGRAPHY AND NDT

4.41	CONTRACTOR shall mobilize Radiography/ NDT agency at site along with adequate number of radiography resources/ NDT equipments & appliances, commensurate with the welding activity and quantum of Radiography/ NDT work load to avoid delays in Radiography/ NDT and consequent generation of back log. In the event of generation of back log leading to Delay/ Hold up of subsequent, activities BHEL has right to engage additional agency for carrying out the radiography at the risk and cost of CONTRACTOR including 100% overhead charge.
4.42	Radiography Check Shots a) To verify that radiographs are being taken on the prescribed / selected welds / spots only, 5% of already radiographed spots shall be selected by the Engineer-in-Charge or his designated person for check shots. The check shots shall be taken up before any further radiography work. b) Radiography of all check shots shall be taken by Contractor at no extra cost to EIL/ OWNER . If mismatch / variation is found in any of the check shot CONTRACTOR shall have to take re-radiography of the entire lot represented by mismatched check shot (a days production or more as decided by Engineer In-Charge) at his own cost
4.43	In the event of any non-matching / variation is observed in re-radiography of the entire lot with reference to the earlier radiographs taken, the radiography agency shall be forthright debarred from site. CONTRACTOR shall then carryout re-radiography up to maximum of 100% of all the prescribed / selected welds/ spots radiographed by the debarred radiography agency (as per direction of the Package In- Charge) at his own cost by engaging a separate Radiography agency acceptable to BHEL/HPCL/EIL. The process for verification of radiographs through check shots shall be continued from the lots selected by the Engineer In- Charge till 2 (two) consecutive lots are found with matching check shot radiographs to the satisfaction of EIL/ OWNER.
4.44	Digital radiography has to be carried in the plant premises. Use of Saferad machines for radiography shall be done. Digital images of the radiography shots shall be captured and put forth for inspection and clearance by Customer/EIL/BHEL. Conventional Radiography to be carried out when called for, as decided by BHEL.
4.45	Digital recorded close proximity/PAUT/TOFD only allowed inside the refinery /unit premises except in fabrication yards
4.46	Inspection and acceptance of the work shall not relieve the CONTRACTOR from any of his responsibilities under this contract.
4.47	Cost towards repeat tests and inspection due to failures, repairs etc. for reasons attributable to the CONTRACTOR shall be borne by the CONTRACTOR.
4.48	The CONTRACTOR shall provide, for purposes of inspection, access ladders, lighting and necessary instruments at his own cost including Low Voltage (24V) lighting equipment for inspection of work.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-V: APPLICATION OF INSULATION

5.0	APPLICATION OF INSULATION
5.1	All attachment welding, including welding of hooks / supports as per pitch both on equipment and piping shall be done as directed by Engineer. Attachment welding shall have to be done by certified welders. If necessary contractor may have to cut the hooks to correct length. Application of red oxide paint including supply of paint on welded portions as directed by BHEL is also included in scope of work.
5.2	The mineral wool mattresses (bonded / un-bonded) / LRB mattresses are received at site in standard sizes. These are to be dressed / cut to suit site requirements by the contractor.
5.3	The number of layers / thickness of mineral wool / LRB mattresses for auxiliaries, pipe lines, valves and other vessels, FST, Deaerator, pumps shall be as per various drawings and as directed by Engineer. For applying the mineral wool mattress, the required holding materials, if necessary by fabrication of rings/ hooks shall be fixed as directed and as per drawings and spec.
5.4	The contractor should ensure, proper finishing of surface of the insulation, sheeting/cladding and cementing as per requirement.
5.5	The contractor should ensure that the finished surface of the insulation works conforms to the dimensions and tolerances given in the drawings. Aesthetic finish and accuracy of work are most important.
5.6	It is the responsibility of the contractor to ensure that the insulation materials and sheet metal covering issued to him for application are well protected against loss or damage from weather conditions. Closed / semi closed sheds or any other arrangements required for this will be by him at his cost. If any damage occurs to the material due to improper storage or due to any causes attributable to the contractor except for normal breakage or damages allowed in such cases, the cost of such damaged material shall be to the account of the contractor.
5.7	Aluminum sheet cladding will be fabricated to the sizes and shapes specified in drawings. Beading, swaging, beveling of sheets, crowning the sheets if necessary will be carried out by him. Two coats of anti-corrosive black bituminous paint are to be applied on inner surfaces of the cladding. Bitumen sealing compound on the joints if necessary is included in the scope of this work. Contractor may note that he will also supply anti-corrosive black bituminous paint & bituminous sealing compound required for above works at his cost. Only if such supply is made by BHEL MUs, same shall be issued free of charges to contractor.
5.8	Aluminum sheet metal cladding over insulation will consist of plain / ribbed / corrugated sheets. The sheets will be supplied in standard sizes. Cutting them to required size, grooving, fabricating bends, boxes etc., for proper covering is contractor's responsibility. Any cutting / bending / welding of fabricated skin casing sheets if required will also be covered within the scope of this contract.
5.9	A logbook shall be maintained by the contractor to obtain clearance for application of insulation. If the contractor does the work on his own accord without prior permission the area may have to be redone at his cost.
5.10	Contractor is liable for the exact accounting of the material issued to him and he shall make any unaccountable losses good. Wastage allowance for the material issued is as below:
1.	Wool / LRB mattresses and cladding sheets 2%

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Chapter-V: APPLICATION OF INSULATION

2.	Insulation bricks and mortar	2%
3.	Castable refractory	1%
5.11	The entire surplus, unused materials etc., supplied by BHEL shall be returned to BHEL after the work is over. Materials like gunny bags and packing materials, empty containers may be returned at periodical intervals.	
5.12	The contractor shall leave certain gaps and opening while doing the work as per instructions of BHEL engineer to facilitate inspection during commissioning and to fix gauges, fittings and instruments. The gaps will have to be finished as per drawings at a later date by the contractor at his cost.	
5.13	If during erection and commissioning any of the parts are to be insulated temporarily fixed and then replaced by permanent ones at a later date or if any of the parts are to be removed for modification, rectification, adjustment and then refitted or if some parts are to be opened for inspection and checking and for measurement of metal surface temperature the same may necessitate removal and re-application of insulation and sheet metal cladding, which shall be done by the contractor and the erection rate quoted shall be inclusive of such contingencies.	
5.14	Removable type of insulation shall be provided for valves, fittings, expansion joints etc. as per the drawings or as directed by BHEL Engineer.	
5.15	All temporary pipelines required during testing, pre-commissioning and commissioning should be insulated as directed by BHEL. The application of insulation shall be payable as per the rates quoted in rate schedule, however dismantling of insulation of temporary piping shall be done at no extra cost to BHEL i.e. no claim /payment against this is admissible. The required insulation material shall be issued by BHEL free of cost.	
5.16	Insulation of exhaust system from inside require locking of nuts by tack welding. This shall be meticulously performed and care shall be taken so as to use consumables, nuts of the right specification.	
5.17	It may be required to dismantle some portion of the insulation for technical requirements during erection and commissioning. The same shall be dismantled and again applied within the lumpsum cost. Material shall be supplied free of cost to BHEL, only when there is no fault of the contractor in the reasons for dismantling of the insulation.	

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Chapter-VI: Painting including Finish Painting

6.0	PAINTING INCLUDING FINISH PAINTING
6.1	All exposed metal parts of the equipment, structure, auxiliaries, piping, and other items (covered within the scope of this contract) after installations are to be painted. Mostly the equipment / components installed are with one coat each of primer paint and synthetic enamel / heat resistant paint. However, due to aging, the same may have got deteriorated for peeled off. The surfaces are to be thoroughly cleaned of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL. The same will be inspected and approved by the engineer before painting.
6.2	After applying the primer paints all structure / equipment / items, shall be finish painted with two coats of alloyed resin machinery enamel paints or as specified by BHEL engineer as specified by BHEL engineer. In case proper finish is not obtained in two coats, the contractor shall apply additional coat (s) till proper finish is achieved. After completion of painting all bright spots shall be cleaned to the satisfaction of Engineer.
6.3	Certain equipment like pedestal, valves, tanks etc. shall require spray painting. The contractor shall make arrangements of the required equipment for spray painting. Spray painting at the job site shall be permitted only at times and locations approved by Engineer.
6.4	Contractor at no extra cost to BHEL shall supply all paints, primers, tools and other consumables including scaffolding materials required for finish painting. Paint is to be BHEL/EIL/HPCL approved make only and painting should be as per colour scheme and quality approved / specified by BHEL/EIL. The painting schedule shall be supplied before start of the job at site. Valid Test Certificate for the paint so supplied shall be made available before use of the same on work. No paint whose shelf life has expired should be used for painting.
6.5	The contractor may be required to fill up dents / marks by applying putty before final painting of equipment. All materials and arrangements have to be made within quoted lump sum price/rates.
6.6	The contractor shall provide legends with direction of flow on equipment and piping in size specified by Engineer. Letter writing shall be done in Hindi / English/ Telugu or in any of the languages as intimated by BHEL/ EIL.
6.7	The painters have to undergo test on a mock plate of size 1m*1m and only qualified painters will be allowed to work. The contractor shall ensure availability of
6.7.1	• Ford Cup-4 to measure consistency of paint,
6.7.2	• Automatic magnetic gauge to measure the dry film thickness ; Elcometer
6.7.3	• SSPC Visual standards to assess degree of cleanliness of surfaces to be painted.
6.8	All paints should be stored in well-ventilated store. The painters and other personnel deployed should use proper protective equipment to avoid inhalation of fumes.
6.10	BHEL or Customer Specification for Shop & Field Painting with regard to surface preparation and final painting with colour codes and scheme for surface preparation and finish paints coating including primer coating for shop and field painting will be given at site at the time of painting work. Contractor shall carry out

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VI: Painting including Finish Painting

	surface preparation and final painting works as per BHEL or Customer specification and instruction of BHEL engineer at site.
6.11	Paints and painting work carried at site shall confirm to the following codes and standards: IS:5 – Colour for ready mixed paints and enamels IS : 101 Part 1 to 9 – Methods of sampling and test for paints, varnishes and related products IS : 1477 Part I&II – Code of practice for painting of ferrous metals in building IS : 2932 – Specifications for enamel, synthetic and exterior, a) Under Coating b) Finishing IS: 9407 – Colour code for identification of pipelines used in thermal power plants. Contractor shall satisfy himself, availability of all information in the specifications for proper selection of the paints and ensure their applications as per Codes.
6.12	All the primer, thinner & paints for final painting and all other consumables like brush, cleaning agents etc. and all T&P including scaffolding materials, manpower, supervision is in contractor's scope.
6.13	Primer Painting: a) After surface preparation, two coats of epoxy resin based zinc primer shall be applied. Dry film thickness of each coat shall be as per the recommendations of primer or paint manufacturer. Primer shall be applied by either spraying or brushing ensuring a continuous film without "holidays". Primer coat shall be immediately applied without any time lag after the surface preparation. b) Any equipment shall be carefully examined and where ever the primer coat is damaged shall be recoated with primer. However over the field welds, bolts and nuts etc. two primer coats as per a) shall be applied.
6.14	Final Finish Painting a) After the primer coat has dried out, the surface shall be cleaned of dust without scratching or in any way damaging the primer coat. Over this, dry surface finish painting shall be carried out. b) Finish painting shall be carried out in two coats. Dry film thickness of each coat shall be as per the recommendation of the primer or paint manufacturer. Minimum thickness including primer and paint coating shall be 400 microns. c) Paint shall be applied either by brushing or spraying. It shall be ensured that brush marks are a minimum and the requirements of workmanship are as specified in IS: 1477 (for site painting works on systems, structures and components). d) Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of ready mixed type in original sealed containers as packed by the paint manufacturer. Addition of thinners shall not be permitted. e) No painting shall be done in frost or foggy weather or when the humidity is high enough to cause condensation on the surface to be painted. Paint shall not be applied when the temperature of the surface to be painted is 5 deg. C or below.
6.15	Components of STG,GT, skids, DG sets and other auxiliaries are supplied painted as per specifications and requirement (for ex. Temperature and other technical

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Chapter-VI: Painting including Finish Painting

	requirement) by BHEL manufacturing units as per their standard applicable painting schemes. Contractor shall carry out primer and finish painting coats and DFT requirement with colour codes & specifications as per requirement of customer. All exposed metal parts of the equipment including piping, structures, railings etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting, and the same being inspected and approved by BHEL engineer for painting. Afterwards, the above parts shall be finished with two coats of alloyed resin machinery enamel paints.
6.16	Touch-up painting on damaged areas after completion of finish painting – - For coatings damaged up to metal surface -Surface preparation shall be carried out by manual cleaning. Minimum 6 inches adjoining area with existing coating shall be roughened by wire brushing, emery paper rubbing etc., for best adhesion of patch primer. Primer coat of touch-up primer has to be applied by brush immediately after the surface preparation. - Over this primer coat, finish coat and final finish coat shall be applied as covered above by brush within maximum seven (7) days of application of touch up primer.
6.17	Painting of welded areas and painting of areas exposed after removal of temporary supports and touch-up painting on damaged areas of employer's structures, where inter-connection, welding or modification etc. has been carried out by the bidder. (a.) Clean the surface to remove flux spatters and loose rust, loose coatings in the adjoining areas of weld seams by wire brush and emery paper.
6.18	The scope of work includes painting of colour bands, lettering, marking and signs for direction of flow/rotation, names etc. of approved colour as per the standard colour codes and specifications specified in tender specification or as advised by BHEL or Customer engineer at site for the equipment or components covered in these specifications. Supply of applicable paints and primer is in Bidder's scope.
6.19	In certain isolated instances where it is not possible to clean the equipment as explained above, cleaning by grinding might have to be resorted to. No damage to the equipment/components should be caused.
6.20	Surface to be painted should be free of oil and grease. It should be removed by using suitable cleaning agents including permitted solvents. Surface cleaned by chemical agent, if required, shall be treated further as prescribed in use of such cleaning agents. The Contractor at his own cost shall provide all the consumables and application implements.
6.21	During the preparation of surface, if the shop coat is damaged by chemical cleaning or by mechanical means, contractor shall repair the same free of cost. Also, due to long storage, the surface may get damaged due to rusting, pitting etc., the contractor will have to repair the surface and apply primers, painting and finish painting as per painting schedule, within this scope of work and no extra cost to BHEL.

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Chapter-VI: Painting including Finish Painting

6.22	This work requires working at higher altitudes from ground level to as high as 30m and more. The work spread is also substantial involving substantial run of structures and piping. Contractor shall take sufficient precautions to avoid any accident and hazard in all respects. The ropes, ladders, scaffolding materials, clamps etc. and climber used should be of standard quality for safe and smooth execution of work.
6.23	Contractor shall carry out the work in such a way that other erected equipment, structure, civil foundations and other property are not damaged. For damages in any of such cases due to lapses by Contractor, BHEL shall have the right to recover the cost of such damages from the Contractor.
6.24	Contractor shall take due care to cover or protect the equipment which are already painted while carrying out the painting of other adjacent equipment. If so happens, it shall be cleaned and repainted by the Contractor without any extra charges.
6.25	In general, painting of structural parts and colour bands, lettering, marking of direction of flow/rotation etc. will be carried out by brush painting. However, areas/equipment inaccessible for manual painting have to be painted by spray painting. The decision of BHEL engineer, in this regard, shall be final and binding on the Contractor. Laying of air hose pipe and any other line required shall be done by Contractor at his cost. The Contractor shall provide spray equipment set.
6.26	Final painting work shall be started after obtaining clearance from BHEL engineers and as per his instructions
6.27	Supply of Paints/Primer/Thinner and application of paints for final painting and all other consumables like brush, cleaning agents etc and all T&P including scaffolding materials, manpower, and supervision is in contractor's scope.
6.28	Final Painting Scheme for this package at HPCL shall be issued during execution.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Testing, Pre- commissioning and Post Commissioning

7.0	TESTING, PRE-COMMISSIONING, COMMISSIONING, AND POST-COMMISSIONING
7.1	The contractor shall carry out all the required tests, pre-commissioning and commissioning activities required for the successful and reliable operation of this contract scope as per the approved commissioning procedure / quality plans of BHEL/EIL. These would include Air /gas tightness test of ducts, Hydraulic test of piping, tanks,deaerators. Trial run of pumps/motors etc. as instructed by BHEL using their own consumables, labour and scaffoldings etc. Inadvertent omission of any test which is required for the successfully commissioning of this contract scope, shall not absolve the contractor of its responsibilities of performing that test.
7.2	All required tests (Mechanical and electrical) indicated by BHEL as per the FQP, erection procedure, commissioning procedure for successful commissioning are included in the scope of these specifications. These tests / activities may not have been listed in these specifications but contractor shall conduct the tests as per the approved commissioning procedure.
7.3	Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However contractor has to take proper care of the equipment issued to him.
7.4	After completion of erection of ducts, the contractor shall conduct the air/gas tightness test Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of work (Putty to be procured by the contractor without any extra cost to BHEL).
7.5	All the tests may have to be repeated till all the equipment satisfy the requirement /obligation of BHEL at various stages. The contractor shall do all the repairs for site welded joints arising out of the failure during testing.
7.6	The scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro test for any other tests. The scope also covers the offsite disposal of effluents of the tests under the scope of this contract as per instruction of BHEL Engineer.
7.7	It shall be the responsibility of the contractor to provide various category of workers in sufficient numbers along with Supervisors during Pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&P's, IMTE's etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.
7.8	It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.
7.9	In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
7.10	During commissioning, opening / closing of valves, changing of gaskets, realignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price / rates shall also include all such work.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Testing, Pre- commissioning and Post Commissioning

7.11	The contractor shall make all necessary arrangements including making of temporary closures on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost.
7.12	The valves will have to be checked, cleaned or overhauled in full or in part before erection, during pre-commissioning and commissioning as may be necessary.
7.13	In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.
7.14	All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of pipes, all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.
7.15	The contractor shall carry out cleaning and servicing of valves and valve actuators prior to pre-commissioning tests and / or trial operations of the plant. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to BHEL Engineer to ensure that no valves and valve actuators are left unserviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats. Cleaning and servicing of all the filters / strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.
7.16	At the time of each inspection, the contractor shall take note of the decisions / changes proposed by the Engineer and incorporate the same at no additional cost. The contractor shall carry out any other test as desired by BHEL Engineer/ Manufacturer on erected equipment covered under scope of this contract during testing and commissioning to demonstrate the physical completion of any part or parts of the work performed by the contractor
7.17	The scope of pre-commissioning, commissioning and post commissioning activities cover installation of all necessary temporary piping, supports, valves, blanking, pumps, tanks etc. and other accessories with access platforms valves, pressure gauges, electric cables, switches, cutting of some of existing valve, placing of rubber wedges in the valves etc., required for hydro test, or any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the off-site disposal of effluents
7.18	It shall be the responsibility of the contractor to preserve the cleaned surface as per BHEL's requirement.
7.19	The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydro-static testing on all piping equipment covered in the specification at no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic Test of various piping systems, Ultrasonic Test for weld defects and finding thickness, Dye penetrant test, Magnetic particles test for Weld defects and materials defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required shall be provided by the contractor for satisfactory conduction of above tests. Special equipment such as magnetic particle tester, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with Qualified technician within finally accepted rates.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VII: Testing, Pre- commissioning and Post Commissioning

7.20	In certain places blanking has to be resorted prior to Hydraulic test and spool pieces have to be erected in place of control valves, orifices and other fittings and these spool pieces have to be subsequently replaced with the regular valves/ fittings by the contractor at no extra cost.
7.21	During this period though the BHEL's/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision, consumables, labour, T&P and IMTEs required till such time the commissioned units are taken over by the BHEL's customer.
7.22	It is possible that due to any reason the final supporting may not be completed before conducting Hydraulic Test. The contractor may have to strengthen or install any additional supports as per instruction of BHEL. This work is a part of the work and no additional payment shall be made on this account
7.23	All the shafts of the equipment shall have to be properly aligned to that of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid over-heating of bearings or other conditions, which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and lubricated as per recommendations of BHEL engineer.
7.24	During commissioning changing of gaskets , tightening of bolts, realigning of rotating and other equipment, attending to leakage and minor adjustments of erected equipment may arise. The quoted rate of contractor shall be inclusive of all such works.
7.25	Lubricating oil units of the rotating machines are to be cleaned thoroughly before pouring of final lubricating oil. Topping up of lubricants during running of the set till handing over to be done by the vendor. Required lubricants both for first filling and topping up are to be supplied by BHEL free of cost. The empty containers of the lubricating oils should be returned to BHEL stores/place indicated by BHEL from time to time.
7.26	The instruction of the motor manufacturer regarding storage of the motors and re conservation must be strictly followed without any deviation.
7.27	Attending the punch points post commissioning and resolve the deficiency for handing over the unit to customer M/s GAIL.
7.28	The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydro-static testing on all piping equipment covered in the specification at no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic Test (as per IBR requirement/ instruction of BHEL), of various piping systems, Ultrasonic Test for weld defects and finding thickness, Dye penetrant test, Magnetic particles test for Weld defects and materials defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required shall be provided by the contractor for satisfactory conduction of above tests. Special equipment such as magnetic particle tester, Metelascope for analysis of weld material of T/P-91 piping, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with Qualified technician within finally accepted rates. All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. These tests/ activities may not have been listed in these specifications.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter VIII: Annexures to the Contract

8.0	Following documents are attached annexures. These documents forms integral part of this contract and all works/penalties/permits/approvals at site related to HSE shall be in line with the guidelines of these documents. In case of any conflict between clauses the documents referred below, the more stringent one shall apply.
8.1	OISD GUIDELINES-192, OISD GUIDELINE-207- These guidelines are released by the Oil Industry Safety Directorate (OISD), Govt. of India, Ministry of Petroleum & Natural Gas. These are to be adhered to during execution of the work of this contract scope at project site. These documents are annexed as Annexure – 8.1(Pages 118 - 201)
8.2	HSE Plan for HPCL Visakhapatnam site dated 19.05.2018 (Doc no.: HSEP:PSER 14-HPCLBHEL REV: 02) This document is Annexure -8.2 (Pages 202 - 299)
8.3	Guidelines for settlement of claims for compensation on accidents applicable to BHEL. This document is as Annexure -8.3(Pages 300- 307)
8.4	Penalty List of M/s EIL, applicable for this contract. This document is annexed as Annexure -8.4(Pages 308- 310)
8.5	Standard specification for Cement Lining to be annexed. This document is annexed as Annexure -8.5 (Pages 311- 326)
8.6	Digital radiography specification. This document is annexed as Annexure -8.6 (Pages 327- 328)
8.7	Color coding for Painting in the CPP. The contract specification of Customer are attached . Contractor will have to follow these guideline for its scope of work under the contract. This document is annexed as Annexure -8.7 (Pages 329- 340)
8.8	OISD-STD-105, Work Permit System. This document to be made available at site during execution.

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OISD GUIDELINES-192, OISD GUIDELINE-207

[ANNEXURE – XIV TO SPECIAL CONDITIONS OF CONTRACT]

SAFETY PRACTICES DURING CONSTRUCTION

OISD-GDN-192

**Oil Industry Safety Directorate
Government of India
Ministry of Petroleum and Natural Gas**

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SAFETY PRACTICES DURING CONSTRUCTION

1.0 INTRODUCTION

Safety in Construction Management deserves utmost attention especially in the hydrocarbon industry, such as Exploration, Refineries, Pipelines and Marketing installations, Gas Processing units etc. Construction is widely recognised as one of the accident prone activities. Most of the accidents are caused by inadequate planning, failure during the construction process and/or because of design deficiencies. Besides property loss, accidents also result in injuries and fatalities to the personnel; same needs to be prevented.

The reasons for accidents during construction activities are related to unique nature of the industry, human behaviour, difficult work-site conditions, extended odd duty hours, lack of training & awareness and inadequate safety management. Unsafe working methods, equipment failure and improper housekeeping also tend to increase the accident rate in construction.

Ensuring good quality of materials, equipment and competent supervision along with compliance of standard engineering practices shall go a long way to in built safety into the system.

The objective of this standard is to provide practical guidance on technical and educational framework for safety and health in construction with a view to:

- (a) prevent accidents and harmful effects on the health of workers arising from employment in construction;
- (b) ensure appropriate safety during implementation of construction;
- (c) provide safety practice guidelines for appropriate measures of planning, control and enforcement.

2.0 SCOPE

This document specifies broad guidelines on safe practices to be adhered to during construction activities in oil industry. However, before commencing any job, specific hazards and its effects should be assessed and necessary corrective/preventive actions should be taken by all concerned. The document is intended only to supplement and not to

replace or supersede the prevailing statutory requirements, which shall also be followed as applicable. For Personal Protective Equipment, OISD-STD-155 (Part I&II) shall be referred to. The scope of this document does not include the design aspects and quality checks during construction.

3.0 DEFINITIONS

Definitions of various terminology are given below:

- *Adequate, appropriate or suitable* are used to describe qualitatively or quantitatively the means or method used to protect the worker.
- *Brace*: A structural member that holds one point in a fixed position with respect to another point; bracing is a system of structural members designed to prevent distortion of a structure.
- *By hand*: The work is done without the help of a mechanised tool.
- *Competent Authority*: A statutory agency having the power to issue regulations, orders or other instructions having the force of law.
- *Competent person*: A person possessing adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work. The competent authorities may define appropriate criteria for the designation of such persons and may determine the duties to be assigned to them.
- *Execution agency*:
Any physical or legal person, having contractual obligation with the owner, and who employs one or more workers on a construction site
- *Owner*:
Any physical or legal person for whom construction job is carried out.
It shall also include owner's designated representative/consultant/nominee/agent, authorised from time to time to act for and on its behalf, for supervising/

coordinating the activities of the execution agency.

- *Hazard*: Danger or potential danger.
- *Guard-rail*: An adequately secured rail erected along an exposed edge to prevent persons from falling.
- *Hoist*: A machine, which lifts materials or persons by means of a platform, which runs on guides.
- *Lifting gear*: Any gear or tackle by means of which a load can be attached to a lifting appliance but which does not form an integral part of the appliance or load.
- *Lifting appliance*: Any stationary or mobile appliance used for raising or lowering persons or loads.
- *Means of access or egress*: Passageways, corridors, stairs, platforms, ladders and any other means for entering or leaving the workplace or for escaping in case of danger.
- *Scaffold*: Any fixed, suspended or mobile temporary structure supporting workers and material or to gain access to any such structure and which is not a lifting appliance as defined above.
- *Toe-board*: A barrier placed along the edge of a scaffold platform, runway, etc., and secured there to guard against the slipping of persons or the falling of material.
- *Worker*: Any person engaged in construction activity.
- *Workplace*: All places where workers need to be or to go by reason of their work.

4.0 GENERAL DUTIES

4.1 GENERAL DUTIES OF EXECUTION AGENCIES

4.1.1 Execution agency should:

- i) provide means and organisation to comply with the safety and health measures required at the workplace.
- ii) provide and maintain workplaces, plant, equipment, tools and machinery and organise

construction work so that, there is no risk of accident or injury to health of workers. In particular, construction work should be planned, prepared and undertaken so that:

- (a) dangers, liable to arise at the workplace, are prevented;
 - (b) excessively or unnecessarily strenuous work positions and movements are avoided;
 - (c) organisation of work takes into account the safety and health of workers;
 - (d) materials and products used are suitable from a safety and health point of view;
 - (e) working methods are adopted to safeguard workers against the harmful effects of chemical, physical and biological agents.
- iii) establish committees with representatives of workers and management or make other arrangement for the participation of workers in ensuring safe working conditions.
 - iv) arrange for periodic safety inspections by competent persons of all buildings, plant, equipment, tools, machinery, workplaces and review of systems of work, regulations, standards or codes of practice. The competent person should examine and ascertain the safety of construction machinery and equipment.
 - v) provide such supervision to ensure that workers perform their work with due regard to safety and health of theirs as well as that of others.
 - vi) Employ only those workers who are qualified, trained and suited by their age, physique, state of health and skill.
 - vii) satisfy themselves that all workers are informed and instructed in the hazards connected with their work and environment and trained in the precautions necessary to avoid accidents and injury to health.
 - viii) Ensure that buildings, plant, equipment, tools, machinery or workplaces in which a dangerous defect has been found should not be used until the defect has been rectified.

- ix) Organise for and remain always prepared to take immediate steps to stop the operation and evacuate workers as appropriate, where there is an imminent danger to the safety of workers.
- x) establish a checking system by which it can be ascertained that all the members of a shift, including operators of mobile equipment, have returned to the camp or base at the close of work on dispersed sites and where small groups of workers operate in isolation.
- xi) provide appropriate first aid, training and welfare facilities to workers as per various statutes like the Factories Act, 1948 etc. and, whenever collective measures are not feasible or are insufficient, provide and maintain personal protective equipment and clothing in line with the requirement as per OISD-STD-155 (Vol. I & II) on Personnel Protective Equipment. They should also provide access to workers to occupational health services.
- xii) Educate workers about their right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on working procedures adopted as may affect safety and health.
- xiii) Ensure that except in an emergency, workers, unless duly authorised, should not interfere with, remove, alter or displace any safety device or other appliance furnished for their protection or the protection of others, or interfere with any method or process adopted with a view to avoiding accidents and injury to health.
- xiv) Ensure that workers do not operate or interfere with plant and equipment that they have not been duly authorised to operate, maintain or use.
- xv) Ensure that workers do not sleep, rest or cook etc in dangerous places such as scaffolds, railway tracks, garages, confined spaces or in the vicinity of fires, dangerous or toxic substances, running machines or vehicles and heavy equipment etc.
- xvii) Obtain the necessary clearance/permits as required and specified by owner
- xviii) As per the Govt. circular as amended from time to time all contractors who employ more than 50 workers or where the contract value exceeds Rs. 50 crores, the following facilities are to be provided by contractor at site :
- Arrangement for drinking water
 - Toilet facilities
 - A creche where 10 or more women workers are having children below the age of 6 years
 - Transport arrangement for attending to emergencies
- xix) should deploy a safety officer at site

4.2 GENERAL DUTIES OF OWNERS

4.2.1 Owners should:

- i) co-ordinate or nominate a competent person to co-ordinate all activities relating to safety and health on their construction projects;
- ii) inform all contractors on the project of special risks to health and safety;
- iii) Ensure that executing agency is aware of the owner's requirements and the executing agency's responsibilities with respect to safety practices before starting the job.

5.0 SAFETY PRACTICES AT WORK PLACES

5.1. GENERAL PROVISIONS

- 5.1.1 All openings and other areas likely to pose danger to workers should be clearly indicated.
- 5.1.2 Workers & Supervisors should use the safety helmet and other requisite Personal Protective Equipment according to job & site requirement. They should be trained to use personal protective equipment.
- 5.1.3 Never use solvents, alkalis and other oils to clean the skin.
- 5.1.4 Lift the load with back straight and knees bent as far as possible. Seek the help in case of heavy load.

5.1.5 Ensure the usage of correct and tested tools and tackles. Don't allow the make shift tools and tackles.

5.1.6 No loose clothing should be allowed while working near rotating equipment or working at heights.

5.2 MEANS OF ACCESS AND EGRESS

Adequate and safe means of access (atleast two, differently located) to and egress from all workplaces should be provided. Same should be displayed and maintained.

5.3 HOUSEKEEPING

5.3.1 Ensure:

- i) proper storage of materials and equipment;
- ii) removal of scrap, inflammable material, waste and debris at appropriate intervals.

5.3.2 Removal of loose materials, which are not required for use, to be ensured. Accumulation of these at the site can obstruct means of access to and egress from workplaces and passageways.

5.3.3 Workplaces and passageways, that are slippery owing to oil, grease or other causes, should be cleaned up or strewn with sand, sawdust, ash etc.

5.4 PRECAUTIONS AGAINST THE FALL OF MATERIALS & PERSONS AND COLLAPSE OF STRUCTURES

5.4.1 Precautions should be taken such as the provision of fencing, look-out men or barriers to protect any person against injury by the fall of materials, or tools or equipment being raised or lowered.

5.4.2 Where necessary to prevent danger, guys, stays or supports should be used or other effective precautions should be taken to prevent the collapse of structures or parts of structures that are being erected, maintained, repaired, dismantled or demolished.

5.4.3 All openings through which workers are liable to fall should be kept

effectively covered or fenced and displayed prominently.

5.4.4 As far as practicable, guardrails and toe-boards should be provided to protect workers from falling from elevated workplaces.

5.5 PREVENTION OF UNAUTHORISED ENTRY

5.5.1 Construction sites located in built-up areas and alongside vehicular and pedestrian traffic routes should be fenced to prevent the entry of unauthorised persons.

5.5.2 Visitors should not be allowed access to construction sites unless accompanied by or authorised by a competent person and provided with the appropriate protective equipment.

5.6 FIRE PREVENTION AND FIRE FIGHTING

5.6.1 All necessary measures should be taken by the executing agency and owner to:

- i) avoid the risk of fire;
- ii) control quickly and efficiently any outbreak of fire;
- iii) bring out a quick and safe evacuation of persons.
- iv) Inform unit/fire station control room, where construction work is carried out within existing operating area.

5.6.2 Combustible materials such as packing materials, sawdust, greasy/oily waste and scrap wood or plastics should not be allowed to accumulate in workplaces but should be kept in closed metal containers in a safe place.

5.6.3 Places where workers are employed should, if necessary to prevent the danger of fire, be provided with:

- i) suitable and sufficient fire-extinguishing equipment, which should be easily visible and accessible;
- ii) an adequate water supply at sufficient pressure meeting the requirements of various OISD standards.

5.6.4 To guard against danger at places having combustible material,

- workers should be trained in the action to be taken in the event of fire, including the use of means of escape.
- 5.6.5 At sites having combustible material, suitable visual signs should be provided to indicate clearly the direction of escape in case of fire.
- 5.6.6 Means of escape should be kept clear at all times. Escape routes should be frequently inspected particularly in high structures and where access is restricted.
- 5.7 LIGHTING**
- 5.7.1 Where natural lighting is not adequate, working light fittings or portable hand-lamps should be provided at workplace on the construction site where a worker will do a job.
- 5.7.2 Emergency lighting should be provided for personnel safety during night time to facilitate standby lighting source, if normal system fails.
- 5.7.2 Artificial lighting should not produce glare or disturbing shadows.
- 5.7.3 Lamps should be protected by guards against accidental breakage.
- 5.7.4 The cables of portable electrical lighting equipment should be of adequate size & characteristics for the power requirements and of adequate mechanical strength to withstand severe conditions in construction operations.
- 5.8 PLANT, MACHINERY, EQUIPMENT AND HAND TOOLS**
- 5.8.1 General Provisions**
- i) Plant, machinery and equipment including hand tools, both manual and power driven, should:
- be of proper design and construction, taking into account health, Safety and ergonomic principles.
 - be maintained in good working order;
 - be used only for work for which they have been designed.
- d) be operated only by workers who have been authorised and given appropriate training.
- e) be provided with protective guards, shields or other devices as required.
- ii) Adequate instructions for safe use should be provided.
- iii) Safe operating procedures should be established and used for all plant, machinery and equipment.
- iv) Operators of plant, machinery and equipment should not be distracted while work is in progress.
- v) Plant, machinery and equipment should be switched off when not in use and isolated before any adjustment, clearing or maintenance is done.
- vi) Where trailing cables or hose pipes are used they should be kept as short as practicable and not allowed to create a hazard.
- vii) All moving parts of machinery and equipment should be enclosed or adequately guarded.
- viii) Every power-driven machine and equipment should be provided with adequate means, immediately accessible and readily identifiable to the operator, of stopping it quickly and preventing it from being started again inadvertently.
- ix) Operators of plant, machinery, equipment and tools should be provided with PPEs, including where necessary, suitable ear protection.
- 5.8.2 Hand tools**
- i) Hand tools should be repaired by competent persons.
- ii) Heads of hammers and other shock tools should be dressed or ground to a suitable radius on the edge as soon as they begin to mushroom or crack.
- iii) When not in use and while being carried or transported sharp tools should be kept in sheaths, shields, chests or other suitable containers.
- iv) Only insulated or nonconducting tools should be used on or near live electrical installations.

- v) Only non-sparking tools should be used near or in the presence of flammable or explosive dusts or vapours.

5.8.3 Pneumatic Tools

- i) Operating triggers on portable pneumatic tools should be:
 - a) so placed as to minimise the risk of accidental starting of the machine.
 - b) so arranged as to close the air inlet valve automatically when the pressure of the operator's hand is removed.
- ii) Hose and hose connections for compressed air supply to portable pneumatic tools should be:
 - a) designed and tested for the pressure and service for which they are intended;
 - b) fastened securely on the pipe outlet and equipped with the safety chain, as appropriate.
- iii) Pneumatic shock tools should be equipped with safety clips or retainers to prevent dies and tools from being accidentally expelled from the barrel.
- iv) Pneumatic tools should be disconnected from power and the pressure in hose lines released before any adjustment or repair is made.

5.8.4 Electrical Tools

- i) Low voltage portable electrical tools should generally be used.
- ii) All electrical tools should be earthed, unless they are "all insulated" or "double insulated" tools which do not require earthing.
- iii) All electrical tools should get inspected and maintained on a regular basis by a competent electrician and complete records kept.

5.8.5 Engines

- i) Engines should:
 - a) be installed so that they can be started safely and the maximum safe speed cannot be exceeded.
 - b) have controls for limiting speed.

- c) have devices to stop them from a safe place in an emergency.
- ii) IC engines should not be run in confined spaces unless adequate exhaust ventilation is provided.
- iii) When IC engines are being fuelled:
 - a) the engine should be shut off.
 - b) care should be taken to avoid spilling fuel;
 - c) no person should smoke or have an naked light in the vicinity.
 - d) a fire extinguisher should be kept readily available.
- iv) Secondary fuel reservoir should be placed outside the engine room.

6.0 CONSTRUCTION ACTIVITIES

The various common activities in construction are as under:

- Excavation
- Scaffolding, Platforms & Ladders
- Structural Work, Laying of Reinforcement & Concreting
- Road Work (Laying of roads)
- Cutting /Welding
- Working in Confined Space
- Proof/Pressure Testing
- Working at Heights
- Handling & Lifting Equipments
- Vehicle Movement
- Electrical
- Offshore
- Demolition
- Radiography
 - Sand/shot blasting/ spray painting
 - Work above water

The safe practices to be followed during the implementation of above construction activities are given below:

6.1 EXCAVATION

- 6.1.1 All excavation work should be planned and the method of excavation and the type of support

work required should be decided considering the following:

- i) the stability of the ground;
 - ii) the excavation will not affect adjoining buildings, structures or roadways;
 - iii) to prevent hazard, the gas, water, electrical and other public utilities should be shut off or disconnected, if necessary;
 - iv) presence of underground pipes, cable conductors, etc.,
 - v) the position of culvert/bridges, temporary roads and spoil heaps should be determined;
- 6.1.2 Before digging begins on site, all excavation work should be planned and the method of excavation and the type of support work required decided.
- 6.1.3 All excavation work should be supervised.
- 6.1.4 Sites of excavations should be thoroughly inspected:
- i) daily, prior to each shift and after interruption in work of more than one day;
 - ii) after every blasting operation;
 - iii) after an unexpected fall of ground;
 - iv) after substantial damage to supports;
 - v) after a heavy rain, frost or snow;
 - vi) when boulder formations are encountered.
- 6.1.5 Safe angle of repose while excavating trenches exceeding 1.5m depth upto 3.0m should be maintained. Based on site conditions, provide proper slope, usually 45°, and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock or provide proper shoring and strutting to prevent cave-in or slides.
- 6.1.6 As far as possible, excavated earth should not be placed within one meter of the edge of the trench or depth of trench whichever is greater.
- 6.1.7 Don't allow vehicles to operate too close to excavated area. Maintain atleast 2m distance from edge of excavation. No load, plant or equipment should be placed or moved near the edge of any excavation where it is likely to cause its collapse and thereby endanger any person unless precautions such as the provision of shoring or piling are taken to prevent the sides from collapsing.
- 6.1.8 Adequately anchored stop blocks and barriers should be provided to prevent vehicles being driven into the excavation. Heavy vehicles should not be allowed near the excavation unless the support work has been specially designed to permit it.
- 6.1.9 If an excavation is likely to affect the security of a structure on which persons are working, precautions should be taken to protect the structure from collapse.
- 6.1.10 Barricade at 1m height (with red & white band/self glowing caution board) should be provided for excavations beyond 1.5m depth. Provide two entries/exits for such excavation.
- 6.1.11 Necessary precautions should be taken for underground utility lines like cables, sewers etc. and necessary approvals/clearances from the concerned authorities shall be obtained before commencement of the excavation job.
- 6.1.12 Water shall be pumped/bailed out, if any accumulates in the trench. Necessary precautions should be taken to prevent entry of surface water in trenches.
- 6.1.13 During rains, the soil becomes loose. Take additional precaution against collapse of side wall.
- 6.1.14 In hazardous areas, air should be tested to ascertain its quality. No one should be allowed entry till it is suitable for breathing.
- 6.1.15 In case of mechanised excavation, precaution shall be taken to not to allow anybody to come within one meter of extreme reach of the mechanical shovel. The mechanised excavator shall be operated by a well-trained experienced operator. When not in operation, the machine shall be kept on firm leveled ground with mechanical shovel resting on ground. Wheel or belt shall be suitably jammed to prevent any accidental movement of the

machine. Suitable precautions as per manufacturer guidelines should be taken for dozers, graders and other heavy machines.

- 6.1.16 In case of blasting, follow strictly IS:4081-1986 & Indian Explosive Act and rules for storage, handling and carrying of explosive materials and execution of blasting operation.

6.2 SCAFFOLDING, PLATFORMS & LADDERS

6.2.1 Metal as material of construction

- i) A scaffold should be provided and maintained or other equally safe and suitable provision should be made where work cannot safely be done on or from the ground or from part of a building or other permanent structure.
- ii) Scaffolds should be provided with safe means of access, such as stairs, ladders or ramps. Ladders should be secured against inadvertent movement.
- iii) Every scaffold should be constructed, erected and maintained so as to prevent collapse or accidental displacement when in use.
- iv) Every scaffold and part thereof should be constructed :
 - (a) in such a way so as not to cause hazards for workers during erection and dismantling;
 - (b) in such a way so as guard rails and other protective devices, platforms, ladders, stairs or ramps can be easily put together;
 - (c) with sound material and of requisite size and strength for the purpose for which it is to be used and maintained in a proper condition.
- v) Boards and planks used for scaffolds should be protected against splitting.
- vi) Materials used in the construction of scaffolds should be stored under good conditions and apart from any material unsuitable for scaffolds.
- vii) Couplers should not cause deformation in tubes. Couplers should be made of drop forged steel or equivalent material.

- viii) Tubes should be free from cracks, splits and excessive corrosion and be straight to the eye, and tube ends cut cleanly square with the tube axis.
- ix) Scaffolds should be designed for their maximum load as per relevant code.
- x) Scaffolds should be adequately braced.
- xi) Scaffolds which are not designed to be independent should be rigidly connected to the building at designated vertical and horizontal places.
- xii) A scaffold should never extend above the highest anchorage to an extent which might endanger its stability and strength.
- xiii) Loose bricks, drainpipes, chimney-pots or other unsuitable material should not be used for the construction or support of any part of a scaffold.
- xiv) Scaffolds should be inspected and certified:
 - (a) before being taken into use;
 - (b) at periodic intervals thereafter as prescribed for different types of scaffolds;
 - (c) after any alteration, interruption in use, exposure to weather or seismic conditions or any other occurrence likely to have affected their strength or stability.
- xv) Inspection should more particularly ascertain that:
 - (a) the scaffold is of suitable type and adequate for the job;
 - (b) materials used in its construction are sound and of sufficient strength;
 - (c) it is of sound construction and stable;
 - (d) that the required safeguards are in position.
- xvi) A scaffold should not be erected, substantially altered or dismantled except by or under the supervision.
- xvii) Every scaffold should be maintained in good and proper condition, and every part should be kept fixed or secured so that no part can be

SAFETY PRACTICES DURING CONSTRUCTION

OISD-GDN-192

**Oil Industry Safety Directorate
Government of India
Ministry of Petroleum and Natural Gas**

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SAFETY PRACTICES DURING CONSTRUCTION

1.0 INTRODUCTION

Safety in Construction Management deserves utmost attention especially in the hydrocarbon industry, such as Exploration, Refineries, Pipelines and Marketing installations, Gas Processing units etc. Construction is widely recognised as one of the accident prone activities. Most of the accidents are caused by inadequate planning, failure during the construction process and/or because of design deficiencies. Besides property loss, accidents also result in injuries and fatalities to the personnel; same needs to be prevented.

The reasons for accidents during construction activities are related to unique nature of the industry, human behaviour, difficult work-site conditions, extended odd duty hours, lack of training & awareness and inadequate safety management. Unsafe working methods, equipment failure and improper housekeeping also tend to increase the accident rate in construction.

Ensuring good quality of materials, equipment and competent supervision along with compliance of standard engineering practices shall go a long way to in built safety into the system.

The objective of this standard is to provide practical guidance on technical and educational framework for safety and health in construction with a view to:

- (a) prevent accidents and harmful effects on the health of workers arising from employment in construction;
- (b) ensure appropriate safety during implementation of construction;
- (c) provide safety practice guidelines for appropriate measures of planning, control and enforcement.

2.0 SCOPE

This document specifies broad guidelines on safe practices to be adhered to during construction activities in oil industry. However, before commencing any job, specific hazards and its effects should be assessed and necessary corrective/preventive actions should be taken by all concerned. The document is intended only to supplement and not to

replace or supersede the prevailing statutory requirements, which shall also be followed as applicable. For Personal Protective Equipment, OISD-STD-155 (Part I&II) shall be referred to. The scope of this document does not include the design aspects and quality checks during construction.

3.0 DEFINITIONS

Definitions of various terminology are given below:

- *Adequate, appropriate or suitable* are used to describe qualitatively or quantitatively the means or method used to protect the worker.
- *Brace*: A structural member that holds one point in a fixed position with respect to another point; bracing is a system of structural members designed to prevent distortion of a structure.
- *By hand*: The work is done without the help of a mechanised tool.
- *Competent Authority*: A statutory agency having the power to issue regulations, orders or other instructions having the force of law.
- *Competent person*: A person possessing adequate qualifications, such as suitable training and sufficient knowledge, experience and skill for the safe performance of the specific work. The competent authorities may define appropriate criteria for the designation of such persons and may determine the duties to be assigned to them.
- *Execution agency*:
Any physical or legal person, having contractual obligation with the owner, and who employs one or more workers on a construction site
- *Owner*:
Any physical or legal person for whom construction job is carried out.
It shall also include owner's designated representative/consultant/nominee/agent, authorised from time to time to act for and on its behalf, for supervising/

coordinating the activities of the execution agency.

- *Hazard*: Danger or potential danger.
- *Guard-rail*: An adequately secured rail erected along an exposed edge to prevent persons from falling.
- *Hoist*: A machine, which lifts materials or persons by means of a platform, which runs on guides.
- *Lifting gear*: Any gear or tackle by means of which a load can be attached to a lifting appliance but which does not form an integral part of the appliance or load.
- *Lifting appliance*: Any stationary or mobile appliance used for raising or lowering persons or loads.
- *Means of access or egress*: Passageways, corridors, stairs, platforms, ladders and any other means for entering or leaving the workplace or for escaping in case of danger.
- *Scaffold*: Any fixed, suspended or mobile temporary structure supporting workers and material or to gain access to any such structure and which is not a lifting appliance as defined above.
- *Toe-board*: A barrier placed along the edge of a scaffold platform, runway, etc., and secured there to guard against the slipping of persons or the falling of material.
- *Worker*: Any person engaged in construction activity.
- *Workplace*: All places where workers need to be or to go by reason of their work.

4.0 GENERAL DUTIES

4.1 GENERAL DUTIES OF EXECUTION AGENCIES

4.1.1 Execution agency should:

- i) provide means and organisation to comply with the safety and health measures required at the workplace.
- ii) provide and maintain workplaces, plant, equipment, tools and machinery and organise

construction work so that, there is no risk of accident or injury to health of workers. In particular, construction work should be planned, prepared and undertaken so that:

- (a) dangers, liable to arise at the workplace, are prevented;
 - (b) excessively or unnecessarily strenuous work positions and movements are avoided;
 - (c) organisation of work takes into account the safety and health of workers;
 - (d) materials and products used are suitable from a safety and health point of view;
 - (e) working methods are adopted to safeguard workers against the harmful effects of chemical, physical and biological agents.
- iii) establish committees with representatives of workers and management or make other arrangement for the participation of workers in ensuring safe working conditions.
 - iv) arrange for periodic safety inspections by competent persons of all buildings, plant, equipment, tools, machinery, workplaces and review of systems of work, regulations, standards or codes of practice. The competent person should examine and ascertain the safety of construction machinery and equipment.
 - v) provide such supervision to ensure that workers perform their work with due regard to safety and health of theirs as well as that of others.
 - vi) Employ only those workers who are qualified, trained and suited by their age, physique, state of health and skill.
 - vii) satisfy themselves that all workers are informed and instructed in the hazards connected with their work and environment and trained in the precautions necessary to avoid accidents and injury to health.
 - viii) Ensure that buildings, plant, equipment, tools, machinery or workplaces in which a dangerous defect has been found should not be used until the defect has been rectified.

- ix) Organise for and remain always prepared to take immediate steps to stop the operation and evacuate workers as appropriate, where there is an imminent danger to the safety of workers.
- x) establish a checking system by which it can be ascertained that all the members of a shift, including operators of mobile equipment, have returned to the camp or base at the close of work on dispersed sites and where small groups of workers operate in isolation.
- xi) provide appropriate first aid, training and welfare facilities to workers as per various statutes like the Factories Act, 1948 etc. and, whenever collective measures are not feasible or are insufficient, provide and maintain personal protective equipment and clothing in line with the requirement as per OISD-STD-155 (Vol. I & II) on Personnel Protective Equipment. They should also provide access to workers to occupational health services.
- xii) Educate workers about their right and the duty at any workplace to participate in ensuring safe working conditions to the extent of their control over the equipment and methods of work and to express views on working procedures adopted as may affect safety and health.
- xiii) Ensure that except in an emergency, workers, unless duly authorised, should not interfere with, remove, alter or displace any safety device or other appliance furnished for their protection or the protection of others, or interfere with any method or process adopted with a view to avoiding accidents and injury to health.
- xiv) Ensure that workers do not operate or interfere with plant and equipment that they have not been duly authorised to operate, maintain or use.
- xv) Ensure that workers do not sleep, rest or cook etc in dangerous places such as scaffolds, railway tracks, garages, confined spaces or in the vicinity of fires, dangerous or toxic substances, running machines or vehicles and heavy equipment etc.
- xvii) Obtain the necessary clearance/permits as required and specified by owner
- xviii) As per the Govt. circular as amended from time to time all contractors who employ more than 50 workers or where the contract value exceeds Rs. 50 crores, the following facilities are to be provided by contractor at site :
- Arrangement for drinking water
 - Toilet facilities
 - A creche where 10 or more women workers are having children below the age of 6 years
 - Transport arrangement for attending to emergencies
- xix) should deploy a safety officer at site
- 4.2 GENERAL DUTIES OF OWNERS**
- 4.2.1 Owners should:
- i) co-ordinate or nominate a competent person to co-ordinate all activities relating to safety and health on their construction projects;
 - ii) inform all contractors on the project of special risks to health and safety;
 - iii) Ensure that executing agency is aware of the owner's requirements and the executing agency's responsibilities with respect to safety practices before starting the job.
- 5.0 SAFETY PRACTICES AT WORK PLACES**
- 5.1. GENERAL PROVISIONS**
- 5.1.1 All openings and other areas likely to pose danger to workers should be clearly indicated.
- 5.1.2 Workers & Supervisors should use the safety helmet and other requisite Personal Protective Equipment according to job & site requirement. They should be trained to use personal protective equipment.
- 5.1.3 Never use solvents, alkalis and other oils to clean the skin.
- 5.1.4 Lift the load with back straight and knees bent as far as possible. Seek the help in case of heavy load.

5.1.5 Ensure the usage of correct and tested tools and tackles. Don't allow the make shift tools and tackles.

5.1.6 No loose clothing should be allowed while working near rotating equipment or working at heights.

5.2 MEANS OF ACCESS AND EGRESS

Adequate and safe means of access (atleast two, differently located) to and egress from all workplaces should be provided. Same should be displayed and maintained.

5.3 HOUSEKEEPING

5.3.1 Ensure:

- i) proper storage of materials and equipment;
- ii) removal of scrap, inflammable material, waste and debris at appropriate intervals.

5.3.2 Removal of loose materials, which are not required for use, to be ensured. Accumulation of these at the site can obstruct means of access to and egress from workplaces and passageways.

5.3.3 Workplaces and passageways, that are slippery owing to oil, grease or other causes, should be cleaned up or strewn with sand, sawdust, ash etc.

5.4 PRECAUTIONS AGAINST THE FALL OF MATERIALS & PERSONS AND COLLAPSE OF STRUCTURES

5.4.1 Precautions should be taken such as the provision of fencing, look-out men or barriers to protect any person against injury by the fall of materials, or tools or equipment being raised or lowered.

5.4.2 Where necessary to prevent danger, guys, stays or supports should be used or other effective precautions should be taken to prevent the collapse of structures or parts of structures that are being erected, maintained, repaired, dismantled or demolished.

5.4.3 All openings through which workers are liable to fall should be kept

effectively covered or fenced and displayed prominently.

5.4.4 As far as practicable, guardrails and toe-boards should be provided to protect workers from falling from elevated workplaces.

5.5 PREVENTION OF UNAUTHORISED ENTRY

5.5.1 Construction sites located in built-up areas and alongside vehicular and pedestrian traffic routes should be fenced to prevent the entry of unauthorised persons.

5.5.2 Visitors should not be allowed access to construction sites unless accompanied by or authorised by a competent person and provided with the appropriate protective equipment.

5.6 FIRE PREVENTION AND FIRE FIGHTING

5.6.1 All necessary measures should be taken by the executing agency and owner to:

- i) avoid the risk of fire;
- ii) control quickly and efficiently any outbreak of fire;
- iii) bring out a quick and safe evacuation of persons.
- iv) Inform unit/fire station control room, where construction work is carried out within existing operating area.

5.6.2 Combustible materials such as packing materials, sawdust, greasy/oily waste and scrap wood or plastics should not be allowed to accumulate in workplaces but should be kept in closed metal containers in a safe place.

5.6.3 Places where workers are employed should, if necessary to prevent the danger of fire, be provided with:

- i) suitable and sufficient fire-extinguishing equipment, which should be easily visible and accessible;
- ii) an adequate water supply at sufficient pressure meeting the requirements of various OISD standards.

5.6.4 To guard against danger at places having combustible material,

- workers should be trained in the action to be taken in the event of fire, including the use of means of escape.
- 5.6.5 At sites having combustible material, suitable visual signs should be provided to indicate clearly the direction of escape in case of fire.
- 5.6.6 Means of escape should be kept clear at all times. Escape routes should be frequently inspected particularly in high structures and where access is restricted.
- 5.7 LIGHTING**
- 5.7.1 Where natural lighting is not adequate, working light fittings or portable hand-lamps should be provided at workplace on the construction site where a worker will do a job.
- 5.7.2 Emergency lighting should be provided for personnel safety during night time to facilitate standby lighting source, if normal system fails.
- 5.7.2 Artificial lighting should not produce glare or disturbing shadows.
- 5.7.3 Lamps should be protected by guards against accidental breakage.
- 5.7.4 The cables of portable electrical lighting equipment should be of adequate size & characteristics for the power requirements and of adequate mechanical strength to withstand severe conditions in construction operations.
- 5.8 PLANT, MACHINERY, EQUIPMENT AND HAND TOOLS**
- 5.8.1 General Provisions**
- i) Plant, machinery and equipment including hand tools, both manual and power driven, should:
- be of proper design and construction, taking into account health, Safety and ergonomic principles.
 - be maintained in good working order;
 - be used only for work for which they have been designed.
- d) be operated only by workers who have been authorised and given appropriate training.
- e) be provided with protective guards, shields or other devices as required.
- ii) Adequate instructions for safe use should be provided.
- iii) Safe operating procedures should be established and used for all plant, machinery and equipment.
- iv) Operators of plant, machinery and equipment should not be distracted while work is in progress.
- v) Plant, machinery and equipment should be switched off when not in use and isolated before any adjustment, clearing or maintenance is done.
- vi) Where trailing cables or hose pipes are used they should be kept as short as practicable and not allowed to create a hazard.
- vii) All moving parts of machinery and equipment should be enclosed or adequately guarded.
- viii) Every power-driven machine and equipment should be provided with adequate means, immediately accessible and readily identifiable to the operator, of stopping it quickly and preventing it from being started again inadvertently.
- ix) Operators of plant, machinery, equipment and tools should be provided with PPEs, including where necessary, suitable ear protection.
- 5.8.2 Hand tools**
- i) Hand tools should be repaired by competent persons.
- ii) Heads of hammers and other shock tools should be dressed or ground to a suitable radius on the edge as soon as they begin to mushroom or crack.
- iii) When not in use and while being carried or transported sharp tools should be kept in sheaths, shields, chests or other suitable containers.
- iv) Only insulated or nonconducting tools should be used on or near live electrical installations.

- v) Only non-sparking tools should be used near or in the presence of flammable or explosive dusts or vapours.

5.8.3 Pneumatic Tools

- i) Operating triggers on portable pneumatic tools should be:
 - a) so placed as to minimise the risk of accidental starting of the machine.
 - b) so arranged as to close the air inlet valve automatically when the pressure of the operator's hand is removed.
- ii) Hose and hose connections for compressed air supply to portable pneumatic tools should be:
 - a) designed and tested for the pressure and service for which they are intended;
 - b) fastened securely on the pipe outlet and equipped with the safety chain, as appropriate.
- iii) Pneumatic shock tools should be equipped with safety clips or retainers to prevent dies and tools from being accidentally expelled from the barrel.
- iv) Pneumatic tools should be disconnected from power and the pressure in hose lines released before any adjustment or repair is made.

5.8.4 Electrical Tools

- i) Low voltage portable electrical tools should generally be used.
- ii) All electrical tools should be earthed, unless they are "all insulated" or "double insulated" tools which do not require earthing.
- iii) All electrical tools should get inspected and maintained on a regular basis by a competent electrician and complete records kept.

5.8.5 Engines

- i) Engines should:
 - a) be installed so that they can be started safely and the maximum safe speed cannot be exceeded.
 - b) have controls for limiting speed.

- c) have devices to stop them from a safe place in an emergency.
- ii) IC engines should not be run in confined spaces unless adequate exhaust ventilation is provided.
- iii) When IC engines are being fuelled:
 - a) the engine should be shut off.
 - b) care should be taken to avoid spilling fuel;
 - c) no person should smoke or have an naked light in the vicinity.
 - d) a fire extinguisher should be kept readily available.
- iv) Secondary fuel reservoir should be placed outside the engine room.

6.0 CONSTRUCTION ACTIVITIES

The various common activities in construction are as under:

- Excavation
- Scaffolding, Platforms & Ladders
- Structural Work, Laying of Reinforcement & Concreting
- Road Work (Laying of roads)
- Cutting /Welding
- Working in Confined Space
- Proof/Pressure Testing
- Working at Heights
- Handling & Lifting Equipments
- Vehicle Movement
- Electrical
- Offshore
- Demolition
- Radiography
 - Sand/shot blasting/ spray painting
 - Work above water

The safe practices to be followed during the implementation of above construction activities are given below:

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- 6.1.1 All excavation work should be planned and the method of excavation and the type of support

work required should be decided considering the following:

- i) the stability of the ground;
 - ii) the excavation will not affect adjoining buildings, structures or roadways;
 - iii) to prevent hazard, the gas, water, electrical and other public utilities should be shut off or disconnected, if necessary;
 - iv) presence of underground pipes, cable conductors, etc.,
 - v) the position of culvert/bridges, temporary roads and spoil heaps should be determined;
- 6.1.2 Before digging begins on site, all excavation work should be planned and the method of excavation and the type of support work required decided.
- 6.1.3 All excavation work should be supervised.
- 6.1.4 Sites of excavations should be thoroughly inspected:
- i) daily, prior to each shift and after interruption in work of more than one day;
 - ii) after every blasting operation;
 - iii) after an unexpected fall of ground;
 - iv) after substantial damage to supports;
 - v) after a heavy rain, frost or snow;
 - vi) when boulder formations are encountered.
- 6.1.5 Safe angle of repose while excavating trenches exceeding 1.5m depth upto 3.0m should be maintained. Based on site conditions, provide proper slope, usually 45°, and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock or provide proper shoring and strutting to prevent cave-in or slides.
- 6.1.6 As far as possible, excavated earth should not be placed within one meter of the edge of the trench or depth of trench whichever is greater.
- 6.1.7 Don't allow vehicles to operate too close to excavated area. Maintain atleast 2m distance from edge of excavation. No load, plant or equipment should be placed or moved near the edge of any excavation where it is likely to cause its collapse and thereby endanger any person unless precautions such as the provision of shoring or piling are taken to prevent the sides from collapsing.
- 6.1.8 Adequately anchored stop blocks and barriers should be provided to prevent vehicles being driven into the excavation. Heavy vehicles should not be allowed near the excavation unless the support work has been specially designed to permit it.
- 6.1.9 If an excavation is likely to affect the security of a structure on which persons are working, precautions should be taken to protect the structure from collapse.
- 6.1.10 Barricade at 1m height (with red & white band/self glowing caution board) should be provided for excavations beyond 1.5m depth. Provide two entries/exits for such excavation.
- 6.1.11 Necessary precautions should be taken for underground utility lines like cables, sewers etc. and necessary approvals/clearances from the concerned authorities shall be obtained before commencement of the excavation job.
- 6.1.12 Water shall be pumped/bailed out, if any accumulates in the trench. Necessary precautions should be taken to prevent entry of surface water in trenches.
- 6.1.13 During rains, the soil becomes loose. Take additional precaution against collapse of side wall.
- 6.1.14 In hazardous areas, air should be tested to ascertain its quality. No one should be allowed entry till it is suitable for breathing.
- 6.1.15 In case of mechanised excavation, precaution shall be taken to not to allow anybody to come within one meter of extreme reach of the mechanical shovel. The mechanised excavator shall be operated by a well-trained experienced operator. When not in operation, the machine shall be kept on firm leveled ground with mechanical shovel resting on ground. Wheel or belt shall be suitably jammed to prevent any accidental movement of the

machine. Suitable precautions as per manufacturer guidelines should be taken for dozers, graders and other heavy machines.

- 6.1.16 In case of blasting, follow strictly IS:4081-1986 & Indian Explosive Act and rules for storage, handling and carrying of explosive materials and execution of blasting operation.

6.2 SCAFFOLDING, PLATFORMS & LADDERS

6.2.1 Metal as material of construction

- i) A scaffold should be provided and maintained or other equally safe and suitable provision should be made where work cannot safely be done on or from the ground or from part of a building or other permanent structure.
- ii) Scaffolds should be provided with safe means of access, such as stairs, ladders or ramps. Ladders should be secured against inadvertent movement.
- iii) Every scaffold should be constructed, erected and maintained so as to prevent collapse or accidental displacement when in use.
- iv) Every scaffold and part thereof should be constructed :
 - (a) in such a way so as not to cause hazards for workers during erection and dismantling;
 - (b) in such a way so as guard rails and other protective devices, platforms, ladders, stairs or ramps can be easily put together;
 - (c) with sound material and of requisite size and strength for the purpose for which it is to be used and maintained in a proper condition.
- v) Boards and planks used for scaffolds should be protected against splitting.
- vi) Materials used in the construction of scaffolds should be stored under good conditions and apart from any material unsuitable for scaffolds.
- vii) Couplers should not cause deformation in tubes. Couplers should be made of drop forged steel or equivalent material.

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- x) Scaffolds should be adequately braced.
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- xii) A scaffold should never extend above the highest anchorage to an extent which might endanger its stability and strength.
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 - (a) before being taken into use;
 - (b) at periodic intervals thereafter as prescribed for different types of scaffolds;
 - (c) after any alteration, interruption in use, exposure to weather or seismic conditions or any other occurrence likely to have affected their strength or stability.
- xv) Inspection should more particularly ascertain that:
 - (a) the scaffold is of suitable type and adequate for the job;
 - (b) materials used in its construction are sound and of sufficient strength;
 - (c) it is of sound construction and stable;
 - (d) that the required safeguards are in position.
- xvi) A scaffold should not be erected, substantially altered or dismantled except by or under the supervision.
- xvii) Every scaffold should be maintained in good and proper condition, and every part should be kept fixed or secured so that no part can be

displaced in consequence of normal use.

- xviii) If out-rigger scaffolding is to be used, it should be specifically designed and inspected before putting in use.

6.2.2 Lifting appliances on scaffolds

- i) When a lifting appliance is to be used on a scaffold:
 - (a) the parts of the scaffold should be carefully inspected to determine the additional strengthening and other safety measures required;
 - (b) any movement of the scaffold members should be prevented;
 - (c) if practicable, the uprights should be rigidly connected to a solid part of the building at the place where the lifting appliance is erected.

6.2.3 Prefabricated scaffolds

- i) In the case of prefabricated scaffold systems, the instructions provided by the manufacturers or suppliers should be strictly adhered to. Prefabricated scaffolds should have adequate arrangements for fixing bracing.
- ii) Frames of different types should not be intermingled in a single scaffold.
- iii) Scaffolding shall be erected on firm and level ground.
- iv) All members of metal scaffolding shall be checked periodically to screen out defective / rusted members. All joints should be properly lubricated for easy tightening.
- v) Entry to scaffolding should be restricted.
- vi) Erection, alteration and removal shall be done under supervision of experienced personnel.
- vii) Use of barrels, boxes, loose bricks etc., for supporting platform shall not be permitted.
- viii) Each supporting member of platform shall be securely fastened and braced
- ix) Where planks are butt-joined, two parallel putlogs shall be used, not

more than 100mm apart, to give support to each plank.

- x) Platform plank shall not project beyond its end support to a distance exceeding 4 times the thickness of plank, unless it is effectively secured to prevent tipping. Cantilever planks should be avoided.
- xi) The platform edges shall be provided with 150mm high toe board to eliminate hazards of tools or other objects falling from platform.
- xii) Erect ladders in the "four up-one out position"
- xiii) Lash ladder securely with the structure.
- xiv) Using non-slip devices, such as, rubber shoes or pointed steel ferules at the ladder foot, rubber wheels at ladder top, fixing wooden battens, cleats etc.
- xv) When ladder is used for climbing over a platform, the ladder must be of sufficient length, to extend at least one meter above the platform, when erected against the platform in "four up-one out position."
- xvi) Portable ladders shall be used for heights not more than 4mt. Above 4mt flights, fixed ladders shall be provided with at least 600 mm landings at every 6mt or less.
- xvii) The width of ladder shall not be less than 300mm and rungs shall be spaced not more than 300mm.
- xviii) Every platform and means of access shall be kept free from obstruction.
- xix) If grease, mud, gravel, mortar etc., fall on platform or scaffolds, these shall be removed immediately to avoid slippage.
- xx) Workers shall not be allowed to work on scaffolds during storms or high wind. After heavy rain or storms, scaffolds shall be inspected before reuse.
- xxi) Don't overload the scaffolding. Remove excess material and scrap immediately.
- xxii) Dismantling of scaffolds shall be done in a pre-planned sequential manner.

6.2.4 Suspended scaffolds/boatwain's chair

- i) In addition to the requirements for scaffolds in general as regards soundness, stability and protection against the risk of falls, suspended scaffolds should meet the following specific requirements.
 - (a) platforms should be designed and built with dimensions that are compatible with the stability of the structure as a whole, especially the length;
 - (b) the number or anchorage should be compatible with the dimensions of the platform;
 - (c) the safety of workers should be safeguarded by an extra rope having a point of attachment independent of the anchorage arrangements of the scaffold;
 - (d) the anchorage and other elements of support of the scaffold should be designed and built in such a way as to ensure sufficient strength;
 - (e) the ropes, winches, pulleys or pulley blocks should be designed, assembled, used and maintained according to the requirements established for lifting gear adapted to the lifting of persons according to national laws and regulations;
 - (f) Before use, the whole structure should be checked by a competent person.

6.2.5 Bamboo Scaffolding

- i) In general, it should be avoided as far as possible. It should not be used in the unit/off-site areas and where hot work is to be done.
- ii) For construction and maintenance of residential and office buildings, situated outside explosive licensed area, bamboo scaffold, if used, should conform to provisions given in IS-3696 (Part 1)-1987.

6.3 STRUCTURAL WORK, LAYING OF REINFORCEMENT & CONCRETING

6.3.1 General provisions

- i) The erection or dismantling of buildings, structures, civil

engineering works, formwork, falsework and shoring should be carried out by trained workers only under the supervision of a competent person.

- ii) Precautions should be taken to guard against danger to workers arising from any temporary state of weakness or instability of a structure.
- iii) Formwork, falsework and shoring should be so designed, constructed and maintained that it will safely support all loads that may be imposed on it.
- iv) Formwork should be so designed and erected that working platforms, means of access, bracing and means of handling and stabilising are easily fixed to the formwork structure.

6.3.2. Erection and dismantling of steel and prefabricated structures

- i) The safety of workers employed on the erection and dismantling of steel and prefabricated structures should be ensured by appropriate means, such as provision and use of:
 - (a) ladders, gangways or fixed platforms;
 - (b) platforms, buckets, boatswain's chairs or other appropriate means suspended from lifting appliances;
 - (c) safety harnesses and lifelines, catch nets or catch platforms;
 - (d) Power-operated mobile working platforms.
- ii) Steel and prefabricated structures should be so designed and made that they can be safely transported and erected.
- iii) In addition to the need for the stability of the part when erected, the design should explicitly take following into account:
 - (a) the conditions and methods of attachment in the operations of transport, storing and temporary support during erection or dismantling as applicable;
 - (b) Methods for the provision of safeguards such as railings and working platforms, and, when necessary, for mounting them

- easily on the structural steel or prefabricated parts.
- iv) The hooks and other devices built in or provided on the structural steel or prefabricated parts that are required for lifting and transporting them should be so shaped, dimensioned and positioned as:
 - (a) to withstand with a sufficient margin the stresses to which they are subjected;
 - (b) Not to set up stresses in the part that could cause failures, or stresses in the structure itself not provided for in the plans, and be designed to permit easy release from the lifting appliance. Lifting points for floor and staircase units should be located (recessed if necessary) so that they do not protrude above the surface;
 - (c) To avoid imbalance or distortion of the lifted load.
 - v) Storeplaces should be so constructed that:
 - (a) there is no risk of structural steel or prefabricated parts falling or overturning;
 - (b) storage conditions generally ensure stability and avoid damage having regard to the method of storage and atmospheric conditions;
 - (c) racks are set on firm ground and designed so that units cannot move accidentally.
 - vi) While they are being stored, transported, raised or set down, structural steel or prefabricated parts should not be subjected to stresses prejudicial to their stability.
 - vii) Every lifting appliance should:
 - (a) be suitable for the operations and not be capable of accidental disconnection;
 - (b) be approved or tested as per statutory requirement.
 - viii) Lifting hooks should be of the self-closing type or of a safety type and should have the maximum permissible load marked on them.
 - ix) Tongs, clamps and other appliances for lifting structural steel and prefabricated parts should:
 - (a) be of such shape and dimensions as to ensure a secure grip without damaging the part;
 - (b) be marked with the maximum permissible load in the most unfavourable lifting conditions.
 - x) Structural steel or prefabricated parts should be lifted by methods or appliances that prevent them from spinning accidentally.
 - xi) When necessary to prevent danger, before they are raised from the ground, structural steel or prefabricated parts should be provided with safety devices such as railings and working platforms to prevent falls of persons.
 - xii) While structural steel or prefabricated parts are being erected, the workers should be provided with appliances for guiding them as they are being lifted and set down, so as to avoid crushing of hands and to facilitate the operations. Use of such appliances should be ensured.
 - xiii) A raised structural steel or prefabricated part should be so secured and wall units so propped that their stability cannot be imperiled, even by external agencies such as wind and passing loads before its release from the lifting appliance.
 - xiv) At work places, instruction should be given to the workers on the methods, arrangements and means required for the storage, transport, lifting and erection of structural steel or prefabricated parts, and, before erection starts, a meeting of all those responsible should be held to discuss and confirm the requirements for safe erection.
 - xv) During transportation within the construction area, attachments such as slings and stirrups mounted on structural steel or prefabricated parts should be securely fastened to the parts.
 - xvi) Structural steel or prefabricated parts should be so transported that the conditions do not affect the stability of the parts or the means of transport result in jolting, vibration or stresses due to blows, or loads of material or persons.

- xvii) When the method of erection does not permit the provision of other means of protection against fall of persons, the workplaces should be protected by guardrails, and if appropriate by toe-boards.
- xviii) When adverse weather conditions such as snow, ice and wind or reduced visibility entail risks of accidents, the work should be carried on with particular care, or, if necessary, interrupted.
- xix) Structures should not be worked on during violent storms or high winds, or when they are covered with ice or snow, or are slippery from other causes.
- xx) If necessary, to prevent danger, structural steel parts should be equipped with attachments for suspended scaffolds, lifelines or safety harnesses and other means of protection.
- xxi) The risks of falling, to which workers moving on high or sloping girders are exposed, should be limited by all means of adequate collective protection or, where this is impossible, by the use of a safety harness that is well secured to a strong support.
- xxii) Structural steel parts that are to be erected at a great height should as far as practicable be assembled on the ground.
- xxiii) When structural steel or prefabricated parts are being erected, a sufficiently extended area underneath the workplace should be barricaded or guarded
- xxiv) Steel trusses that are being erected should be adequately shored, braced or guyed until they are permanently secured in position.
- xxv) Load-bearing structural member should not be dangerously weakened by cutting, holing or other means.
- xxvi) Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.
- xxvii) Open-web steel joists that are hoisted singly should be directly

placed in position and secured against dislodgment.

6.3.3 Reinforcement

- i) Ensure that workers use Personnel Protective equipment like safety helmet, safety shoes, gloves etc.
- ii) Don't place the hand below the rods for checking clear distance. Use measuring devices.
- iii) Don't wear loose clothes while checking the rods.
- iv) Don't stand unnecessarily on cantilever rods.
- v) To carry out welding/cutting of rods, safety procedures/precautions as mentioned in Item No. 6.5 to be followed.
- vi) For supplying of rods at heights, proper staging and/or bundling to be provided.
- vii) Ensure barricading and staging for supplying and fixing of rods at height.
- viii) For short distance carrying of materials on shoulders, suitable pads to be provided.
- ix) While transporting material by trucks/trailers, the rods shall not protrude in front of or by the sides of driver's cabin. In case such protrusion cannot be avoided behind the deck, then it should not extend $1/3^{rd}$ of deck length or 1.5M which ever is less and tied with red flags/lights.

6.3.4 Concreting

- i) Ensure stability of shuttering work before allowing concreting.
- ii) Barricade the concreting area while pouring at height/depths.
- iii) Keep vibrator hoses, pumping concrete accessories in healthy conditions and mechanically locked.
- iv) Pipelines in concrete pumping system shall not be attached to temporary structures such as scaffolds and formwork support as the forces and movements may effect their integrity.

- v) Check safety cages & guards around moving motors/parts etc. provided in concreting mixers.
- vi) Use Personal Protective Equipment like gloves, safety shoes etc. while dealing with concrete and wear respirators for dealing with cement.
- vii) Earthing of electrical mixers, vibrators, etc. should be done and verified.
- viii) Cleaning of rotating drums of concrete mixers shall be done from outside. Lockout devices shall be provided where workers need to enter.
- ix) Where concrete mixers are driven by internal combustion engine, exhaust points shall be located away from the worker's workstation so as to eliminate their exposure to obnoxious fumes.
- x) Don't allow unauthorised person to stand under the concreting area.
- xi) Ensure adequate lighting arrangements for carrying out concrete work during night.
- xii) Don't allow the same workers to pour concrete round the clock. Insist on shift pattern.
- xiii) During pouring, shuttering and its supports should be continuously watched for defects.

6.4 ROAD WORK

- 6.4.1 Site shall be barricaded and provided with warning signs, including night warning lamps at appropriate locations for traffic diversion.
- 6.4.2 Filled and empty bitumen drums shall be stacked separately at designated places.
- 6.4.3 Mixing aggregate with bitumen shall preferably be done with the help of bitumen batch mixing plant, unless operationally non-feasible.
- 6.4.4 Road rollers, Bitumen sprayers, Pavement finishers shall be driven by experienced drivers with valid driving license.
- 6.4.5 Workers handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen

with aggregate, shall be provided with PVC hand gloves and rubber shoes with legging up to knee joints.

- 6.4.6 At the end of day's work, surplus hot bitumen in tar boiler shall be properly covered by a metal sheet, to prevent anything falling in it,
- 6.4.7 If bitumen accidentally falls on ground, it shall be immediately covered by sprinkling sand, to prevent anybody stepping on it. Then it shall be removed with the help of spade.
- 6.4.8 For cement concrete roads, besides site barricading and installation of warning signs for traffic diversion, safe practices mentioned in the chapter on "Concreting", shall also be applicable.

6.5 CUTTING/WELDING

- 6.5.1 Common hazards involved in welding/cutting are sparks, molten metal, flying particles, harmful light rays, electric shocks etc. Following precautions should be taken: -
 - i) A dry chemical type fire extinguisher shall be made available in the work area.
 - ii) Adequate ventilation shall be ensured by opening manholes and fixing a shield or forced circulation of air etc, while doing a job in confined space.
 - iii) Ensure that only approved and well-maintained apparatus, such as torches, manifolds, regulators or pressure reducing valves, and acetylene generators, be used.
 - iv) All covers and panels shall be kept in place, when operating an electric Arc welding machine.
 - v) The work piece should be connected directly to Power supply, and not indirectly through pipelines/structures/equipments etc.
 - vi) The welding receptacles shall be rated for 63 A suitable for 415V, 3 Phase system with a scraping earth. Receptacles shall have necessary mechanical interlocks and earthing facilities.
 - vii) All cables, including welding and ground cables, shall be checked for

- any worn out or cracked insulation before starting the job. Ground cable should be separate without any loose joints.
- viii) Cable coiling shall be maintained at minimum level, if not avoidable.
 - ix) An energised electrode shall not be left unattended.
 - x) The power source shall be turned off at the end of job.
 - xi) All gas cylinders shall be properly secured in upright position.
 - xii) Acetylene cylinder shall be turned and kept in such a way that the valve outlet points away from oxygen cylinder.
 - xiii) Acetylene cylinder key for opening valve shall be kept on valve stem, while cylinder is in use, so that the acetylene cylinder could be quickly turned off in case of emergency. Use flash back arrestors to prevent back-fire in acetylene/oxygen cylinder.
 - xiv) When not in use, valves of all cylinders shall be kept closed.
 - xv) All types of cylinders, whether full or empty, shall be stored at cool, dry place under shed.
 - xvi) Forced opening of any cylinder valve should not be attempted.
 - xvii) Lighted gas torch shall never be left unattended.
 - xviii) Store acetylene and oxygen cylinders separately.
 - xix) Store full and empty cylinders separately.
 - xx) Avoid cylinders coming into contact with heat.
 - xxi) Cylinders that are heavy or difficult to carry by hand may be rolled on their bottom edge but never dragged.
 - xxii) If cylinders have to be moved, be sure that the cylinder valves are shut off.
 - xxiii) Before changing torches, shut off the gas at the pressure reducing regulators and not by crimping the hose.
 - xxiv) Do not use matches to light torches, use a friction lighter.
 - xxv) Move out any leaking cylinder immediately.
 - xxvi) Use trolleys for oxygen & acetylene cylinder and chain them.
 - xxvii) Always use Red hose for acetylene and other fuel gases and Black for oxygen, and ensure that both are in equal length.
 - xxviii) Ensure that hoses are free from burns, cuts and cracks and properly clamped.
 - xxix) Avoid dragging hoses over sharp edges and objects
 - xxx) Do not wrap hoses around cylinders when in use or stored.
 - xxxi) Protect hoses from flying sparks, hot slag, and other hot objects.
 - xxxii) Lubricants shall not be used on Ox-fuel gas equipment.
 - xxxiii) During cutting/welding, use proper type goggles/face shields.
- ## 6.6 WORKING IN CONFINED SPACES
- ### 6.6.1 Following safety practices for working in confined space like towers, columns, tanks and other vessels should be followed in addition to the safety guidelines for specific jobs like scaffolding, cutting/welding etc.
- i) Shut down, isolate, depressurise and purge the vessel as per laid down procedures.
 - ii) Entry inside the vessel and to carry out any job should be done after issuance of valid permit only in line with the requirement of OISD-STD-105.
 - iii) Ensure proper and accessible means of exit before entry inside a confined space.
 - iv) The number of persons allowed inside the vessel should be limited to avoid overcrowding.
 - v) When the work is going on in the confined space, there should always be one man standby at the nearby manway.

- vi) Before entering inside the vessels underground or located at lower elevation, probability of dense vapours accumulating nearby should also be considered in addition to inside the vessel.
- vii) Ensure requisite O₂ level before entry in the confined space and monitor level periodically or other wise use respiratory devices.
- viii) Check for no Hydrocarbon or toxic substances before entry and monitor level periodically or use requisite Personal Protective Equipment.
- ix) Ensure adequate ventilation or use respiratory devices.
- x) Depending upon need, necessary respirator system, gas masks and suit shall be worn by everyone entering confined space. In case of sewer, OWS or in the confined area where there is a possibility of toxic or inert gas, gas masks shall be used by everyone while entering.
- xi) Barricade the confined spaces during hoisting, radiography, blasting, pressure testing etc.
- xii) Use 24V flameproof lamp fittings only for illumination.
- xiii) Use tools with air motors or electric tools with maximum voltage of 24V.
- xiv) House keeping shall be well maintained.
- xv) Safety helmet, safety shoes and safety belt shall be worn by everyone entering the confined space.
- xvi) Don't wear loose clothing while working in a confined space.
- xvii) In case of the vessels which are likely to contain pyrophoric substances (like Iron Sulphide), special care need to be taken before opening the vessel. Attempt should be made to remove the pyrophoric substances. Otherwise, these should be always kept wet by suitable means.
- xviii) The cutting torches should also be kept outside the vessel immediately after the cutting.
- xix) The gas cylinders used for cutting/welding shall be kept outside.
- xx) All cables, hoses, welding equipment etc., shall be removed from confined space at end of each work day, even if the work is to be resumed in the same space the next day.
- xxi) To the extent possible sludge shall be cleared and removed from outside before entering.
- xxii) No naked light or flame or hot work such as welding, cutting and soldering should be permitted inside a confined space or area unless it has been made completely free of the flammable atmosphere, tested and found safe by a competent person. Only non-sparking tools and flameproof hand lamps protected with guard and safety torches should be used inside such confined space or area for initial inspection, cleaning or other work required to be done for making the area safe.
- xxiii) Communication should be always maintained between the worker and the attendant.

6.7 PROOF/PRESSURE TESTING

- 6.7.1 Review test procedure before allowing testing with water or air or any other fluid.
- 6.7.2 Provide relief valves of adequate size while testing with air or other gases.
- 6.7.3 Ensure compliance of necessary precautions, step wise loading, tightening of fasteners, grouting etc. before and during testing.
- 6.7.4 Inform all concerned in advance of the testing.
- 6.7.5 Keep the vents open before opening any valve for filling/drainage of liquid used for hydrotesting. The filling/drainage should not exceed the designed rate for pressure testing.
- 6.7.6 Provide separate gauges of suitable range for pressurising pump and the equipment to be tested.
- 6.7.7 Provide gauges at designated locations for monitoring of pressures.

6.7.8 Check the calibration of all pressurising equipment and accessories and maintain records.

6.7.9 Take readings at pre-defined intervals.

6.8 WORKING AT HEIGHTS

6.8.1 General Provision

- i) While working at a height of more than 3 meters, ISI approved safety belt shall be used.
- ii) While working at a height of more than 3 meters, permit should be issued by competent person before commencement of the job.
- iii) Worker should be well trained on usage of safety belt including its proper usage at the time of ascending/descending.
- iv) All tools should be carried in tool kits to avoid their falling.
- v) If the job is on fragile/sloping roof, roof walk ladders shall be used.
- vi) Provide lifeline wherever required.
- vii) Additional safety measures like providing Fall Arrestor type Safety belt, safety net should be provided depending upon site conditions, job requirements.
- viii) Keep working area neat and clean. Remove scrap material immediately.
- ix) Don't throw or drop material/equipment from height.
- x) Avoid jumping from one member to another. Use proper passageway.
- xi) Keep both hands free while climbing. Don't try to bypass the steps of the ladder.
- xii) Try to maintain calm at height. Avoid over exertion.
- xiii) Avoid movements on beam.
- xiv) Elevated workplaces including roofs should be provided with safe means of access and egress such as stairs, ramps or ladders.

6.8.2 Roof Work

- i) All roof-work operations should be pre-planned and properly supervised.

ii) Roof work should only be undertaken by workers who are physically and psychologically fit and have the necessary knowledge and experience for such work.

iii) Work on roofs shouldn't be carried on in weather conditions that threaten the safety of workers.

iv) Crawling boards, walkways and roof ladders should be securely fastened to a firm structure.

v) Roofing brackets should fit the slope of the roof and be securely supported.

vi) Where it is necessary for a person to kneel or crouch near the edge of the roof, necessary precautions should be taken.

vii) On a large roof where work have to be carried out at or near the edge, a simple barrier consisting of crossed scaffold tubes supporting a tubing guardrail may be provided.

viii) All covers for openings in roofs should be of substantial construction and be secured in position.

ix) Roofs with a pitch of more than 10 should be treated as sloping.

x) When work is being carried out on sloping roofs, sufficient and suitable crawling boards or roof ladders should be provided and firmly secured in position.

xi) During extensive work on the roof, strong barriers or guardrails and toe-boards should be provided to stop a person from falling off the roof.

xii) Where workers are required to work on or near roofs or other places covered with fragile material, through which they are liable to fall, they should be provided with suitable roof ladders or crawling boards strong enough and when spanning across the supports for the roof covering to support those workers.

xiii) A minimum of two boards should be provided so that it is not necessary for a person to stand on a fragile roof to move a board or a ladder, or for any other reason.

6.8.3 Work on tall chimneys

- i) For the erection and repair of tall chimneys, scaffolding should be provided. A safety net should be maintained at a suitable distance below the scaffold.
- ii) The scaffold floor should always be at least 65 cm below the top of the chimney.
- iii) Under the working floor of the scaffolding the next lower floor should be left in position as a catch platform.
- iv) The distance between the inside edge of the scaffold and the wall of the chimney should not exceed 20 cm at any point.
- v) Catch platforms should be erected over:
 - (a) the entrance to the chimney;
 - (b) Passageways and working places where workers could be endangered by falling objects.
- vi) For climbing tall chimneys, access should be provided by:
 - (a) stairs or ladders;
 - (b) a column of iron rungs securely embedded in the chimney wall;
 - (c) Other appropriate means.
- vii) When workers use the outside rungs to climb the chimney, a securely fastened steel core rope looped at the free end and hanging down at least 3 m should be provided at the top to help the workers to climb on to the chimney.
- viii) While work is being done on independent chimneys the area surrounding the chimney should be enclosed by fencing at a safe distance.
- ix) Workers employed on the construction, alteration, maintenance or repair of tall chimneys should not:
 - a) work on the outside without a safety harness attached by a lifeline to a rung, ring or other secure anchorage;
 - b) put tools between the safety harness and the body or in pockets not intended for the purpose;

- c) haul heavy materials or equipment up and down by hand to or from the workplace on the chimney;
- d) fasten pulleys or scaffolding to reinforcing rings without first verifying their stability;
- e) work alone;
- f) climb a chimney that is not provided with securely anchored ladders or rungs;
- g) Work on chimneys in use unless the necessary precautions to avoid danger from smoke and gases have been taken.
- x) Work on independent chimneys should not be carried on in high winds, icy conditions, fog or during electrical storms.

6.9 HANDLING AND LIFTING EQUIPMENT:

6.9.1 General Provisions

Following are the general guidelines to be followed with regard to all types of handling and lifting equipment in addition to the guidelines for specific type of equipments dealt later on.

- i) There should be a well-planned safety programme to ensure that all the lifting appliances and lifting gear are selected, installed, examined, tested, maintained, operated and dismantled with a view to preventing the occurrence of any accident;
- ii) All lifting appliances shall be examined by competent persons at frequencies as specified in "The Factories act".
- iii) Check thoroughly quality, size and condition of all lifting tools like chain pulley blocks, slings, U-clamps, D-shackles etc. before putting them in use.
- iv) Safe lifting capacity of all lifting & handling equipment, tools and shackles should be got verified and certificates obtained from competent authorities before its use. The safe working load shall be marked on them.
- v) Check periodically the oil, brakes, gears, horns and tyre pressure of all moving equipments like cranes,

- forklifts, trailers etc as per manufacturer's recommendations.
- vi) Check the weights to be lifted and accordingly decide about the crane capacity, boom length and angle of erection.
 - vii) Allow lifting slings as short as possible and check packing at the friction points.
 - viii) While lifting/placing of the load, no unauthorised person shall remain within the radius of the boom and underneath the load.
 - ix) While loading, unloading and stacking of pipes, proper wedges shall be placed to prevent rolling down of the pipes.
 - x) Control longer jobs being lifted up from both ends.
 - xi) Only trained operators and riggers should carry out the job. While the crane is moving or lifting the load, the trained rigger should be there for keeping a vigil against hitting any other object.
 - xii) During high wind conditions and nights, lifting of heavy equipments should be avoided. If unavoidable to do erection in night, operator and rigger should be fully trained for night signaling. Also proper illumination should be there.
 - xiii) Allow crane to move on hard, firm and leveled ground.
 - xiv) When crane is in idle condition for long periods or unattended, crane boom should either be lowered or locked as per manufacturer's guidelines.
 - xv) Hook and load being lifted shall remain in full visibility of crane operators, while lifting, to the extent possible.
 - xvi) Don't allow booms or other parts of crane to come within 3 meters reach of overhead electrical cables.
 - xvii) No structural alterations or repairs should be made to any part of a lifting appliance, which may affect the safety of the appliance without the permission and supervision of the competent person.

6.9.2 Hoists

- i) Hoist shafts should be enclosed with rigid panels or other adequate fencing at:
 - (a) ground level on all sides;
 - (b) all other levels at all points at which access is provided;
 - (c) all points at which persons are liable to be struck by any moving part.
- ii) The enclosure of hoist shafts, except at approaches should extend where practicable at least 2mt above the floor, platform or other place to which access is provided except where a lesser height is sufficient to prevent any person falling down the hoistway and there is no risk of any person coming into contact with any moving part of the hoist, but in no case should the enclosure be less than 1mt in height.
- iii) The guides of hoist platforms should offer sufficient resistance to bending and, in the case of jamming by a safety catch, to buckling.
- iv) Where necessary to prevent danger, adequate covering should be provided above the top of hoist shafts to prevent material falling down them.
- v) Outdoor hoist towers should be erected on firm foundations, and securely braced, guyed and anchored.
- vi) A ladderway should extend from the bottom to the top of outdoor hoist towers, if no other ladderway exists within easy reach.
- vii) Hoisting engines should be of ample capacity to control the heaviest load that they will have to move.
- viii) Hoists should be provided with devices that stop the hoisting engine as soon as the platform reaches its highest stopping place.
- ix) Winches should be so constructed that the brake is applied when the control handle is not held in the operating position.
- x) It should not be possible to set in motion from the platform a hoist, which is not designed for the conveyance of persons.

- xi) Winches should not be fitted with pawl and ratchet gears on which the pawl must be disengaged before the platform is lowered.
 - xii) Hoist platforms should be capable of supporting the maximum load that they will have to carry with a safety factor.
 - xiii) Hoist platforms should be equipped with safety gear that will hold the platform with the maximum load if the hoisting rope breaks.
 - xiv) If workers have to enter the cage or go on the platform at landings there should be a locking arrangement preventing the cage or platform from moving while any worker is in or on it.
 - xv) On sides not used for loading and unloading, hoist platforms should be provided with toe-boards and enclosures of wire mesh or other suitable material to prevent the fall of parts of loads.
 - xvi) Where necessary to prevent danger from falling objects, hoist platforms should be provided with adequate covering.
 - xvii) Counterweights consisting of an assemblage of several parts should be made of specially constructed parts rigidly connected together.
 - xviii) Counterweights should run in guides.
 - xix) Platforms should be provided at all landings used by workers.
 - xx) Following notices should be posted up conspicuously and in very legible characters:
 - (a) on all hoists:
 - on the platform: the carrying capacity in kilograms or other appropriate standard unit of weight;
 - on the hoisting engine: the lifting capacity in kilograms or other appropriate standard unit of weight;
 - (b) on hoists authorised or certified for the conveyance of persons:
 - on the platform or cage: the maximum number of persons to be carried at one time;
 - (c) on hoists for goods only:
 - on every approach to the hoist and on the platform: prohibition of use by persons.
 - xxi) Hoists intended for the carriage of persons should be provided with a cage so constructed as to prevent any person from falling out or being trapped between the cage and any fixed part of the structure when the cage gate is shut, or from being struck by the counterbalance weight or by articles or materials tailing down the hoistway.
 - xxii) On each side in which access is provided, the cage should have a gate fitted with devices which ensure that the gate cannot be opened except when the cage is at a landing and that the gate must be closed before the cage can move away from the landing.
 - xxiii) Every gate in the enclosure of the hoist shaft which gives access from a landing place to the cage should be fitted with devices to ensure that the gate cannot be opened except when the cage is at that landing place, and that the cage cannot be moved away from that landing place until the gate is closed.
- ### 6.9.3 Derricks
- #### Stiff-leg derricks
- i) Derricks should be erected on a firm base capable of taking the combined weight of the crane structure and maximum rated load.
 - ii) Devices should be used to prevent masts from lifting out of their seating.
 - iii) Electrically operated derricks should be effectively earthed from the sole plate or framework.
 - iv) Counterweights should be so arranged that they do not subject the backstays, sleepers or pivots to excessive strain.
 - v) When derricks are mounted on wheels:

- a) a rigid member should be used to maintain the correct distance between the wheels;
- b) they should be equipped with struts to prevent them from dropping if a wheel breaks or the derrick is derailed.
- vi) The length of a derrick jib should not be altered without consulting the manufacturer.
- vii) The jib of a scotch derrick crane should not be erected within the backstays of the crane.

Guy derricks

- i) The restraint of the guy ropes should be ensured by fitting stirrups or anchor plates in concrete foundations.
- ii) The mast of guy derricks should be supported by six top guys spaced approximately equally.
- iii) The spread of the guys of a guy derrick crane from the mast should not be more than 45° from the horizontal.
- iv) Guy ropes of derricks should be equipped with a stretching screw or turnbuckle or other device to regulate the tension.
- v) Gudgeon pins, sheave pins and fool bearings should be lubricated frequently.
- vi) When a derrick is not in use, the boom should be anchored to prevent it from swinging.

6.9.4 Gin poles

- i) Gin poles should:
 - (a) be straight;
 - (b) consist of steel or other suitable metal;
 - (c) be adequately guyed and anchored;
 - (d) be vertical or raked slightly towards the load;
 - (e) be of adequate strength for the loads that they will be required to lift/move.
- ii) Gin poles should not be spliced and if a gin pole is composed of different elements, they should be assembled in conformity with their intrinsic material strength.

- iii) Gin poles should be fastened at their feet to prevent displacement in operation.
- iv) Gin poles, which are moved from place to place and re-erected, should not be taken into use again before the pole, lifting ropes, guys, blocks and other parts have been inspected, and the whole appliance has been tested under load.
- v) When platforms or skips are hoisted by gin poles, precautions should be taken to prevent them from spinning and to provide for proper landing.

6.9.5 Tower cranes

- i) Where tower cranes have cabs at high level, persons, capable and trained to work at heights, should only be employed as crane operators.
- ii) The characteristics of the various machines available should be considered against the operating requirements and the surroundings in which the crane will operate before a particular type of crane is selected.
- iii) Care should be taken in the assessment of wind loads both during operations and out of service. Account should also be taken of the effects of high structures on wind forces in the vicinity of the crane.
- iv) The ground on which the tower crane stands should have the requisite bearing capacity. Account should be taken of seasonal variations in ground conditions.
- v) Bases for tower cranes and tracks for rail-mounted tower cranes should be firm and level. Tower cranes should only operate on gradients within limits specified by the manufacturer. Tower cranes should only be erected at a safe distance from excavations and ditches.
- vi) Tower cranes should be sited where there is clear space available for erection, operation and dismantling. As far as possible, cranes should be sited so that loads do not have to be handled over occupied premises, over public thoroughfares, other construction works and railways or near power cables.

- vii) Where two or more tower cranes are sited in positions where their jibs could touch any part of the other crane, there should be direct means of communication between them and a distinct warning system operated from the cab so that one driver may alert the other of impending danger.
- viii) The manufacturers' instructions on the methods and sequence of erection and dismantling should be followed. The crane should be tested before being taken into use.
- ix) The climbing operation of climbing tower cranes should be carried out in accordance with manufacturers' instructions. The free-standing height of the tower crane should not extend beyond what is safe and permissible in the manufacturers' instructions.
- x) When the tower crane is left unattended, loads should be removed from the hook, the hook raised, the power switched off and the boom brought to the horizontal. For longer periods or at times when adverse weather conditions are expected, out of service procedures should be followed. The main jib should be slewed to the side of the tower away from the wind, put into free slew and the crane immobilised.
- xi) A windspeed measuring device should be provided at an elevated position on the tower crane with the indicator fitted in the drivers' cab.
- xii) Devices should be provided to prevent loads being moved to a point where the corresponding safe working load of the crane would be exceeded. Name boards or other items liable to catch the wind should not be mounted on a tower crane other than in accordance with the manufacturers' instructions.
- xiii) Tower cranes should not be used for magnet, or demolition ball service, piling operations or other duties, which could impose excessive loading on the crane structure.

6.9.6 Lifting ropes

- i) Only ropes with a known safe working capacity should be used as lifting ropes.
- ii) Lifting ropes should be installed, maintained and inspected in accordance with manufacturers' instructions.
- iii) Repaired steel ropes should not be used on hoists.
- iv) Where multiple independent ropes are used, for the purpose of stability, to lift a work platform, each rope should be capable of carrying the load independently.

6.10 VEHICLE MOVEMENT

- 6.10.1 Park vehicles only at designated places. Don't block roads to create hindrance for other vehicles.
- 6.10.2 Don't overload the vehicle.
- 6.10.3 Obey speed limits and traffic rules.
- 6.10.4 Always expect the unexpected and be a defensive driver.
- 6.10.5 Drive carefully during adverse weather and road conditions.
- 6.10.6 Read the road ahead and ride to the left.
- 6.10.7 Be extra cautious at nights. Keep wind screens clean and lights in working condition.
- 6.10.8 All vehicles used for carrying workers and construction materials must undergo predictive/preventive maintenance and daily checks
- 6.10.9 Driver with proper valid driving license shall only be allowed to drive the vehicle
- 6.10.10 Routes shall be leveled, marked and planned in such a way so as to avoid potential hazards such as overhead power lines and sloping ground etc.
- 6.10.11 While reversing the vehicles, help of another worker should be ensured at all times
- 6.10.12 An unattended vehicle should have the engine switched off
- 6.10.13 Wherever possible one-way system shall be followed
- 6.10.14 Barriers/fixed stops should be provided for excavation/openings to prevent fall of vehicle

- 6.10.15 Load should be properly secured
- 6.10.16 The body of the tipper lorry should always be lowered before driving the vehicle off.
- 6.10.17 Signs/signals/caution boards etc. should be provided on routes .

6.11 ELECTRICAL

6.11.1 General Provisions

- i) Only persons having valid licenses should be allowed to work on electrical facilities.
- ii) No person should be allowed to work on live circuit. The same, if unavoidable, special care and authorisation need to be taken.
- iii) Treat all circuits as "LIVE" unless ensured otherwise.
- iv) Electrical "Tag Out" procedure "MUST" be followed for carrying out maintenance jobs.
- v) Display voltage ratings prominently with "Danger" signs.
- vi) Put caution/notice signs before starting the repair works.
- vii) All electrical equipment operating above 250V shall have separate and distinct connections to earth grid.
- viii) Proper grounding to be ensured for all switch boards and equipment including Portable ones prior to taking into service.
- ix) Make sure that electrical switch boards, portable tools, equipments (like grinding machine etc.) don't get wet during their usage. If it happens, stop the main supply, make the tools dry and then only use them. Check proper earthing.

All temporary switch boards/ KIOSKS put up at work site should be suitably protected from rain and the level of same should be high enough to avoid contact with water due to water logging.
- x) Don't work wet on electrical system.
- xi) Don't overload the electrical system.
- xii) Use only proper rated HRC fuses.
- xiii) Industrial type extension boards and Plug sockets are only to be used.
- xiv) ELCB for all temporary connections must be provided. Use insulated 3 pin plug tops.
- xv) All power supply cables should be laid properly and neatly so that they don't cause hindrance to persons working and no physical damage also takes place to the cables during various construction activities.
- xvi) All Power cables to be properly terminated using glands and lugs of proper size and adequately crimped.
- xvii) Use spark-proof/flame proof type electrical fittings in Fire Hazard zones as per area classification under OISD-STD-113.
- xviii) Check installations of steel plates/pipes to protect underground cables at crossings.
- xix) Don't lay unarmored cable directly on ground, wall, roof or trees. All temporary cables should be laid at least 750 mm below ground and cable markers should be provided. Proper sleeves should be provided at road crossings. In case temporary cables are to be laid on wooden poles/steel poles, the minimum cable heights should be 4.5 M.
- xx) Maintain safe overhead distance of HT cables as per Indian Electricity Rules and relevant acts.
- xxi) Don't connect any earthing wire to the pipelines/structures.
- xxii) Don't make any unsafe temporary connections, naked joints/wiring etc.
- xxiii) Ensure that temporary cables are free from cuts, damaged insulation, kinks or improper insulated joints.
- xxiv) Check at periodic intervals that pins of sockets and joints are not loose.
- xxv) Protect electrical wires/equipments from water and naked flames.
- xxvi) Illuminate suitably all the work areas.
- xxvii) All switchboards should be of MS structure only and incoming source should be marked.
- xxviii) Hand lamps should not be of more than 24V rating.
- xxix) Fire extinguishers (DCP/CO₂/Sand buckets) should be kept near

temporary switch boards being used for construction purposes. Don't use water for fighting electrical fires.

xxx) Insulating mats shall be provided in the front and back end of switch boards.

xxxi) All parts of electrical installations should be so constructed, installed and maintained as to prevent danger of electric shock, fire and external explosion.

Periodic checking/certification of electrical safety appliances such as gloves, insulating mats, hoods etc. to be done/witnessed along with maintaining a register at site signed by competent authority.

xxxii) A notice displaying following, should be kept exhibited at suitable places:

- a) prohibiting unauthorised persons from entering electrical equipment rooms or from handling or interfering with electrical apparatus;
- b) containing directions as to procedures in case of fire, rescue of persons in contact with live conductors and the restoration of persons suffering from electric shock;
- c) specifying the person to be notified in case of electrical accident or dangerous occurrence, and indicating how to communicate with him.

xxxiii) No other cables/pipes to be laid in trench used for electrical cables.

xxxiv) Utmost care should be taken while excavating Earth from cable trench to avoid damage or any accident.

xxxv) Sub-station floor cut-outs meant for switch board installations to be covered wherever installation is incomplete.

NOTE: A Residual Current Operated Circuit Breaker (RCCB) or Earth Leakage Circuit Breaker (ELCB), when installed, protects a human being to the widest extent. RCCB or ELCB should be provided as per Indian Electricity Rules.

6.11.2 Inspection and maintenance

i) All electrical equipment should be inspected before taking into use to

ensure suitability for its proposed use.

ii) At the beginning of every shift, the person using the electrical equipment should make a careful external examination of the equipment and conductors, especially the flexible cables.

iii) Apart from some exceptional cases, work on or near live parts of electrical equipment should be forbidden.

iv) Before any work is begun on conductors or equipment that do not have to remain live:

- a) the current should be switched off by a responsible authorised person;
- b) precautions should be taken to prevent the current from being switched on again;
- c) the conductors or the equipment should be tested to ascertain that they are dead;
- d) the conductors and equipment should be earthed and short-circuited;
- e) neighbouring live parts should be adequately protected against accidental contact.

v) After work has been done on conductors and equipment, the current should only be switched on again on the orders of a competent person after the earthing and short-circuiting have been removed and the workplace reported safe.

vi) Electricians should be provided with approved and tested tools, and personal protective equipment such as rubber gloves, mats etc.

vii) All conductors and equipment should be considered to be live unless there is a proof of the contrary.

viii) When work has to be done in dangerous proximity to live parts the current should be cut off. If for operational reasons this is not possible, the live parts should be fenced off or enclosed by qualified staff from the sub-station concerned.

6.11.3. Testing

- i) Electrical installations should be inspected and tested and the results recorded.
- ii) Periodic testing of the efficiency of the earth leakage protective devices should be carried out.
- iii) Particular attention should be paid to the earthing of apparatus, the continuity of protective conductors, polarity and insulation resistance, protection against mechanical damage and condition of connections at points of entry.

6.12 OFFSHORE

6.12.1 General

The isolated nature of offshore installations are hazardous. They call for greater need for safety and survival at offshore. Safety at offshore is safety of installations and safety of personnel. Safety problems and accidents at offshore have high risks due to limited space, helicopter operation, sea transport etc. Following are the general safety guidelines to be followed in addition to the safety guidelines stipulated for specific jobs dealt later on:

- i) Workers should be well trained to do their job independently with high degree of self-control and self-discipline.
- ii) On arrival at offshore, everyone should be briefed about the safety rules to be followed at offshore, evacuation system etc. All personnel should wear overall (dangri), helmet and shoes for personnel protection.
- iii) In case of emergency, workers should follow instruction of Field Production Superintendent (F.P.S.) In certain cases instructions may be given to abandon the offshore installation and evacuate the persons to safe location.
- iv) To overcome above problems, offshore personnel must receive training for using life saving appliances and other personal survival techniques.
- v) Any person working at offshore should have one person as standby for any eventuality.

6.12.2 Drilling Rigs

- i) Location of jack up rigs should not be less than 5 Kms from shipping route. Orientation of the rig, wind direction etc are required for safe landing of helicopter. Information w.r.t. sea currents, wind speed, Hi-lo tide etc are required for mooring of supply vessels.
- ii) Sea bed condition at every location should be ensured for safety of rig.
- iii) Radio and other communication facilities should be such to maintain contact with base all times.
- iv) During toeing of rig, the rig deck should be clear of load, toeing lines should be in good condition and tensions in various toeing lines should be constantly monitored.
- v) Few steps during toeing are:
 - a) crane booms should be secured to their vestr,
 - b) all hatches and water tight doors should be closed,
 - c) number of personnel on board should be restricted,
 - d) evacuate in case of emergency and operation should be completed preferably in day light.

6.12.3 Drilling

- i) In view of CO₂ and H₂S gas cut from well, effective ventilation should be provided where drilling is in progress.
- ii) Safety alarm shall be checked in advance in view of failure of ventilation system.
- iii) Suitable sensors for H₂S and Methane should be function tested time to time and suitable colour code should be given.
- iv) Working areas of the crane should be illuminated during night to avoid accident.
- v) Clear space should be available for despatch and receipt of load and, in particular, basket transfer of passengers. Persons engaged in loading/unloading of materials should be protected from falling into the sea.

- vi) Signal light should be fitted at the top of the jib.
- vii) Crane hook should be fitted with safety latches.
- viii) Experienced person should be engaged in operation of specific equipment like winches, cranes etc.
- ix) At least three cable turns shall always be there on the winch drum.
- x) Adequate communication like walkie talkie, round robin phone should be available between the crane operator, supervisor and helper.
- xi) Crane operation should be completely stopped during helicopter landing/taking off.
- xii) Except for helicopter landing deck, all decks, platforms, bridges, ladders should have rigid and fixed guard rails atleast one meter high and should have one intermediate rail midway between the handrail and 100 mm toe board.
- xiii) Wooden ladders shall not be used at offshore.
- xiv) Flow sensor in the flow line should be ensured for safe working and to avoid blow out.
- xv) Hydrogen sulphide gas In offshore is of great risk and at 10 ppm (0.001%) concentration in air, a person should not be exposed for more than 8 hours, If concentration is more, then breathing apparatus should be used. Corrosion of equipment is also caused by H₂S.
- xvi) Portable H₂S gas detector should be continuously used.

6.12.4 Production Platforms

- i) In case hydrocarbon is released due to overpressure, leak, overflow, gas blow etc., shut down process to stop flow of hydrocarbon. Prevent ignition of released hydrocarbon and in case of fire shut in the process complex and follow emergency contingency plan.
- ii) Sub surface safety valve (SSSV) below the well head should be actuated during uncontrolled well - flow and they should be regularly checked.

- iii) Surface safety valve or SDV should be checked for no gas leakage from bleed port / flange etc., in the well head area. It should not be in "mechanical override" or bypassed from panel.
- iv) High pressure gas lift lines - blowdown system should be O.K.
- v) Auto actuation of SDVs in the inlet of pressure vessels should be O.K. and in "normal position" from shutdown panels. A record of status of switches normal/bypassed in auto-con* panels (PSH, PSL, LSL, ILSL) should be maintained.

* Shut Down Panels

- vi) Welders rectifier set and electrical connections to it should be checked and approved by electrical-in-charge for proper electrical safety.
- vii) "SCADA" telemetry system if available should be operational for remote opening and closing of wells at unmanned platforms (through RPMC).
- viii) Local ESD/FSD (near the work site) should be provided for jobs of very critical nature, so that the persons working can access it immediately in emergency for safety. Safety officer should judge the requirement & inform FPS for the same.
- ix) Railings and Gratings etc. in and around work area should be O.K. and inspected to avoid slippage of man into sea.
- x) Emergency shut down (ESD) system is initiated when an abnormal condition is detected. ESD should be checked once in six months.
- xi) Platform should be manned round the clock.
- xii) Welding and cutting work should be regulated by hot work permit.
- xiii) All detectors should be calibrated as per recommendation of the manufacturer.
- xiv) No system should be by-passed which affects the system of platform.

- xv) In H₂S field platforms, due care shall be taken as per recommendations.
- xvi) Follow the instructions of F.P.S. during stay at platform

6.12.5 Fire Prevention And Control

- i) Provision be made for safe handling and storage of dirty rags, trash, and waste oil. Flammable liquids and chemicals applied on platform should be immediately cleaned.
- ii) Paint containers and hydrocarbon samples, gas cylinders for welding and cutting should be stored properly. Cylinders should be transported in hand-cart.
- iii) Smoking should be restricted and no smoking area should be identified.
- iv) Special attention should be given to crude oil pump seals, diesel and gas engines which are potential source of ignition in the event of failure.
- v) Fire and smoke detectors i.e. ultraviolet heat, thermal and smoke detector should be function tested once in three months.
- vi) Fire is controlled in offshore by water spraying, Halon, CO₂ flooding, DCP and sprinkler system.
- vii) Foaming agent is applied for controlling fire in liquid hydrocarbon. The system is not effective in gas fire.
- viii) Light weight breathing system should be used.
- ix) The fire control plan at offshore should reveal control station, fire alarms and fire detectors, deluge valves and sprinkler, fire extinguishing appliances, fireman outfit and ventilation system.
- x) Fire fighting equipment should be maintained in ready to use condition.

6.12.6 Life Saving Appliances

- i) Life boats with a speed of 6 knots and carrying capacity upto 50 persons are used in offshore.
- ii) No. of life boats on one installation should have a capacity to

accommodate twice the number of persons onboard installation.

- iii) Launching appliances and life boat equipment should be checked every week.
- iv) Boat landing areas should be adequately illuminated.
- v) Life raft has no power and they rely on drift.
- vi) Life jacket lifts the wearer after entering water.
- vii) Life buoys are used to rescue persons if any person accidentally falls in the sea.
- viii) All life saving appliances should be inspected by the MMD surveyor /sr. officials once a year.
- ix) Every life boat shall be inspected once a week.
- x) Every life boat and life raft should be serviced once a year by a competent authority,

6.12.7 Safety Precautions during Helicopter Transportation

- i) Passenger briefing regarding safety rules while travelling in helicopter should be carried out before boarding the helicopter.
- ii) Emergency procedure should be briefed to all the passenger In case helicopter is to ditch into the sea.
- iii) Heli-pad should have a non-skid surface. Nylon rope net should be stretched on the deck.
- iv) Proper drainage should be available on helideck.
- v) There should be no obstruction on the helideck itself and within 3 meters of its parameter. Closest super structure above the helideck should have red obstruction light.
- vi) While landing fire crew of two persons should be standby adjacent to helideck.
- vii) Heli-deck should be properly illuminated for night landing.
- viii) During switching off helicopter, persons should not be allowed to go out/ towards helicopter

6.13 DEMOLITION

6.13.1. General provisions

- i) When the demolition of any building or structure might present danger to workers or to the public:
 - (a) necessary precautions, methods and procedures should be adopted, including those for the disposal of waste or residues;
 - (b) the work should be planned and undertaken only under the supervision of a competent person.
- ii) Before demolition operations begin:
 - (a) structural details and builders' drawings should be obtained wherever possible;
 - (b) details of the previous use should be obtained to identify any possible contamination and hazards from chemicals, flammables, etc.;
 - (c) an initial survey should be carried out to identify any structural problems and risks associated with flammable substances and substances hazardous to health. The survey should note the type of ground on which the structure is erected, the condition of the roof trusses, the type of framing used in framed structures and the load-bearing walls;
 - (d) a method of demolition should be formulated after the survey and recorded in a method statement having taken all the various considerations into account and identifying the problems and their solutions;
- iii) All electric, gas, water and steam service lines should be shut off and, as necessary, capped or otherwise controlled at or outside the construction site before work commences.
- iv) If it is necessary to maintain any electric power, water or other services during demolition operations, they should be adequately protected against damage.
- v) As far as practicable, the danger zone round the building should be adequately fenced off and sign posted. To protect the public a fence 2m high should be erected enclosing the demolition operations and the access gates should be secured outside working hours.
- vi) The fabric of buildings contaminated with substances hazardous to health should be decontaminated. Protective clothing and respiratory devices should be provided and worn.
- vii) Where plant has contained flammable materials, special precautions should be taken to avoid fire and explosion.
- viii) The plant to be demolished should be isolated from all other plant that may contain flammable materials. Any residual flammable material in the plant should be rendered safe by cleaning, purging or the application of an inert atmosphere as appropriate.
- ix) Care should be taken not to demolish any parts, which would destroy the stability of other parts.
- x) Demolition activities should not be continued under adverse climatic conditions such as high winds, which could cause the collapse of already weakened structures.
- xi) To prevent hazards parts of structures should be adequately shored, braced or otherwise supported.
- xii) Structures should not be left in a condition in which they could be brought down by wind pressure or vibration.
- xiii) Where a deliberate controlled collapse technique is to be used, expert engineering advice should be obtained, and:
 - (a) it should only be used where the whole structure is to come down because it relies on the removal of key structural members to effect a total collapse;
 - (b) it should only be used on sites that are fairly level and where there is enough surrounding space for all operatives and equipment to be withdrawn to a safe distance.
- xiv) When equipment such as power shovels and bulldozers are used for

demolition, due consideration should be given to the nature of the building or structure, its dimensions, as well as to the power of the equipment being used.

- xv) If a swinging weight is used for demolition, a safety zone having a width of at least one-and-a-half times the height of the building or structure should be maintained around the points of impact.

6.13.2. Demolition of structural steelwork

- i) All precautions should be taken to prevent danger from any sudden twist, spring or collapse of steelwork, ironwork or reinforced concrete when it is cut or released.
- ii) Steel construction should be demolished tier by tier.
- iii) Structural steel parts should be lowered and not dropped from a height.

6.14 RADIOGRAPHY

- 6.14.1 All radiography jobs shall be carried out as per BARC Safety Regulations
- 6.14.2 During field radiography, nearby area around the radiation source should be cordoned off.
- 6.14.3 If the field radiography is to be done at the same location repeatedly, it is advisable to provide either a wire fencing around or a temporary brick enclosure.
- 6.14.4 Special permission/permit should be taken for radiography from area-in-charge.
- 6.14.5 As far as possible, field radiography should be done only during night time when there is little or no occupancy there.
- 6.14.6 Radiation warning signals should be pasted all along the cordoned off area.
- 6.14.7 Entry into the restricted area by unauthorised persons should be strictly prohibited during exposure.
- 6.14.8 The radiation level alongwith the cordon should be monitored by a suitable and well-calibrated radiation survey meter.

- 6.14.9 All personnel working with radiography sources should wear appropriate protective equipment and film badges issued by BARC.

- 6.14.10 Protection facilities such as manipulator rod, remote handling tongs, lead pots, radiation hazard placards and means of cordon off shall be available at each site.

- 6.14.11 The radiography source shall never be touched or handled directly with hands.

- 6.14.12 The package containing radiography cameras and sources should never be carried by public transport like bus, train etc.

- 6.14.13 Radiography sources and cameras, when not in use, should be stored inside a source pit with lock and key arrangement as approved by BARC. The storage room should preferably be located in an isolated area of minimum occupancy and radiation level outside the storage room should not exceed 0.25 mR/hr as per BARC Regulations.

- 6.14.14 In case of an accident (due to loss or of damage to radiography source), action should be taken in line with BARC Safety Rules/Guidelines.

6.15 SAND/SHOT BLASTING/ SPRAY PAINTING

- 6.15.1 Sand blasting should be used only after approval from competent person.

- 6.15.2 Air Compressor used for sand/shot blasting/painting should have guard and positioned away from the work place.

- 6.15.3 Exhaust of the prime mover, if IC engine is used, should be directed away from the work place.

- 6.15.4 In case of motor driven compressor, the body of the motor as well as the compressor to be properly earthed.

- 6.15.5 The hoses used for compressed air should be of proper quality, and health of the same to be ensured through regular check/ test.

- 6.15.6 The operator of sand/shot blasting/painting should wear suitable PPE's including mask.
- 6.15.7 Adequate measures to be taken to suppress dust/spray particle.
- 6.15.8 Sand used for sand blasting should be suitably covered & protected from rain/moisture.
- 6.15.9 When these activities are done in confined places, adequate measure to be taken for proper ventilation.

6.16 WORK ABOVE WATER

6.16.1 General Provisions

- i) Where work is done over or in close proximity to water & where possibility of drowning exists, provision should be made for:
 - a) Preventing workers from falling into water;
 - b) The rescue of workers in danger of drowning;
 - c) Safe and sufficient transport.
- ii) Provisions for the safe performance of work over or in close proximity to water should include, where appropriate, the provision and use of suitable and adequate:
 - a) fencing, safety nets and safety harnesses;
 - b) lifebuoys, life jackets and manned boats;
 - c) protection against such hazards as reptiles and other animals.
- iii) Gangways, pontoons, bridges, footbridges and other walkways or work places over water should:
 - a) possess adequate strength and stability;
 - b) be sufficiently wide to allow safe movement of workers;
 - c) have level surfaces free from tripping hazards;
 - d) be adequately lit when natural light is insufficient;
 - e) where practicable and necessary, to prevent danger, be provided with toe-boards, guard rails, hand ropes etc.
 - f) be secured to prevent dislodgment by rising water or high winds;
 - g) if necessary, be equipped with ladders which should be sound, of sufficient strength and length and be securely lashed to prevent slipping.

- iv) All deck openings including those for buckets should be fenced.

6.16.2 Rescue & Emergency procedures

- i) Persons who work over water should be provided with some form of buoyancy aid. Life jackets should provide sufficient freedom of movement, have sufficient buoyancy to bring persons to the surface and keep them afloat face upwards, be easily secured to the body, be readily visible by way of self luminous paint/strip.
- ii) Nobody should work alone on or above water.
- iii) Each worker should be trained in the procedure to be followed in the event of an emergency.

7.0 ADDITIONAL SAFETY PRECAUTION FOR UNITS WITH HYDROCARBONS

In addition to general safety precautions as outlined above for the activities in Clause 6.0, following additional safety precautions need to be taken for the sites within the operating area or nearby, where presence of Hydrocarbons cannot be ruled out.

- i) No job shall be carried out without a valid permit. Permit should be in line with OISD-STD-105 "Work Permit System".
- ii) Smoking should be prohibited in all places containing readily combustible or flammable materials and "No Smoking" notices be prominently displayed.
- iii) In confined spaces and other places where flammable gases, vapours or dusts can cause danger, following measures should be taken:
 - (a) only approved type electrical installations and equipment, including portable lamps, should be used;
 - (b) there should be no naked flames or source of ignition;
 - (c) oily rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place;
 - (d) ventilation should be provided.

- iv) Regular inspections should be made of places where there are fire risks. These include the vicinity of heating appliances, electrical installations and conductors, stores of flammable and combustible materials, welding and cutting operations.
- v) Welding, flame cutting and other hot work should only be done after issuance of work permit in line with the requirement of OISD-STD-105 after appropriate precautions, as required, are taken to reduce the risk of fire. For carrying out other jobs also, OISD-STD-105 should be followed strictly.
- vi) Fire-extinguishing equipment should be well maintained and inspected at suitable intervals by a competent person. Access to fire-extinguishing equipment such as hydrants, portable extinguishers and connections for hoses should be kept clear at all times.
- vii) All supervisors and a sufficient number of workers should be trained in the use of fire-extinguishing equipment, so that adequate trained personnel are readily available during all working periods.
- viii) Audio means to give warning in case of fire should be provided where this is necessary to prevent danger. Such warning should be clearly audible in all parts of the site where persons are liable to work. There should be an effective evacuation plan so that all persons are evacuated speedily without panic and accounted for and all plant and processes shut down.
- ix) Notices should be posted at conspicuous places indicating:
 - (a) the nearest fire alarm;
 - (b) the telephone number and address of the nearest emergency services.
- x) The work site shall be cleared of all combustible materials, as Sparks and molten metal coming from the welding job can easily ignite combustible materials near or below the welding site. If the combustible materials cannot be removed from the area, the same shall be properly shielded.
- xi) A dry chemical type fire extinguisher shall be made available in the work area. Also fire protection facilities like running hoses etc. as per permit should be complied with.
- xii) Wherever required, welding screens shall be put up to protect other equipment in adjoining areas against flying sparks. Material used should be metal/asbestos/water curtain.
- xiii) Welding or cutting of vessels/equipments used in Hydrocarbon/hazardous chemicals shall be done after proper gas freeing and verifying the same with the explosive-meter.
- xiv) The confined space/equipment shall be gas freed and cleaned.
- xv) Absence of any toxic gas and any flammable gas above explosion limit shall be ensured with the help of gas detection instrument and explosive meter respectively.
- xvi) Used and hot electrode stubs shall be discarded in a metal bucket.
- xvii) Use approved and certified flame arrestors for vehicles.
- xviii) Work permit to be obtained, if construction work is carried out within existing operating area.

8.0 FIRST AID

First aid facilities should be provided in line with various statutory regulations like factory act etc. However following care should be taken:

- i) First aid, including the provision of trained personnel should be ensured at work sites. Arrangement should be made for ensuring the medical attention of the injured workers. First aid box should be as per the Factory rules.
- ii) Suitable rescue equipment, like stretchers should be kept readily available at the construction site.
- iii) First-aid kits or boxes, as appropriate and as per statutory requirements, should be provided at workplaces and be protected against contamination by dust, moisture etc.

- iv) First-aid kit or boxes should not keep anything besides material for first aid in emergencies.
- v) First-aid kits and boxes should contain simple and clear instructions to be followed, be kept under the charge of a responsible person qualified to render the first aid and be regularly inspected and stocked.
- vi) Where the work involves risk of drowning, asphyxiation or electric shock, first-aid personnel should be proficient in the use of resuscitation and other life saving techniques and in rescue procedures.
- vii) Emergency telephone numbers of nearby Hospitals, Police, Fire Station and Administration should be prominently displayed.

9.0 DOCUMENTATION

The intention of keeping documentation of all types of accident(s) is to prevent recurrence of similar accident(s). All accidents should be reported as per OISD Guidelines (OISD-GDN-107) and Factories act, 1948.

All accidents (major, minor or near miss) should be investigated, analysed and recommendations should be documented along with implementation status.

All related data should be well-documented and further analysis highlighting the major cause(s) of accidents be done. This will help in identifying thrust areas and training needs for prevention of accidents.

10.0 SAFETY AWARENESS & TRAINING

Safety awareness to all section of personnel ranging from site-in-charge to workmen helps not only preventing the risk but also build up the confidence. Time and expenditures also get saved as a result.

Safety awareness basically seeks to persuade/inform people on safety besides supplementing skill also. Awareness programme may include followings:

- i) **Poster:** Posters with safety slogan in humorous, gruesome demonstrating manner may be used to discourage bad habits attributable to accidents by appealing to the workers' pride, self-love, affection curiosity or human aspects. These should be displayed in prominent location(s).
- ii) **Safety Sign Boards:** Different type of message of cautioning, attention, notice etc. should be displayed at the appropriate places for learning/awareness of the workmen while working at site.
- iii) **Films & Slides:** Film(s) narrating the accident including the causes and possible remedial ways of preventing the recurrence of a similar accident should be displayed at regular intervals. Slides consisting main points of the film show may also be shown to workers.
- iv) **Talks, lectures & conferences:** The success of these events would depend much on audience's understandings of the speaker (s). The speakers are to be knowledgeable and good presenter. Speakers should know to hold the attention and to influence the audiences.
- v) **Competitions:** Organise competition(s) between the different deptts/categories of workers. The sense of reward/recognition also will improve safety awareness and result in enhancing safety levels.
- vi) **Exhibitions:** Exhibitions also make the workers acquainted with hazards and means of preventive measures.
- vii) **Safety Publication:** Safety publications including pocket books dealing with ways of investigation and prevention in the field of safety and so on, may be distributed to workers to promote the safety awareness.
- viii) **Safety Drives:** From time to time, an intensive safety drive by organising a safety day or a safety week etc. should be launched.
- ix) **Training:** Training for covering the hazards for different trade should be imparted. Training should also include the specific hazards related

to a job in addition to the general safety training as has been dealt in various chapters and should include all workers. Reference may be drawn from OISD-STD-154.

11.0 REFERENCES

- i) *Factory Act, 1948*
- ii) *Indian Electricity Rules*
- iii) *Safety & Health in Construction by ILO*
- iv) *The Building & Other Construction Workers (Regulation, Employment and Conditions of Service) Act 1996*

**LIST OF SAFETY CODES FOR CIVIL WORKS PUBLISHED BY BUREAU OF
INDIAN STANDARDS**

Sr.no	Code No.	Title
01.	IS : 818	Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations – First Revision.
02.	IS : 875	Code of practice for Structural safety of buildings: Masonry walls
03.	IS : 933	Specification for Portable Chemical Fire Extinguisher, Foam Type – Second Revision.
04.	IS : 1179	Specification for Equipment for Eye and Face Protection during Welding – First Revision.
05.	IS : 1904	Code of practice for Structural safety of buildings: Shallow foundations
06.	IS : 1905	Code of practice for Structural safety of buildings: Masonry walls
07.	IS : 2171	Specification for Portable Fire Extinguishers, Dry Powder Type – Second Revision.
08.	IS : 2361	Specification for Building Grips – First Revision.
09.	IS : 2750	Specification for Steel Scaffoldings.
10.	IS : 2925	Specification for Industrial Safety Helmets – First Revision.
11.	IS : 3016	Code of Practice for Fires Precautions in Welding and Cutting Operations – First Revision.
12.	IS : 3521	Industrial safety belts and harnesses
13.	IS : 3696 – Part I	Safety Code for Scaffolds and Ladders : Part I – Scaffolds.
14.	IS : 3696 – Part II	Safety Code for Scaffolds and Ladders : Part II – Ladders.
15.	IS : 3764	Safety Code for Excavation Work.
16.	IS : 4014 -Part I & II	Code of practice for Steel tubular scaffolding
17.	IS : 4081	Safety Code for Blasting and Related Drilling Operations.
18.	IS : 4082	Recommendations on staking and storage of construction materials at site
19.	IS : 4130	Safety Code for Demolition of Buildings – First Revision.
20.	IS : 4138	Safety Code Working in Compressed Air-First Revision
21.	IS : 4756	Safety code for Tunneling works
22.	IS : 4912	Safety requirements for Floor and Wall Openings, Railings and toe Boards –First Revision.
23.	IS : 5121	Safety Code for Piling and other Deep Foundations.
24.	IS : 5916	Safety Code for Construction involving use of Hot Bituminous Materials.
25.	IS : 5983	Specification for Eye Protectors – First Revision.
26.	IS : 6922	Structures subject to underground blasts, criteria for safety and design of
27.	IS : 7155	Code of recommended practices for conveyor safety
28.	IS : 7205	Safety Code for Erection on Structural Steel Works.

Sr.no	Code No.	Title
29.	IS : 7069	Safety Code for Handling and Storage of Building Materials.
30.	IS : 7293	Safety Code for Working with Construction Machinery.
31.	IS : 7323	Guidelines for operation of Reservoirs
32.	IS : 7969	Safety code for handling and storage of building material
33.	IS : 8758	Recommendation for Fire Precautionary Measures in construction of Temporary Structures and Pandals.
34.	IS : 8989	Safety Code for Erection of Concrete Framed Structures.
35.	IS : 9706	Code of Practices for construction of Arial ropeways for transportation of material
36.	IS : 9759	Guidelines for de-watering during construction
37.	IS : 9944	Recommendations on safe working load for natural and man-made fibre roap slings
38.	IS : 10291	Safety code for dress divers in civil engineering works
39.	IS :10386 – Part I	Safety Code for Construction, Operation and Maintenance for River Valley Projects.
40.	IS :10386 – Part II	Safety Code for Construction, Operation and Maintenance of River Valley Projects.
41.	IS : 11057	Code of practice for Industrial safety nets
42.	IS : 13415	Code of Practice on safety for Protective barriers in and around building
43.	IS : 13416	Recommendations for preventive measures against hazards at working places

OISD – GDN – 207

**FOR RESTRICTED
CIRCULATION ONLY**

OCTOBER 2002

CONTRACTOR SAFETY

OISD – GUIDELINES – 207

**Oil Industry Safety Directorate
Government of India
Ministry of Petroleum & Natural Gas**

CONTRACTOR SAFETY

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CONTRACTOR SAFETY

1.0 INTRODUCTION

Oil and Gas operations like Drilling, Production, Refining, Transportation and Distribution are inherently hazardous. A large number of contractor workforce is deployed to carry out construction, maintenance and other jobs. The analysis of the incidents in the Petroleum Sector indicates that a large number of incidents involved contractor workforce and have resulted in either casualty or injury besides leading to property damage and operational interruptions and environmental degradation.

In order to improve the safety levels of oil installations, the contractor safety is of utmost importance and there is a need to institute a good contractor safety system.

2.0 SCOPE

This standard covers broadly the guidelines on the management system for enhancing the safety levels of the contractor workforce deployed in construction, maintenance and operation activities in the hydrocarbon industry.

The safety precautions to be taken while carrying out different activities during construction / maintenance have separately been covered in OISD-GDN-192 on "Safety Practices during Construction".

3.0 DEFINITIONS

Work station/Work site

A place/unit where the job is carried out by contractor/executing agency in specified manner with safety, during construction phase or in operation phase.

Owner

Any physical or legal person/entity for whom prescribed job is carried out.

It shall also include owner's designated representative / consultant /nominee / agent, authorised from time to time to act for and

on its behalf, for supervising / co-ordinating the activities of the contractor/execution agency.

Contractor / Executing Agency

A physical or legal person/entity having contractual obligation with the owner, and who deploys one or more worker on the site.

Contractor Worker

It covers all workmen who are either self-employed or employed through contractor, the casual workers and includes contractor's supervisor, working at a location / site employed directly by Owner or through their contractor.

Incident

An incident is an unplanned, uncontrolled, unintended or unforeseen event, caused by unsafe acts and / or unsafe conditions, resulting in or having the potential to result in personal injury and/or property damage.

Consultant

Consultant is a physical or legal person/entity engaged by owner to provide the consultancy services to owner for management of the contract on their behalf or as specified.

Designer

Designer is a physical or legal person / entity engaged by owner to provide design services of a work site.

Owner's Representative / Engineer In Charge

The Owner's representative/Engineer-in-charge is the one, who has been designated by the owner to manage the contract.

Owner's Safety Officer

A properly trained person designated by owner who ensures safety at work site.

4.0 DUTIES/ RESPONSIBILITIES

4.1 OWNER

4.1.1 Owner's Management

The commitment to safety has to be emphasised by the owner by practice by its own management and employees at all levels. The duties and responsibilities of owner should include:

- i) To institute a mechanism for identification and compliance of all applicable statutory rules & regulations (Refer Annexure I for a list of few important Bureau of Indian Standards & statutory regulations).
- ii) To provide specific information to contractors and make workers aware on the hazards associated with job assigned.
- iii) To provide information about Risk Mitigation measures available at the place of work.
- iv) To provide the contractor with information on Owners Safety Plan & Regulations, Emergency Management Plan, lockout/ tag out procedure, confined space entry, work permit system, excavation/trench permit system etc.
- v) To specify rules (e.g. for security including access arrangements) and safety rules such as fire protection, first aid arrangements, Work Permit systems etc.
- vi) To provide comprehensive list of statutory regulations / standards and specification, to be complied with during execution of contract, in the tender document itself.
- vii) To ensure training of the contractor workforce, medical examination, and proper usage of safety equipment.

viii) To specify the requirements of Health, Safety and Environment (HSE) (commensurate with the nature of job) in Pre- Qualification criteria.

ix) To designate Engineer-in-charge and safety officer.

x) To arrange for a multi-disciplinary safety audit team to conduct surprise / regular safety audits and monitor the implementation of the recommendations.

xi) To introduce suitable schemes for motivation of the contractor worker to adhere to safety guidelines.

xii) To review safety practices & their implementation through periodic surprise visit of the work sites and monthly review meeting.

xiii) To develop the HSE plans and incorporate the same in the tender document.

xiv) To liaise with external agencies like press, public etc and with law enforcement, regulatory, statutory agencies etc.

xv) To report to statutory agencies on safety compliance and accidents, if any.

4.1.2 Owner's Representative/Engineer-in-charge

The duties & responsibilities of engineer-in-charge should include:

- i) To ensure that all Contract requirements including Health, Safety, Environment & Security are complied with.
- ii) To ensure that contractor workforce deployed is adequately qualified, trained and in state of health to commensurate with the requirements of the job.
- iii) To ensure that the Tools / Tackles and Machinery being used are properly

tested and are in sound working conditions and necessary resources proposed for providing safe place of work and necessary PPE are being used.

- iv) To take the required necessary corrective action immediately upon noticing or receipt of a report on noncompliance or any such condition which poses a threat to health, safety or environment. If during the course of execution of the contract, any situation of non-compliance with the contractor's safety and health plan are noticed / reported, the same will be taken up with the contractor for correction. In the event of repeated non compliance, suitable action to be initiated as per the contract.
- v) To ensure that the incidents are reported to all concerned within stipulated timeframe.
- vi) To ensure submission of a plan for safe working (Method Statement) from contractor and approval of the same by competent person / department.
- vii) To ensure that Work Permit System in line with OISD-STD-105 is adhered to.
- viii) To ensure availability of all the documentation needed for the execution of contract.
- ix) To ensure that the quality controls have been maintained during fabrication/erection and all jobs required for safe commissioning have been carried out.
- x) To ensure safe dismantling of all temporary facilities/connections put up by the contractor, after completion of work.
- xi) To compile a report on the safety performance (at the conclusion of each contract or periodically such as annually for renewable and long-term

contracts), which is to be considered in future when selecting contractors.

- xii) To ensure that the Consultant, contractor and sub-contractor employ / designate qualified & trained Safety Engineer / Officer commensurate with requirement of the job.

4.1.3 Owner's Safety Officer

The duties & responsibilities of the Owner's Safety Officer should include:

- i) To assess the hazards associated with jobs in consultation with all concerned and establish safe working procedure including identification of the escape routes.
- ii) To establish a written record of factors which can cause injuries and illnesses.
- iii) To undertake routine/surprise inspections of all work sites and identify unsafe conditions & practices, if any. Check for compliance of the safety practices being followed with approved HSE Plan.
- iv) To investigate promptly the incidents (including near-miss) in order to advise corrective and/or preventive action.
- v) To maintain statistical information for use in analyzing all phases of incidents and events involving contract personnel.
- vi) To provide the means for complying with the reporting requirements for occupational injuries and illnesses.
- vii) To check whether the proposed working arrangements are safe and satisfactory, particularly at the interface between the contractor's planned work and owner's existing facilities.
- viii) To communicate to the Contractor the imposed restrictions which may affect the work/personnel such as the temporary closure of a corridor or electrical isolation of equipment.

- ix) To review and monitor the contractor's adherence to approved HSE plan and all applicable environmental, health, and safety requirements.
- x) To ensure that Consultant, Contractor's Managers, Supervisors and workmen at all levels (who will plan, monitor, oversee and carry out the work) undergo Health, Safety and Environmental training in their respective responsibilities with respect to conducting work safely and with due regard for the protection of the environment.
- xi) To identify areas of operations where specialized training is required to deal with potential dangers.
- xii) To document and to bring to the attention of the Owner's Supervisor and Contractor any non-compliance/violation of the safety norms against approved safety and health plan or safety and health requirements and also raise these issues in the Safety Committee Meetings.
- xiii) To take part in Tool Box Meetings at random and to ensure maintenance of records.

4.2 CONTRACTOR

4.2.1 Contractor's Management

Duties & responsibilities of the contractor should include the following:

- i) To implement safe methods and practices, deploy appropriate machinery, tools & tackles, experienced supervisory personnel and skilled work force etc. required for execution.
- ii) To prepare a comprehensive and documented plan for implementation, monitoring and reporting of Health, Safety and Environment (HSE) and implement the same after its approval.

- iii) To nominate qualified & trained Safety Engineers / Officers reporting to the Site in charge, for supervision, co-ordination and, liaison for the implementation of the safety plan.

Similar HSE Plan should be implemented at the sub- contractor's or supplier's site /office. However the compliance with the HSE Plan is to be the sole responsibility of the Contractor.

- iv) To arrange suitable facilities in liaison with the owner for drinking water, toilets, lighting, canteen, crèche etc as applicable as per Laws/ Legislation at site and also arrange for workmen compensation insurance, third party liability insurance, registration under ESI / PF act etc as applicable.
- v) To arrange for fire protection equipment as per the advice of owner.
- vi) To ensure that its employees have completed appropriate health and safety training as required by the statute / regulation and also as per requirements of the Owner / Consultant. The documentation of such training imparted to all its employees should be maintained and produced for verification as required.
- vii) To comply with all the security arrangements of owner.
- viii) To ensure that the plant and equipment used on-site by him / his employees is correctly registered, controlled and maintained in sound working condition.
- ix) To ensure availability of First Aid boxes and First Aid trained attendant.
- x) To ensure that all incidents including near misses are reported to all concerned immediately.

In construction projects where sub-contractors are engaged, the contractor should set out the responsibilities, duties and safety measures that are expected of

the sub-contractor's workforce. These measures should include the provision and use of specific safety equipment, methods of carrying out specific tasks on safety and the inspection and appropriate use of tools.

The responsibilities indicated separately under contractor's Supervisor, Safety Officer and contract worker are contractually that of the Contractor and legally binding on the Contractor only. However the specific detailing as above has been given separately for guidance and operational convenience.

The selection of sub contractors, if employed, should be approved by the owner. Sub-contractor should comply fully with all safety rules and conditions applicable to the main contractor.

4.2.2 Contractor's Supervisor / Safety Officer

Duties & responsibilities of the Contractor's supervisor/Safety Officer should include the following:

- i) To ensure strict compliance with work permit system by carrying out work only with appropriate work permits and after ensuring that all safety precautions / conditions in the permit are complied with and closing the same after job completion.
- ii) To ensure that required guards and protective equipment are provided, used, and properly maintained.
- iii) To ensure that tools and equipment are properly maintained and tested.
- iv) To plan the workload and assign workers to jobs in commensuration with their qualification, experience and state of health.
- v) To ensure that the workers understand the work to be done, the hazards that may be encountered, and the proper precautions/procedure for carrying out the work safely.
- vi) To take immediate action to correct any violation of safety rules observed or reported.
- vii) To ensure that the workers likely to be exposed to hazardous chemicals/materials have access to appropriate Material Safety Data Sheets (MSDS), wherever applicable, and provide necessary mitigation measures.
- viii) To ensure inspection and certification of all tools (hand operated as well as mechanically operated) being used. Defective tools shall be immediately removed.
- ix) To ensure that appropriate warning signboards or tags are displayed.
- x) To ensure that workers have proper training for their job assignments, including use of appropriate PPE and first aid fire fighting equipment.
- xi) To comply with all applicable safety and health standards, rules, regulations and orders issued by competent authority pertaining to the assigned activities.
- xii) To ensure that sick and/or injured workers receive appropriate first aid and/or medical attention.
- xiii) To report each incident and/or injury in accordance with established procedures and assist in investigation.
- xiv) To take necessary action for correction of any unsafe act / condition at the workplace. However, in case the same is outside the limits of authority, it should be reported to Owner's Engineer-in-charge immediately.
- xv) To conduct daily inspections to ensure compliance with safety standards, codes, regulations, rules and orders applicable to the work concerned.

- xvi) To ensure that workers under their supervision are aware of their responsibilities.
- xvii) To arrange daily tool box meeting and regular site safety meetings and maintain records in the required formats. (Refer Clause 5.9.1)
- xviii) To arrange stand-by supervisor/ worker where situations so demand.
- xix) To develop methods and display banners/posters to inculcate safety consciousness.
- xx) To attend training and ensure participation of his workers for training as per schedule arranged by the Owner / Consultant and keeps himself updated.
- xxi) To keep records of number of persons working at the site.
- xxii) To keep a constant liaison with Engg-in-charge / owners' representative on safety issues.
- xxiii) To maintain accident & nearmiss record in a register.
- xxiv) To ensure that only PPE of the approved type by owner is used at site.

A separate Safety Officer should be assigned, where more than 100 workers are employed at site. For smaller jobs, the supervisor should assume the role of the safety officer also.

4.2.3 Contract workers

The duties & responsibilities of the contractor worker should include the following:

- i) To perform work safely as per the job requirement and instructions.
- ii) To inform all concerned regarding unsafe conditions/acts.

- iii) To wear PPE as stipulated and necessary for the job.
- iv) To inform promptly to their supervisor regarding all work related incidents resulting in personal injury, illness and/or property damage.
- v) To take all necessary and appropriate safety precautions to protect themselves, other personnel and the environment.

4.3 CONSULTANT

The activities and responsibilities covered under the scope of the Owner may be delegated to the consultant in those cases as applicable, based on the respective contract conditions. The primary responsibility of Consultant is to ensure compliance with agreed HSE plan for the contract by the Contractor. However those responsibilities conferred on Owner as Principal employer cannot be delegated to consultant.

Where the consultant's scope involves Engineering and Design, those factors under **Designer** should also be applicable.

In all cases, the Consultant's scope should include submission of latest HSE plans for work under his and Contractor's purview and implementing the same till job completion. It should conform to owner's overall HSE plan. This should include Guidelines and Implementation and Reporting Methodology to be followed with required report formats.

Adequate number of Safety Officers shall be provided by the Consultant with necessary skills required for the work to be performed.

The Consultant shall review the documents submitted by the contractor and advise owner on acceptance as well as advise suitability and number of Contractor's safety officers / supervisors.

4.4 DESIGNER

The Process Designer should identify all hazards and risks likely to be encountered during fabrication, erection including

dismantling, Pre-commissioning, commissioning and Performance run to meet the Guarantees and advise the risk mitigation measures.

All the hazards and safety measures to be adopted while handling Dangerous chemicals and Catalysts should be detailed by the Process Licensor and the same should be again included in the scope of the suppliers. Specific write ups/MSDS should be obtained from Patented single source suppliers also.

Designs should recognize, include and apply safe practice during preparation, construction and subsequent operational use and maintenance after completion of the Project.

All documents including drawings and calculations are to be originated, checked and approved in accordance with latest international codes, standards, specifications and design basis philosophy.

Preferred use of low risk materials, policy on hazardous substances, preferred use of low noise and dust-suppressed equipment etc. should be encouraged.

5.0 SAFETY MANAGEMENT

5.1 JOB SAFETY ANALYSIS (JSA)

Job safety analysis (JSA) provides a mechanism by which the contractor, safety officer or supervisor take a detailed look at how an individual task is performed and its inherent hazards and preventive measures. This procedure helps in integrating accepted safety and health principles and practices into a particular operation. In a JSA, each step of the job is examined to identify potential hazards and to determine the safest way to do the job.

A job safety analysis includes five steps as below:

- Select a job
- Break the job down into a sequence of steps
- Identify the hazards against each of these steps (based on knowledge of

accident, causes of injuries and personal experience) and determine the preventive measures to overcome these hazards

- Apply the controls to the hazards
- Evaluate the controls

5.2 CRITERIA OF SELECTION OF A CONTRACTOR

“Contractor Safety” can be ensured to a large extent if competent agency for execution of assignment or job, based on HSE system agreed upon by owner, is selected. It is necessary to assess his capabilities and competencies to perform work safely.

A databank should be developed for all the contractors for their past performance on HSE aspects. An attempt should also be made to get similar data from other similar industries.

The data required will depend upon complexity involved in the job and type / size of resources required. Format needs to be suitably developed depending upon size, nature of the job & hazard associated therein. The format designed should also take care of the skill required to carry out the job.

Performance review is essential for all type of contractors. It helps in recording actual performance/experience with contractors while the contract is in progress. It is essential that resources agreed as per the contract are reviewed at mobilization stage for ensuring compliance from the day one and thorough effective supervision / monitoring system are at place.

This activity also helps in taking timely action in case of unsatisfactory performance to correct the situation and ensure safe work during execution period and deciding about suitability of the contractor for future jobs.

The periodicity of such performance review will depend upon size/type/complexity of contract. However, the performance should be reviewed at least at mobilisation stage and at the end of the contract.

5.3 SITE PLANNING AND LAYOUT

Before starting the construction/maintenance job at existing workplace in operation or green field locations, following should be ensured: -

- i) Details regarding location of workshop/ fabrication yard, site office, stores, laboratory, electrical installations, placement of construction machinery, medical and welfare facilities, lighting underground and above ground piping route, cable route etc. should be decided prior to commencement of the work in consultation with owner / Consultants and implementation should be ensured. Layout should be displayed at strategic locations.
- ii) The resources required to meet any emergency situations like fire fighting, first aid etc. should be planned and mobilized as per the job requirement.
- iii) The sequence or order in which work to be done and any hazardous operations or processes should be identified.
- iv) Free access to site shall be provided with clear roads, passage, gangways, staircases etc. Access to construction site should be leveled, open and free from any obstructions like construction material or scrap/waste, exposure to hazards such as falling materials, material handling equipment and vehicles. Any pit or ditch shall be covered or barricaded.
- v) Arrangements should be made to maintain good housekeeping at site. Scrap and debris generated out of construction work should be removed/disposed off at a regular interval as directed. Emergency exit should be provided in case of blockade of primary exit.
- vi) Suitable warning notices and also the routes to and from welfare facilities should be displayed prominently.

vii) Pedestrian pathways and routes for vehicular traffic (light/heavy vehicles including material handling equipment) should be earmarked.

viii) Artificial lighting to be provided at places where work continues or workers pass by after sunset or in case natural light is insufficient like confined spaces.

ix) Keep all equipment /machines under cover to prevent them from dust, rain/flood water, heat etc. and follow storage instructions as applicable for each of them.

5.4 GATE ENTRY PROCEDURE

Gate entry at any site / workplace / unit is to be restricted to ensure entry of only authorised persons / vehicles.

5.4.1 Entry procedure for all contractor worker should be as follows:

A. Issuance of Pass

- i) The passes are to be issued after the owner's representative/engineer-in-charge forwards the application of the contractor providing complete details of the workers being engaged. The contractor may be asked to submit Character & Antecedents (C&A) verification of individual worker from concerned authorities.
- ii) With regard to issuance of passes for all vehicles including material handling equipment, owner's representative / engineer-in-charge should forward the application only after ensuring that all documents pertaining to the fitness of the vehicle/equipment and valid driving license of the driver etc. are available.
- iii) The passes should be serially numbered with address, contractor name, identification mark, signature of the worker etc.
- iv) Special colour code for passes should be used for persons entering different

areas like Administrative Block, Unit area, Project Area (wherever applicable).

- v) Contractor workers engaged on routine basis for long periods should be provided with monthly photo pass.
- vi) Special permit is required separately for working beyond normal working hours and holidays.

B. Gate Entry

- i) Entry of the contractor's employees should be permitted with valid gate passes only.
- ii) Entry of contractor's workers should be allowed in presence of authorized representative of contractor.
- iii) Records of persons at the time of entry/exit should be maintained.
- iv) At the entry gate of the location, a physical checking for non-carrying of lighter, matchboxes, explosives etc. should be carried out.
- v) Gate passes/Identity Cards should be displayed on persons at all the times.
- vi) For Mega-projects at existing / operating installations, it is preferable to have a separate gate for entry of contractor workers and also the project areas should be segregated fencing from operational area by fencing / other physical means.
- vii) No vehicle should be allowed to enter in an operational area without proper flame arrestor.
- viii) Awareness on Safety through training / posters etc. highlighting Do's and Don'ts should be spread within entire contractor workforce. Video/Audio tapes on Safety Topics should be played preferably.
- ix) For occasionally engaged labourers such as for material handling etc., spot photograph may be preferably

taken with two copies (one for preparing the pass and other for attachment with gate register). Specific advice and recommendation of User Department may be given due cognizance. Relevant details are to be written. The pass should be collected back at the gate after day's work.

5.4.2 Tank Truck Loading (TTL) Operation :

At the loading / unloading location, a large no. of Tank Trucks of petroleum products enter the installation. Crew members are generally not regular entrants. The procedure should be as follows:

- i) The gate pass should be issued to the individual crew members on written request of the transporter mentioning TT registration nos., License and certificate of training as per MV rule 9.
- ii) Character & Antecedent (C & A) verification of the TTL crew through local police is to be done preferably and record maintained.
- iii) For loading/unloading purpose, register entry at security gate is made before allowing entry into the premises with recording of names of crew members, time of entry, pass Sr. No., TT no. etc.
- iv) For loading/unloading, crew is allowed entry alongwith TT only, after checking of TT from explosive/security point of view.
- v) Out time, invoice no., Destination etc., are recorded while TTs go out of the security gate.

5.5 TRAINING

Training is to educate contractor workforce on various hazards associated with the job/workplace and on the respective preventive / mitigation measures to avoid untoward incidents.

i) Workers should be adequately and suitably:

- (a) informed of potential safety and health hazards to which they may be exposed to at their workplace;
- (b) instructed and trained in the measures available for the prevention, control and protection against those hazards.

ii) No person should be employed in any work at a workplace unless that person has received the necessary information, instruction and training so as to be able to do the work competently and safely. The competent authority should, in collaboration with employers, promote training programs to enable all the workers to read and understand the information / instructions related to safety and health matters.

iii) The information, instruction and training should be given in a language understood by the worker and written, Oral, visual and participative approaches should be used to ensure that the worker has assimilated the information.

iv) Every worker should receive instruction and training regarding the general safety and health measures common to the workplace. This should include:

- (a) general rights and duties of workers at the workplace;
- (b) means of access and egress both during normal working and in an emergency;
- (c) measures for good housekeeping;
- (d) location and proper use of welfare amenities and first aid facilities provided;
- (e) proper use and care of the items of personnel protective

equipment and protective clothing provided to the worker;

- (f) general measures for personal hygiene and health protection;
- (g) fire precautions to be taken;
- (h) action to be taken in case of an emergency;
- (i) requirements of relevant safety and health rules and regulations.

Copies of the relevant safety and health rules, regulations and procedures should be available to workers upon the commencement of and upon any change of employment.

5.5.1 Training Techniques

a) Lectures

This technique should be applied when it is required to transfer information in local language to a large contractor workforce with controlled content and time.

b) Case Study

This is an effective technique based on the presentation of case of real events by Trainer to highlight probable causes like Human Error, ignorance about the job etc.

c) Videos

Videos, an effective technique of communication, should be used to display the right techniques of performing a task in a safe manner and hazards associated with a job.

d) Demonstration at site

Right way to do a job should invariably be demonstrated to workers at the site itself. The right way is also a safe way. Hazards due to wrong procedures, short cuts and their adverse effects etc. should also be highlighted.

5.5.2 Training/Awareness Module and Frequency

A. General Safety Training to all categories of contractor employees should be imparted before induction and annually thereafter. No person should be allowed to enter the installation without undergoing this training. This training program may cover:

- i) Mandatory uses of PPE like Cotton clothes, Helmet, Safety Shoes, Safety Belts etc.
- ii) Probable Hazards
- iii) Important Telephone No / Escape route
- iv) First Aid
- v) Use of Fire extinguisher

The contractor workers, if engaged in operation of the plants/facilities, should be trained in line with Clause No. 4.6 of OISD-GDN-206 on "Safety Management System". For other categories of contractor workers, training modules for different category employees are as follows:

B. Contractor Supervisor

Contractor Supervisor should be trained in accordance with the provision of clause no. 5.1.1.2, 5.2.7, 5.3.10, 5.6.12 and 5.7.8 of OISD-STD-154 on 'Safety Aspects in Functional Training'

C. Contractor Worker

Yearly training programme should be carried out for contractor worker and the records should be maintained. The training programme should cover at least the following:

- i) Worker responsibility for safety of himself and work area.
- ii) Associated hazards with the job and job area including electrical shock hazards.

- iii) Importance of First Aid fire fighting equipment, their use & operations
- iv) Communication system at the installation
- v) Fire / Accident Reporting procedure
- vi) General Safety rules
- vii) Safety Measures during execution of job such as:
 - Welding / Cutting / Grinding
 - Working at height
 - Confined space entry
 - X ray / radiation
 - Erection / Dismantling of scaffolding
 - Tank construction and repairs
 - Handling of chemicals etc.
- viii) Importance & use of PPE
- ix) Emergency Routes
- x) Assembly Points
- xi) Job Specific Training

D. Consultant / Contractor

Awareness program should be carried out for Consultant / Contractor at the time of induction. This program should cover at least the following:

- i) Responsibility of contractor for safety of their personnel and work area
- ii) Hazardous property of Petroleum products and chemical used
- iii) Communication system
- iv) Fire / Accident Reporting procedure
- v) Medical facility available
- vi) Statutory requirements

- vii) Importance of First Aid equipment and required at the site
- viii) Work Permit system
- ix) Direct/ Indirect losses due to accident
- x) Safety Measures while executing the jobs such as:
 - Welding / Cutting / Grinding
 - Working at height
 - Confined space entry
 - X ray / radiation
 - Erection / Dismantling of scaffolding
 - Tank construction and repairs
 - Handling of chemicals etc.
 - electrical jobs
- xi) Safety training needs of their supervisors and workers
- xii) Importance & Use of PPE at the site
- xiii) General Safety rules at the installation

E Security Personnel

Training program should be carried out for Security personnel at the time of induction and annually thereafter and the records should be maintained. The training program should cover at least the following:

- i) Layout of Plant and Facilities
- ii) Vulnerable locations
- iii) Safety regulations (Statutory and in company)
- iv) Fire Protection Facilities and Locations
- v) Role in case of Fire / Disaster
- vi) Emergency Procedure and Drills
- vii) Industrial First Aid
- viii) Use of Personnel Protective Equipment
- ix) Disaster Management Plan

5.6 INSPECTION / AUDIT

Inspection / Audit is a tool to evaluate compliance of all safety requirements. Most of the information could be gathered

through site inspection using ready-made check lists to ensure that contractors / agencies abide by the safety rules and norms while working at operating / construction sites.

A checklist, while carrying out different type of jobs, should be developed based on hazards associated with the job being performed and requirements as per OISD-GDN-192 on "Safety Practices during Construction". Typical format is enclosed at Annexure II, which should be modified to suit the requirement of the site / job to be done.

Before starting the work and at regular intervals thereafter, Contractor's Supervisor/safety Officer and Owner's representative / Engineer-in charge/safety Officer should inspect as per the checklist so prepared to ensure that contractor has prepared to start the work with all safety precaution required for safe execution of job.

5.7 PENALTIES FOR NON-COMPLIANCE

Financial or other type of penalties like seizure of gate passes, stoppage of work for a limited period etc. may be levied on the contractors or their workers for non-compliance of safety rules. A provision of suitable accident severity based penalty clause for contractor may be incorporated to ensure adherence of systems and procedures. A few of the usual non-compliance are as follows:

- Non-usage of PPEs like Safety helmet / Safety shoes / Safety goggles / Respiratory protection etc. by the contractor personnel
- Non-usage of the safety belt and life line by the workers while working at height
- Non-provision of basic safety requirement such as 24 V lamp for working in confined space, uncertified / non standard lifting tools, earth leakage protection & earthing connections for electrical appliances as per Indian Electricity Rules, emergency isolation switches etc.

- Violation of Safety Permit conditions like Fire fighting equipment
- Non-barricading of area while rigging, digging etc.
- Working without valid work permit
- Unauthorised road closure/blockage

5.8 INCIDENT REPORTING AND INVESTIGATION SYSTEM

All the incidents including near-miss should be reported immediately by contractor's Supervisor to Contractor and owner's Supervisor/Engineer-in-charge, who should inform to Owner's Safety Officer and owner's Management. Owner's Safety Department will be required for onward reporting as per OISD, Statutory requirements.

All accidents regardless of the extent of injury or damage should be investigated in order to find probable causes, lessons learnt thereof and remedial measures required to prevent its recurrence.

The incident investigation should be done as per provision of clause no. 4.12 of OISD-GDN-206 on 'Safety Management System'. All the recommendations of investigation / Enquiry Report need to be monitored closely for its implementation. A proper record needs to be maintained to ensure implementation of all the recommendations and same should be reviewed from time to time.

5.9 SAFETY COMMITTEE MEETINGS

Following three type of safety committee meetings should be held aiming at raising the level of safety consciousness at the site:

5.9.1 Toolbox meeting

To maintain awareness, update training and convey important safety and health information, contractor supervisors should conduct tool box meetings at least weekly and also prior to start of any work. All the contractor workers should attend this meeting. The owner's supervisor/Engineer-in-charge and safety officers should also

attend these meetings on random basis. Tool box meeting should be conducted more frequently depending upon circumstances. Record of the same can be maintained in the following typical format.

TOOLBOX MEETING FORM

SUBJECT :
 PRESENTER :
 DATE :
 TIME : From..... To.....
 CONTENT IN BRIEF :

Participant's Name	Signature
-----	-----
-----	-----
-----	-----

5.9.2 Site Safety Committee Meeting

Primary purpose of this safety committee is to enable owner, contractor and workers to work together to monitor the site safety and health plan so as to prevent accidents and improve working condition on site. Its size and membership will depend on the size and nature of job.

The safety committee should include representatives of owner, consultant, contractor identified as safety officer/supervisor. It should be headed by Engineer-in-charge.

The safety committee should have regular and frequent meetings, atleast fortnightly, to discuss the safety and health program on site and to make suggestions for improvement. The meetings should be documented with a time bound action plan. The functions carried out by safety committee should include:

- i) Review compliance of pending items of last Safety meetings.
- ii) Consideration of the reports of safety personnel.
- iii) Discussion of accident/near-miss and illness reports in order to make appropriate recommendation for prevention.

iv) Examination/evaluation of suggestions made by workers. v) Dissemination of acquired knowledge through training programs and information sharing sessions. vi) Discussion & review of Fire Prevention & Disaster Management Plan. vii) To send recommendation to Apex Body for consideration/approvals.	2) OISD-GDN-192 on “Safety During Construction” 3) OISD-STD-155 Part(I&II) on “Personnel Protective Equipment” 4) Building & Other Construction workers (Regulation of Employment & Condition of Service) Act 1996

5.9.3 Safety Review Meeting by Location Head

This meeting should be headed by the Location head and attended by Owner’s Supervisor/Engineer-in-charge, owner’s safety Officer and all concerned department heads. Prime purpose of this review is to ensure that all the recommendations of various committees are being complied with and to take decisions on critical points raised. This meeting should take place at least once in every quarter. All the investigation reports/ audit findings with status of implementation of recommendations should be discussed.

5.10 SAFETY EQUIPMENT / PERSONNEL PROTECTIVE EQUIPMENT

The type of safety equipment to be used is decided based on the job requirement. Selection should be made based on OISD-GDN-192, OISD-STD-155 (Part I & II) and the job requirement. Safety equipment / Personnel Protective Equipment (PPE) shall be of approved make. Contractor shall provide necessary training to each employee regarding proper usage and upkeep of PPE including its limitation.

A register showing stock and issue of PPE should be maintained by the contractor at site and must be available for inspection.

6.0 REFERENCES

- 1) OISD-GDN-206 on “Safety Management System”

ANNEXURE I**LIST OF SAFETY CODES FOR CIVIL WORKS PUBLISHED BY BUREAU OF
INDIAN STANDARDS**

Sl.no.	Code No.	Title
1	IS: 818	Code of Practice for Safety and Health Requirements in Electric and Gas Welding and Cutting Operations – First Revision.
2	IS: 875	Code of practice for Structural safety of buildings: Masonry walls
3	IS: 933	Specification for Portable Chemical Fire Extinguisher, Foam Type – Second Revision.
4	IS: 1179	Specification for Equipment for Eye and Face Protection during Welding – First Revision
5	IS: 1904	Code of practice for Structural safety of buildings: Shallow foundations
6	IS: 1905	Code of practice for Structural safety of buildings: Masonry walls
7	IS: 1989 – Part II	Leather Safety Boots and shoes for heavy metal industry
8	IS: 2171	Specification for Portable Fire Extinguishers, Dry Powder Type – Second Revision
9	IS: 2361	Specification of Building Grips – First Revision
10	IS: 2750	Specification for Steel Scaffoldings
11	IS: 2925	Specification for Industrial Safety Helmets – First Revision
12	IS: 3016	Code of Practice for Fires Precautions in Welding and Cutting Operations – First Revision
13	IS: 3521	Industrial Safety Belts and harnesses
14	IS: 3696 – Part I	Safety Code for Scaffolds and Ladders: Part I – Scaffolds
15	IS: 3696 – Part II	Safety Code for Scaffolds and Ladders: Part II – Ladders
16	IS: 3764	Safety Code for Excavation Work
17	IS: 4014 – Part I & II	Code of Practice for Steel Tubular Scaffolding
18	IS: 4081	Safety Code for Blasting and Related Drilling Operations
19	IS: 4082	Recommendations on stacking and storage of construction materials at site
20	IS: 4130	Safety Code for Demolition of Buildings – First Revision
21	IS: 4138	Safety Code for working in compressed air – First Revision

22	IS: 4756	Safety Code for Tunneling works
23	IS: 4912	Safety requirements for Floor and Wall openings, Railings and toe boards – First Revision
24	IS: 5216 – Part I & II	Recommendations on safety procedures and practices in electrical work
25	IS: 5121	Safety code for piling and other deep foundations
26	IS: 5916	Safety Code for Construction involving use of Hot Bituminous materials
27	IS: 6994 – Part I	Specifications for safety gloves: Part I – Leather and Cotton gloves
28	IS: 5983	Specification for Eye Protectors – First Revision
29	IS: 6922	Criteria for safety and design of structures subject to underground blasts
30	IS: 7155	Code of recommended practices for conveyor safety
31	IS: 7205	Safety Code for Erection on Structural Steel Works
32	IS: 7069	Safety Code for Handling and Storage of Building Materials
33	IS: 7293	Safety Code for Working with Construction Machinery
34	IS: 7323	Guidelines for operation of Reservoirs
35	IS: 7969	Safety Code for handling and storage of building materials
36	IS: 8758	Recommendation for Fire Precautionary Measures in construction of Temporary Structures and Pandals
37	IS: 8989	Safety Code for Erection of Concrete Framed Structures
38	IS: 9706	Code of Practices for construction of Aerial ropeways for transportation of material
39	IS: 9759	Guidelines for de-watering during construction
40	IS: 9944	Recommendations on safe working load for natural and manmade fibre rope slings
41	IS: 10667	Guide for selection of industrial safety equipment for protection foot and leg
42	IS: 10291	Safety Code for dress divers in civil engineering works
43	IS: 10386 – Part I	Safety Code for Construction, Operation and Maintenance for River Valley Projects
44	IS: 10386 – Part II	Safety Code for Construction, Operation and Maintenance for

River Valley Projects

45	IS: 11057	Code of Practice for Industrial Safety Nets
46	IS: 13415	Code of Practice on safety for Protective barriers in and around building
47	IS: 13416	Recommendations for preventive measures against hazards at working places

Statutory Regulations

Latest Statutory Acts and Rules, as given below, may be referred:-

1. The Petroleum Acts 1934 and Petroleum Rules 2002
2. The Factory Act, 1948 (As amended by Factory Amendment Act 1987) and concerned Factory Rules
3. The Water (Prevention and Control of Pollution) Act 1974 & Rules 1975
4. The Environment (Protection) Act 1986
5. The Manufacturing, Storage and Import of Hazardous Rules 1989
6. The Hazardous Wastes Management (Management & Handling) Rules 1989
7. The Indian Electricity Act 1901 and Rules 1956
8. The Indian Explosive Acts, 1884 & The Indian Explosive Rules 1983
9. The Gas Cylinder Rules 1981 and the static & Mobile Pressure Vessels (Unfired) Rules 1981
10. The Indian Boiler Act 1923 and Regulations 1950
11. The Public Liability Act 1991 as amended in 1992
12. The Motor Vehicle act 1988 and Central Motor Vehicle rules 1989
13. Building & Other Construction workers (Regulation of Employment & Condition of Service) Act 1996

In addition to above, various other statutory acts like EPF, ESIS, Minimum wage act and other local statutory requirements shall also be complied with.

CHECK LIST FOR SAFETY INSPECTION / AUDIT

Job _____ Location _____ Date of Audit _____ Frequency _____

Inspected by _____ Contractor (s) _____

Sl.no.	ITEM	YES	NO	NA	REMARKS / ACTION
1.0	PERSONNEL PROTECTIVE EQUIPMENT (PPE): Are following PPEs being used as per the job requirements?				
1.1	Safety Helmets				
1.2	Safety Shoes				
1.3	Gum Boots				
1.4	Safety Belts with life line				
1.5	Gloves				
1.6	Ear Plug				
1.7	Goggles				
1.8	Shield Glass				
1.9	Face Protection				
1.10	Breathing Apparatus				
1.11	Canister Mask				
1.12	Hand wash / Eye wash/ Respirating filter / cloth				
1.13	Boiler Suit				
1.14	Others				
2.0	HOUSE KEEPING				
2.1	Whether Waste Bins are provided / used				
2.2	Are Passageways / Walkways clear?				
2.3	Is General neatness O.K.?				
2.4	Is the Ground free from oil, grease etc. and is not found to be slippery?				
2.5	Others				

3.0	EXCAVATION				
3.1	Whether soil stability is checked?				
3.2	Whether proper shoring for the excavation is provided to prevent cave-in for side of slope >45 Degree?				
3.3	Whether proper precautions have been taken if the excavation is adjoining to heavy structure like building, street and roadways?				
3.4	While excavating whether proper slope usually 45° & suitable benches of 0.5 m width at each 1.5 m depth are provided?				
3.5	Whether barricading of 1m height with glowing caution board is provided for excavation beyond 1.5m depth?				
3.6	Whether excavating earth is placed beyond 1m of the edge of the trench?				
3.7	Whether heavy vehicle movement is restricted to come too close to the excavating area?				
3.8	Whether necessary precaution is taken for underground pipes, sewers, cables by contractors?				
3.9	Whether excavation hot work permit is taken?				
3.10	Whether extra precaution is taken for bailing out water properly while excavating?				
3.11	During rains whether the excavation is done with extra precaution to prevent caving in?				
3.12	Whether two separate entry/ exit points with necessary ladders / steps, as per requirement, have been provided?				
3.13	Whether one person is available at all the time to communicate any hazards noticed with workers working in deep trenches or excavation?				
3.14	Whether necessary precautions like				

	regular gas testing are being taken in areas having hydrocarbons and LPG so that no gas accumulation takes place in the trenches.				
3.15	Whether IS: 4081-1986 & Indian Explosive act & rules for storage, handling & carrying of explosive material and execution of blasting operation is followed?				
3.16	Whether in case of mechanised excavation, caution board is provided for do's and don'ts like 'Nobody to enter' within one meter of the extreme reach?				
3.17	Whether the following are inspected during excavation work :- a) Boulder formation encountered b) Collapsing / development of cracks of sides c) Marked damage to support d) Unexpected fall of ground e) Inspection of site after each blast.				
3.18	Others				
4.0	PERMITS				
4.1	Whether valid work permit is issued to start any work?				
4.2	Whether all conditions of the permit are fulfilled before starting the job?				
4.3	As noted in the permit, whether compliance of all the recommendations are ensured?				
4.4	Whether permits are available at work site all the times?				
4.5	Whether hot work permit registered in fire station?				
4.6	Whether permits are being closed after the completion of job?				
4.7	Others				
5.0	SAFETY IN CUTTING / WELDING/GRINDING				
5.1	Whether LPG / Oxygen / Acetylene/ Gas				

	cylinders are kept outside only while working in confined space?				
5.2	Are Acetylene /LPG cylinders kept in upright position and secured at designated places under shed – wet gunny bags wrapped around it if the same is under sun at designated place?				
5.3	Check cylinder and cylinder valves for any kind of damage?				
5.4	Whether protective valves are kept on cylinder while not in use?				
5.5	Whether proper means and method for transportation of cylinders to avoid dropping and rolling are being adopted / followed?				
5.6	Whether gas cylinders, regulators are kept away/free from oil and grease?				
5.7	Whether all hoses were found to be free of any damage or crack?				
5.8	Whether oxygen and acetylene cylinders are stored separately?				
5.9	Whether color coding is being used for easy identification of different type of cylinders and hoses?				
5.10	Whether cylinder keys are available near the cylinder?				
5.11	Whether gas torches with NRV with flash back arrestor of approved make are only being used?				
5.12	Whether pressure gauges are in working condition and checked from time to time?				
5.13	Whether welding shields are used while welding?				
5.14	Whether proper earthing for welding machines are provided?				
5.15	Whether power is taken from approved sources (welding receptacles)?				
5.16	Whether welding receptacles are properly grounded?				

5.17	Whether welding cables are maintained in good condition and without any joints/cuts?				
5.18	Whether to avoid short circuit, welding machines are protected against rain?				
5.19	Whether earth connectors are securely connected to the job and not to the adjoining pipeline or structure?				
5.20	Whether flame arrestor of DG set is of approved make and quality?				
5.21	Others				
6.0	SAND / SHOT BLASTING				
6.1	Whether sand blasting is used only after getting approval from competent authority?				
6.2	Whether air compressor used for sand / shot blasting are positioned away from work place?				
6.3	Whether exhaust of the prime mover is directed away from the work place?				
6.4	Whether in case of motor driven compressor, the body of the motor as well as the compressor is properly earthed?				
6.5	Whether line operator of sand/shot blasting wear suitable PPEs including mask?				
6.6	Whether adequate measures are adopted to confine dust/spray particles?				
6.7	Whether adequate measures are taken for proper ventilation while the work is done in confined space?				
6.8	Others				
7.0	SAFETY WHILE WORKING AT HEIGHTS / SCAFFOLDING / LADDERS				
7.1	Whether work permit is obtained to take up work at height above 3 mts?				
7.2	Whether steel pipes scaffoldings are used in unit/off site areas?				

7.3	Whether provision for suitable platform with all scaffoldings are made? Whether its construction is as per specification with toe board and railing?				
7.4	Whether the area below working at height is cordoned?				
7.5	Whether suitable platform is provided?				
7.6	Whether ISI approved quality and good condition safety belts are used while working at heights?				
7.7	Whether life line of safety belt is Anchored to an independent secured support capable of withstanding load of a falling person?				
7.8	Whether the area around the scaffold is cordoned off to prohibit the entry of unauthorized person?				
7.9	Whether ropes used are of good condition and adequate strength free of defects?				
7.10	Whether ladder is placed at secured and leveled surface?				
7.11	Whether it is extended 1.5 Mts. Above the landing point?				
7.12	Whether ladder used are of adequate length and tying short ladder is avoided?				
7.13	Whether metallic ladders are placed away from electrical system?				
7.14	Whether tools or materials are removed after completion of the day's job at heights?				
7.15	Whether a valid permit is obtained before taking up work on asbestos or fragile roof?				
7.16	Whether sufficient precaution is taken while working on fragile roof?				
7.17	Whether provision is made to arrange duck ladder, crawling board for working at fragile roof?				
7.18	Whether scaffolding has been erected on rigid / firm / levelled surfaces only?				

7.19	Whether scaffold has been inspected by competent person prior to being put in use?				
7.20	Whether the scaffolding has been designed for the load to be borne?				
7.21	Whether the erection and dismantling of the scaffolding is being done only by trained persons and under supervision?				
7.22	Whether safety net with proper working arrangement and life line has been provided?				
7.23	Others				
8.0	SAFETY IN CONFINED SPACE				
8.1	Whether a permit is obtained to enter a confined space?				
8.2	Whether gas test for hydrocarbon, toxic gas, oxygen level is obtained before entering any confined space?				
8.3	Whether adequate oxygen level is ensured in confined space before entering? If not, whether all precaution like using of Breathing Apparatus set is ensured?				
8.4	Whether, in case of chance of ingress of hydrocarbon gases / toxic gases, Personnel Monitoring System (PMS) is used or not?				
8.5	Whether only in presence of a supervisor, worker enters in confined space?				
8.6	Whether provision of sufficient means of entry and exit is available?				
8.7	Whether provision of ventilation to remove welding fumes, dust, exhaust gases are made?				
8.8	Whether provision of 24V (Hand lamps with cage as per OISD-STD-155) light for working inside space is made?				

8.9	Is it strictly ensured that a stand-by trained person is standing outside before a person enters a confined space and communication is being maintained all the time with workers working inside?				
8.10	Whether life belt with one end under control of stand-by person outside is kept while working in confined space?				
8.11	Whether Personnel protective Equipment are in good condition as specified in the permit?				
8.12	Whether absence of Hydrogen Sulfide, CO or other toxic gas is ensured before entering into a confined space? If yes, whether proper required PPE like BA, Gas Mask are used.				
8.13	Whether boxing up is being done only as per the approved procedures and by competent persons?				
8.14	Whether all the safety precautions listed in OISD-GDN-192 are taken while working in sewers, OWS etc.?				
8.15	Whether proper house keeping is being maintained inside the confined space?				
8.16	Whether training has been provided to workers working in the confined space and the workers only of sound health are being asked to work in the confined space?				
8.17	Others				
9.0	SAFETY IN MATERIAL HANDLING				
9.1	Whether all lifting tools, tackles, machines, chains, ropes etc. are of sound construction, made of sound material and maintained in good condition?				
9.2	Whether safe working load, date of testing visibly marked/painted on the equipment?				
9.3	Whether lifting tools, tackles are of adequate strength for the load to be handled?				
9.4	Whether all parts including the working gears fixed or movable of every lifting machine, chain, rope, tackles specify the				

	following condition: a) Thoroughly examined by competent person at least once a year or such interval as required by statutory authority. b) Document of such examination are maintained and produced to owner supervisor before use of particular equipment?				
9.5	Whether chain blocks and cables are inspected before each use to assure their sound condition?				
9.6	Whether hoist and lift if used are: a) Properly maintained and thoroughly examined by competent authority at least once in every year. b) A register to be maintained to record particulars of such examination in prescribed forms and shall be produced to the owner supervisor before use.				
9.7	Whether area below the movement of boom of crane is cleared to avoid injury from falling objects?				
9.8	Whether it is ensured that crew of truck leave the truck in crane handling area before starting loading / unloading, if not involved in rigging operation?				
9.9	Whether transporting material from one place to another is done by suitable means?				
9.10	Whether carrier with sufficient capacity without projecting parts is used for transporting materials?				
9.11	Whether riggers engaged are well trained and conversant with signaling procedures including night signalling if required?				
9.12	Whether permission of authorized person is obtained before working on or near an overhead crane?				
9.13	Whether trained riggers are available all the time along with crane?				

9.14	Whether barricading has been done to ensure no unauthorised person enters in the working area of the crane?				
9.15	Whether lifting plan has been prepared and approved before start of the work?				
9.16	Whether route of crane movement has been planned before the crane moves out of the garage?				
9.17	Whether it has been ensured that no electrical cable come within 3 metres or safe distance from the boom of the crane?				
9.18	Whether boom is being kept in the horizontal position or locked while idling?				
9.19	Whether material is being stacked / destacked in trucks with the help of wedges to ensure no slippage while loading / unloading takes place?				
9.20	Whether the forklift / crane is being operated only by trained person?				
9.21	Others				
10.0	ELECTRICAL SAFETY				
10.1	Has the Electrical Line Clearance procedure been followed involving electrical and other concerned Dept. and filling of formats?				
10.2	Have Danger Signs with Voltage rating/ Men at work signboards been displayed at both Sub Station as well as the work site?				
10.3	Has the contractor worker understood the electrical circuit on which he is going to work with probable electrical hazards and mitigation measures to be adopted?				
10.4	Whether contractor has engaged electrician (s) having valid electrical licence in line with provisions in Indian Electricity Rules?				

10.5	Have all checks prior to switching operation been carried out and authorisation of owner/ user section obtained subsequently?				
10.6	Have all earthing links on electrical conductors removed before charging the line/ apparatus?				
10.7	Have PPE as prescribed under Indian Electricity Rules been in place, kept healthy and used?				
10.8	Are earthing and bonding arrangement of non-current carrying metallic parts in line with provisions of Indian Electricity Rules – 1956 amended time to time as IS: 3043?				
10.9	Have electrical part of OISD-GDN-192 and Clause No. 9.0 for Temporary installations in OISD-173 been understood and followed wherever applicable?				
10.10	Are flexible wires having voltage of 240 volts above earth potential taken through PVC conduits?				
10.11	Whether portable hand lamps with a voltage rating of not more than 24 volts used with flameproof enclosures in confined spaces within columns, vessels etc?				
10.12	Have the Switches, MCBs, fuses etc. been inspected for proper ratings?				
10.13	Has Earth Leakage Circuit Breaker (ELCB) been used on the incoming side to protect against leakage of current? Is the device tested every time the work is started?				
10.14	Whether all portable appliances are provided with insulated Three pin Plugs and socket arrangement?				
10.15	Whether industrial type extension boards and plug sockets are used?				
10.16	Has the electrical equipment brought to site by contractor been inspected by owner's supervisor/ safety officer for damage/cuts/abrasion etc? Is record of				

	Insulation Resistance, wherever required , being kept?				
10.17	Have standard practices for termination of conductors/ cables been followed (e.g. use of proper lugs, crimping tool, cable glands etc)? Is cable armour in continuity from feeding point to load?				
10.18	Are the Contractor supervisor and workmen well acquainted with first aid for electrical shock?				
10.19	Are the wires/ cables identifiable along their route towards the load by using colour coding and/or markers?				
10.20	Others				
11.0	ROAD WORK				
11.1	Whether site is barricaded and provided with warning signs including night warning lamps/ self glowing markers at appropriate location for diversion of traffic?				
11.2	Whether mixing aggregates with bitumen is done with the help of batch mixing plants? If no, whether adequate precautions have been taken?				
11.3	Whether road rollers, bitumen sprayers, pavement finishers are driven by experienced drivers with valid driving licenses?				
11.4	Whether the worker handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen with aggregate are provided with PVC hand gloves rubber shoes with pegging upto knee joints?				
11.5	Others				
12.0	FORM WORK, REINFORCEMENT				
12.1	Whether form work, shuttering, shoring etc. are adequately designed and provided to erect the structure and to support the expected load?				

12.2	Whether staging (support) for shuttering is designed for loads like worker movement, impact load and other incidental loads during construction?				
12.3	Whether workers use PPEs at work site?				
12.4	Whether all safety procedures are adopted while cutting rod?				
12.5	Whether proper staging and bundling is provided for supplying rods at height?				
12.6	Whether sufficient cross bracings are provided for high staging works at vulnerable points?				
12.7	Others				
13.0	CONCRETING				
13.1	Whether the concreting area is barricaded?				
13.2	Whether vibrator hoses, pumping concrete accessories are in healthy condition and mechanically strong?				
13.3	Whether it is ensured that no pipe line in concrete pumping system is attached to any temporary strut such as scaffolds etc.?				
13.4	Whether it is checked that safety guards around moving parts are provided in concrete mixer/ machines?				
13.5	Whether earthing of electrical mixers, vibrator etc. are checked?				
13.6	Whether entry of unauthorised person in the concreting area is restricted?				
13.7	Whether adequate lighting arrangement is made in the concreting area if working during night?				
13.8	Whether PPEs like gum boots, gloves and dust masks etc. are being used?				
13.9	For overhead or underground work, whether form work and shuttering have been checked so that the same do not collapse during concreting?				

13.10	Others				
14.0	DEMOLISHING (DEMOLISHING BY BLAST NOT CONSIDERED)				
14.1	Has the stability of structure been examined by competent person and found OK?				
14.2	Are non-sparking tools being used, if required?				
14.3	Is intermittent clearing operation being done to keep the area reasonably tidy and clean?				
14.4	Whether effective barricading has been provided?				
14.5	Whether Electrical and other facilities like water, oil, gas pipelines have been isolated/protected?				
14.6	Whether the plan of demolition (including sequence of activities) has been prepared and approved prior to start of the work?				
14.7	Others				
15.0	RADIOGRAPHY				
15.1	Are safety precautions for handling of source as per guidelines of BARC being followed?				
15.2	Is the potency of the source being used within acceptable limits as per the BARC regulations?				
15.3	Is the area being cordoned with proper signs during radiography?				
15.4	Does proper place exist as per BARC regulations for storage of source / Personnel safety equipment?				
15.5	Does the radiographer has valid certificate of radiography from competent authority (BARC)?				
15.6	Is radiographer using Exposure Meter / Dosi Meter?				
15.7	Whether minimum occupancy of the				

	premises / workplace is being ensured while radiography is in progress?				
15.8	Is permit system being followed?				
15.9	Others				
16.0	ADDITIONAL SAFETY PRECAUTION FOR UNITS WITH HYDROCARBONS				
16.1	Are jobs being carried out with a valid work permit only as per OISD-STD-105 "Work Permit System".				
16.2	Is smoking prohibited in all places containing combustible or flammable materials and "No Smoking" notices prominently displayed.				
16.3	Are only approved type electrical installations and equipment, including portable lamps, being used?				
16.4	Are oily rags, waste, wooden materials and clothes or other substances liable to spontaneous ignition being removed?				
16.5	Are the combustible materials properly shielded in case same cannot be removed from the area?				
16.6	Has welding screens (like metal/asbestos/ water curtain) been put up to protect other equipment / facilities/ OWS/ drains in adjoining areas against flying sparks, as may be required?				
16.7	Is Gas-testing being done with the means of a calibrated Gas detection Meter prior to start of Hot work and being done subsequently at regular intervals as per the requirement?				
16.8	Are regular inspections being done of places where there are fire risks like in the vicinity of heating appliances, electrical installations and conductors, stores of flammable and combustible materials, welding and cutting operations?				
16.9	Are fire-extinguishing equipment being placed at strategic locations and are kept well maintained and inspected at suitable intervals by a competent person.				
16.10	Are access to fire-extinguishing equipment such as hydrants, portable				

	extinguishers and connections for hoses kept clear at all times?				
16.11	Are all supervisors and a sufficient number of workers trained in the use of fire-extinguishing equipment?				
16.12	Are audio means, to give warning in case of fire provided, audible in all parts of the site where persons are liable to work?				
16.13	Is there an effective evacuation plan in place so that all persons are evacuated speedily without panic?				
16.14	Others				
17.0	EMERGENCY PROCEDURES				
17.1	Is signaling / siren system effective?				
17.2	Is arrangement for rescuing affected person adequate?				
17.3	Are signs showing emergency exit route installed?				
17.4	Is emergency exit route clear of obstacles?				
17.5	Is communication system adequate?				
17.6	Whether emergency vehicle with driver has been provided to meet any emergency situation?				
17.7	Does any tie-up with hospitals or local doctors exist?				
17.8	Has the assembly point for workers in case of emergency been identified and earmarked?				
17.9	Has training been provided to a few workers for First Aid?				
17.10	Others				
18.0	WELFARE FACILITIES				
18.1	Is hygienic conditions prevailing at labour camps?				
18.2	Are First Aid facilities available?				

18.3	Does proper sanitation exist at site office and labour camps?				
18.4	Does any arrangement of medical facilities like tie ups with nearby hospital exist?				
18.5	Is proper drinking water facility available for workmen & staff?				
18.6	Are crèches provided for children (if applicable)?				
18.7	Is any proper place/canteen/restroom provided for eating food and taking rest?				
18.8	Is any place earmarked for storing / keeping clothing?				
18.9	Is Adequate washing facility available?				
18.10	Does proper ventilation at working place exist?				
18.11	Others				
19.0	GENERAL				
19.1	Are illumination levels at workplace and passages adequate?				
19.2	Is communication system adequate?				
19.3	Are display and caution boards provided at strategic locations?				
19.4	Are road barriers being used for blocking any roads/passage?				
19.5	Has the structure been adequately secured against storm/high winds during construction/ erection?				
19.6	Are the equipment properly earthed?				
19.7	Are vehicles being checked like brakes, oil, lights etc. on regular basis?				
19.8	Is compressed air being used only for its intended purpose and not for any other purpose?				
19.9	Are only proper clothes and not loose clothes being used while working around				

	machinery?				
19.10	Are nails or other sharp objects being removed or bent?				
19.11	Are machine guards over moving parts of machinery such as coupling, pulley, wheel etc. installed?				
19.12	Whether after maintenance of machinery the guards are securely fitted before putting into operation?				
19.13	Are working platforms / gangways provided with hand rails & toe guards?				
19.14	Are swing platforms provided with chains & secured adequately when not in use?				
19.15	Are the approaches to work sites being maintained & kept clear of obstacles?				
19.16	Whether engines of equipment entering into the operating area have exhaust and muffler system with approved spark arrestor?				
19.17	Whether vehicles/engine driven equipment, electrical equipment and tools used are certified?				
19.18	Whether contractors inform his workers about hazards and safe procedures?				
19.19	Whether sufficient care is taken so that spark do not go outside working enclosure & falls below?				
19.20	Whether contractor's qualified / trained supervisor is present?				
19.21	Whether all exhausts of engines are provided with approved type of flame arrestors and exhaust is not facing toward the place where the workers are working?				
19.22	Others				

Signature of the Auditor

SITE HSE PLAN FOR HPCL- VISAKHAPATNAM



HSE

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR – EASTERN REGION

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SITE HSE PLAN FOR HPCL-VISAKHAPATNAM



DOC NO. : HSEP:PSER:14-HPCL- BHEL	REV NO. : 02	EFF DATE : 19.05.18
PREPARED BY	REVIEWED BY:	APPROVED BY
ISSUED TO :		
COPY NO. :	ISSUED BY	
DATE OF ISSUE :	(NAME, DESGN./DEPT.)	(SIGN.)



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
HPCL- VISAKHAPATNAM**

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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 and its sub-contractors at **HPCL-Visakhapatnam** site. This shall be read along with HSE plan of EIL, OISD standard-192 & 207. In case of any conflict of clauses, the more stringent one shall apply.
- 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.

2.0 SCOPE

The document is applicable for HPCL-Visakhapatnam site within contractual scope of work

3.0 OBJECTIVES

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.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including sub-contractors 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 authority.
- 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.

3.1 Goals and Targets -

- To achieve "Zero Loss Time Incident at Site"
- 100% compliance of all legal/statutory requirements related to EHS.
- 100% Health, Safety and Environmental Induction training attendance for all employees and sub-contractors.
- 100% High Risk activities to be carried out only after approved Method Statement, HIRA/JSA and Permit to Work are implemented.

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- 100% PPEs compliance in high & medium risk activities.
- 100% incident reporting, recording and reviewing for corrective & preventive actions.
- A monthly review shall be scheduled and conducted to assess HSE program compliance and to close any recognized gaps to improve safety management and incident prevention.

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/-

Director (Power)

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5.0 TERMS AND DEFINITIONS

5.1 DEFINITIONS

5.1.1 INCIDENT

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

5.1.2 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".

5.1.3 MAN-HOUR WORKED

The total number of employee hours worked by all employees including sub-contractors 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 workday 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.

5.1.4 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.

5.1.5 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.

5.1.6 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.

5.1.7 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.

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:

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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.

5.1.8 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:

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

5.1.9 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:

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

5.1.10 INCIDENCE RATE

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

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

6.0 HSE ORGANISATION

The deployment matrix of HSE personnel is furnished below: The nos include those deployed by BHEL directly and those deployed by sub-contractors

No of workers deployed	Requirement of safety personnel for every shift		
	Safety Steward	Safety supervisor	Safety Officer
1-50	1	1	1
51-100			
101-150	2		
151-200			
201-250	3		
251-300		2	
301-350	4		
351-400			
401-450	5		
451-500			
501-1000	10	4	
1001-1500	15	6	2
1501-2000	20	8	

In case any of the safety personnel leaves job at the site, the same shall be intimated to the owner/ Consultant/ EIL. BHEL/ Sub-contractor shall recruit new personnel and fill up the vacancy.

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6.1 QUALIFICATION FOR HSE PERSONNEL

a) Safety Steward/Observer

As a minimum, he shall possess class XII pass certificate and trained in fire-fighting as well as in safety/occupational health related subjects, with minimum two year of practical experience in construction work environment and should have adequate knowledge of the local language spoken by majority of the workers at the construction site.

b) Safety Supervisor

As a minimum, he shall possess a recognized graduation Degree in Science (with Physics & Chemistry) or a diploma in Engg. or Tech. with minimum Two years of practical experience in construction work environment and should possess requisite skills to deal with construction safety & fire related day-to-day issues.

c) Safety Officer / Safety Engineer

Safety officer/Engineer Should Possess following Qualification &Experience:

(i) Recognized degree in any branch of Engg. or Tech. or Architecture with practical experience of working in a building or other construction work in supervisory capacity for a period of not less than two years,

or

possessing recognized diploma in any branch of Engg. or Tech with practical experience of working in a building or other construction work in supervisory capacity for a period of not less than five years.

(ii) Recognized degree or diploma in Industrial safety

(iii) Preferably have adequate knowledge of the language spoken by majority of the workers at the construction site.

Alternately

(i) Person possessing Graduation Degree in Science with Physics & Chemistry and degree or diploma in Industrial Safety (from any Indian institutes recognized by AICTE or State Council of Tech. Education of any Indian State) with practical experience of working in a building, plant or other construction works (as Safety Officer, in line with Indian Factories Act, 1958) for a period of not less than five years, may be considered as Safety Officer.

d) HSE In-Charge

The HSE officer deployed by BHEL directly shall be designated as HSE In-Charge. Duties & responsibilities of such person shall be commensurate with that of relevant statute and primarily to coordinate with top management of Client and sub-contractors.

In case the statutory requirements i.e. State or Central Acts and / or Rules as applicable like the Building and Other Construction Workers' Regulation of Employment and Conditions of Service- Act,1996 or State Rules (wherever notified), the Factories Act, 1948 or Rules (wherever notified), etc. are more stringent than above clarifications, the same shall be followed.

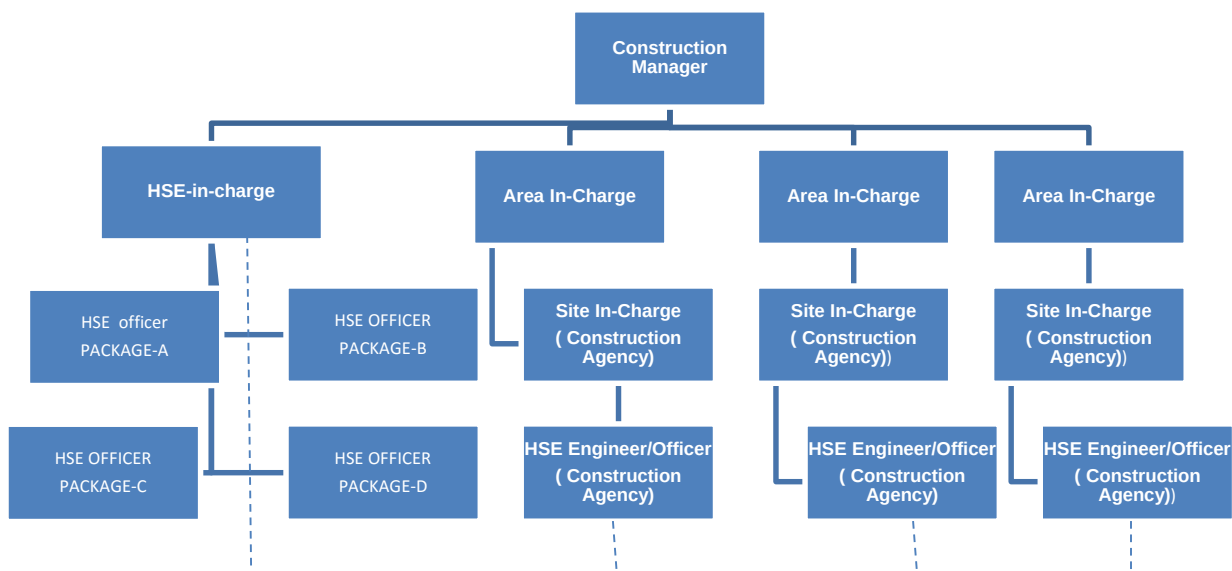
BHEL/Sub-contractors shall ensure physical availability of safety personnel at the place of specific work location, where Hot Work Permit is required/granted. No work shall be started at the project sites until above safety personnel & concerned Site Engineer of BHEL/Sub-contractor are physically deployed at site. BHEL shall verify & authenticate credentials of such safety

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personnel and furnish Bio-Data/Resume/Curriculum Vitae of the safety personnel as above for EIL/Owner's approval, at least 1 month before the mobilization. BHEL, whenever required, shall arrange submission of original testimonials/certificates of their Safety personnel, to subsequently EIL/Owner (for Verification/scrutiny, etc.)

Imposition / Realization of penalty shall not absolve BHEL from responsibility of deploying competent safety officer at site. Adequate planning and deployment of safety personnel shall be ensured by BHEL so that field activities do not get affected because of non-deployment of competent & qualified safety people in appropriate numbers.

Tentative HSE organogram follows:



6.2 RESPONSIBILITIES

6.2.1 Construction Manager:

- To appoint HSE-in-charge.
- To chair monthly site HSE review Meetings.
- To define roles and responsibilities of the employees under their control with respect to HSE Management System implementation.
- To coordinate with MR for setting HSE objectives and targets in BSC.
- To formulate detailed schedule of activities for implementation of HSE programs.
- To implement Operational Control Procedures (OCPs).
- To arrange resources for implementation of HSE programs.
- To identify and arrange for provision of required training to employees as well as suppliers/ contractors.
- To ensure investigation into any significant incident or safety lapse.
- To ensure corrective action and preventive action for non- conformities / observations.

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- To generate HSE performance reports and forwarding the same to MR.
- To communicate the feedback received from interested parties to MR and vice versa.
- To communicate to suppliers / sub-contractors regarding HSE issues pertaining to the activities / services provided by suppliers /sub- contractors and to ensure their training, if required.
- To ensure effective implementation of Emergency Preparedness Response Plans and periodical mock drills.
- To stop work as & when identified unsafe.
- To facilitate HSE promotion.

6.2.2 HSE-in-Charge

- 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 and other emergency Drills and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- Apprise PSER/HQ on safety related problems.
- Deploy safety wardens suitably.
- 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.
- To stop work as & when identified unsafe.
- 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, sub-contractors on HSE matters

6.2.3 SECTION IN-CHARGE (RESPECTIVE PACKAGE IN CHARGE)

- Shall report to Construction Manager.

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- Shall demonstrate the personal commitment of his subordinates towards implementation of HSE targets.
- Shall implement the requirements of the client and company safety policy and the HSE Plan.
- Shall manage supervisory structure within their respective sections to ensure that the detailed requirements of Health Safety and Environment Policy of the Customer/ Company is understood and implemented by all personnel engaged in their respective area of operation.
- Shall ensure that the persons working under him shall be competent to maintain the Safety Standards at their site.
- Shall continuously review HSE performance within his sections to ensure that performance targets are being achieved.
- Shall ensure that Induction Training and Tool Box talks are conducted at his site regularly.
- To stop work as & when identified unsafe.
- Shall conduct periodic HSE inspection and mock-drill.
- Shall ensure that specific Risk Assessments conducted by trained and competent personnel at the appropriate time and that the resultant control measures are communicated to the persons responsible for supervising and executing the work.
- Shall ensure that all management and supervisory personnel engaged within his section conduct routine HSE surveillance.

6.2.4 ALL EMPLOYEES

- To adopt safe working practices wherever they are undergoing.
- To take corrective action and preventive action in case any non-conformity is observed on product / process / system with respect to Occupational Health, Safety and Environment.
- To report all incidents including near miss to HSE officer or HSE coordinator (Site) / HOD (SOX).
- In case any particular activity / work has extremely high consequential risk or high environmental impact, the employee shall bring it to the notice of Site in charge before starting the work.
- To ensure that the workers are engaged by the sub-contractor for the job after undergoing induction training.
- To ensure that the persons engaged in his area follow the safety rules like using appropriate PPEs.
- To get involved in exercises like Job Safety Analysis and Work Permit System.
- To engage licensed electricians for site electrical works.
- To report any incident including near misses or safety lapses immediately to safety officer/HSE co-ordinator/RCM.
- To stop work as & when identified unsafe.
- To maintain & promote improved level of house-keeping all the time at site.
- To support/co-operate with audit team members as & when safety audits are carried out.
- To involve in investigation, if any incident occurs in his work area.
- To participate in safety promotional programmes.
- To attend the safety committee meeting, if he is a member/ invitee

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- To ensure that only fit T&Ps and qualified persons are engaged.

6.2.5 SITE IN -CHARGE OF SUB-CONTRACTOR

- 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 statutes
- Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent authorities.
- 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 sub-contractor 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, mock drill, medical camps, induction training and training on HSE at site.
- Shall ensure full co-operation during HQ/External /Customer HSE audits.
- 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.

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- Shall ensure adequate emergency preparedness.
- Shall be member of site HSE committee and attend all meetings of the committee

6.2.6 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUB-CONTRACTOR

- 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, sub-contractors on HSE matters

7.0 Award and Motivation Scheme

- BHEL shall organize monthly safety day at the site involving all the persons working with BHEL. This shall be clubbed with National level programmes like National Safety Day/ Road Safety Week/ National Environment Day. On such occasions, various events shall be organized including a short lecture on theme of the month or the national programme. Mock-drills, fire drills etc shall also be organized. Various awards are also announced like Best Vendor, Best employees, Best Safety officers for the month. The winners get prizes. The winners are decided based on HSE performance only. Special prizes are also given to persons in recognition of their performance in responding to an emergency situation or eliminating/ minimizing a significant hazard or saving human lives/property from injury/damage.

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- As such, there is no cash award system in vogue. However, a special monetary award is considered in case of outstanding HSE performance by vendors on case-to-case basis. If BHEL gets any monetary award from customer like safety bonus, the same shall be shared with the vendors.

8.0 HSE TRAINING & AWARENESS

8.1 HSE INDUCTION TRAINING

All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL/subcontractor/customer at a specific location:

No employee shall be engaged without induction training

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 major hazards & risks, aspects & impacts and mitigation measures related to the jobs to be performed by the person or group of person.
- First aid facility.
- Emergency Contact No.
- Incident reporting.
- Fire prevention and emergency response.
- Rules to be followed in the labor colony (if applicable)
- Use and maintenance of PPEs (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
- Dress requirement- no loose dress/ ornaments
- No smoking/alcohol/drug abuse/gambling/fights/theft/damage to property
- General Traffic rules/pedestrian rules
- Cell phone use restrictions
- House keeping
- Security Compliance Requirements
- Environmental Compliance Requirement
- 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 Contractor's in-house HSE induction, all employees shall be tested by asking questions orally or in writing and must pass the test with a 70% passing score, to find out if training input has been retained. Test scores shall be documented and each employee shall sign an induction training form (**format no. HSEP:13-F02**) 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.

8.2 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 tool box is a forum for two-way communication between management and the employees. Pep talk is focused on a specific job. The agenda shall consist of the followings:
 - Details of the jobs being intended for immediate execution.

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- 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.
- Feedback from employees
- Any doubt clearing session at the end.
- Record of Tool box talk shall be maintained as per **format no. HSEP:13-F11**
- Tool box talk to be conducted at least once a week for the specific work.

8.2.1 PRE JOB BRIEFING

A separate documented daily pre job briefing must be conducted at the actual job/work site location with the supervisor and work crew, to cover working environment/conditions, safe work practices for the activities to be carried out, required PPE and review of the work package, JSA and permit requirements. Each crew member and the supervisor will sign off on the pre job briefing form, and form will be submitted to the HSE department at the end of each shift.

8.4 HSE TRAINING DURING PROJECT EXECUTION

- HSE training shall be arranged by BHEL/sub-contractor 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:
 - Work-at-height
 - Hazards identification and risk analysis (HIRA)
 - Work Permit System
 - Incident investigation and reporting
 - Fire fighting
 - First aid
 - T & Ps fitness and operation
 - 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.
- Skill labor (like fitter, electrician, rigger, scaffolder, carpenter etc.) will pass through the trade test (written and practical) conducted at site by the respective engineer & EHS officer. A pass sticker of qualified person to be marked on their ID Card/Gate Pass.

8.4.1 HSE Induction for Visitors: No visitors are allowed to visit the construction site without safety induction, mandatory PPEs, and designated escort.

8.4.2 Safety Induction for all (Staff/engineers/sub-Contractors officials/supervisors): It is compulsory to provide safety induction and briefing about the site HSE management systems, requirements and individual's roles & responsibility to carry out the activities in safe manner, before deploying them.

8.4.3 **Monthly awareness programme on Health, Environment and those safety topics not covered in the above list for training shall be covered**

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9.0 HSE AUDIT

- There shall be HSE audit by External auditors at least on half-yearly basis. BHEL shall take necessary corrective actions, if called for, to the satisfaction of the auditors.
- BHEL shall also conduct internal audit by qualified Internal Auditors at an interval not more than 3 months. A detailed procedure is attached.

10.0 Meetings

- BHEL shall ensure participation of his top most executive at site i.e. Resident Construction Manager in Safety Committee/HSE Committee meetings arranged by EIL/ Owner usually on monthly basis or as and when convened. In case BHEL's top most executive at site is not in a position to attend such meeting, he shall inform Customer in writing before the commencement of such meeting indicating reasons of his absence and nominate his representative – failure to do so may invite very stringent penalization against BHEL, as deemed fit in Contract. The RCM of Sub-contractors shall attend HSE meeting convened BHEL at least once in a fortnight along with safety officers and package-in-charges under him. The obligation of compliance of any observations during the meeting shall be always time bound. The sub-contractors shall always assist BHEL to achieve the targets set by them on HSE management during the project implementation.
- Agenda of internal HSE meeting should broadly cover: -
 - a) Confirmation of record notes /minutes of previous meeting
 - b) Discussion on outstanding subjects of previous points / subjects, if any
 - c) Incidents / Accidents (of all types) at project site, if any
 - d) Current topics related to site activities / subjects of discussion
 - e) House keeping
 - f) Behavioral Safety
 - g) Information / views / deliberations of members / site,
 - h) Report from Owner / Client
 - i) Status of Safety awareness, Induction programs & Training programs

The time frame for such HSE meeting shall be religiously maintained by one and all

11.0 FIRST AID & MANAGEMENT:

11.1 FIRST-AID ROOM:

There shall be a First-aid room with a single bed and a stretcher. The First-aider shall be available in this room. **An ambulance shall be provided if deployment exceeds 400 workmen**

11.2 FIRST AIDER

- One Qualified First-aider shall be available throughout the working hours in a First-Aid room. Every injury shall be treated, recorded and reported. The first-aider shall refer the patient to a hospital/ Lab/Doctor for further treatment/ investigation, if he considers so.

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- 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.

11.3 FIRST AID BOX

- The First-aid boxes shall have items as listed in Appendix-B. If need arises, First-aiders have to carry the First-aid box to place of any incident. Inventory of these items has to be monitored clearly and replenishment of stock shall be done expeditiously.
- Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste –Management and Handling Rules, 1998)

12.0 SUB-CONTRACTOR MANAGEMENT:

Sub-contractors shall be engaged for various parts of the scope of work known, each part being called a package. A team of BHEL officials shall oversee various aspects of jobs associated including HSE related activities. The Sub-contractor shall be informed of the HSE requirements thru a document prepared based on HSE Plan issued by EIL document no:6-82-0001 Rev7. Compliance of the aforesaid HSE plan by sub-contractors shall be ensured through daily observation of activities, recording deviations, conveying to the concerned subcontractor, getting the deviations corrected within a time frame and initiating appropriate administrative actions against workmen/ sub-contractor, if so called for or counselling the concerned to prevent its recurrence by BHEL team.

There shall be a review of HSE at least once in a fortnight with the sub-contractors.

12.1 GENERAL DISCIPLINE:

- Workmen under influence of liquor or drug or any other intoxication shall not be permitted to work and sent out of the work area. They shall not be permitted to carry cigarettes, lighter, tobacco powder, drugs, intoxicating drinks etc
- Workmen shall not be permitted to smoke in work area- smoking in designated space shall be permitted, if provided.
- None shall be permitted to carry any arms or firearms.
- The workmen shall report to work on time and follow supervisor's instruction.
- Use of cell phone particularly in hazardous jobs shall be discouraged like height work, crane operation etc.
- Horseplay, willful violation of rules shall be dealt with suitable disciplinary action including suspension and termination. They shall be subjected to physical frisking or alcohol/drug test at random by security and security shall be authorized to take appropriate disciplinary action against any delinquent employee like throwing out of the gate for the day and so on. If any such employee returns to work, he shall be put through induction training once again.

13.0 HSE Incidents Monitoring and Management:

Every incident including near-misses or injury of any kind and at any level of severity shall be immediately reported by BHEL employees or the contractor's workmen in their work area to the safety officer/ HSE –in-charge, site engineer or RCM. The site HSE –in-charge shall be the nodal person for this purpose.

For any reportable injury to any employee or to the contractor's workmen, the safety officer/ HSE-in-charge shall report the incident in incident/ incident report, to EIL/Owner in format HSE-2. Non-reportable incidents like near-miss shall be reported in format HSE-4.

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In the case of serious injury requiring hospitalization or fatality, communication shall be made to customer through telecom immediately with submission of incident report within 24 hrs and detail investigation report may be forwarded in INCIDENT INVESTIGATION REPORT FORMAT-HSE-3 within 3 days.

Investigations into serious or potentially serious incidents shall be conducted using accepted Root Cause Analysis (RCA) methodology cause and effect, 5 why's, etc., to determine the Physical, Human and Latent Root Causes for these type accident/incidents.

The site shall maintain record of incidents / incidents at site, and shall be available for inspection by representatives of statutory agencies / officials visiting site from customer The Safety Officer/ HSE coordinator shall maintain these records.

13.1 Incident Investigation Procedure:

The purpose of the investigation procedure is to find out root cause of accidents / incidents & not to find out faults, so as to avoid recurrences, in future and share lessons learned.

RCM shall constitute a committee of at-least 2 site engineers within 24 hours of such incidents. The investigation shall aim at finding out the basic unsafe acts / conditions that have caused the incidents. Immediately after all appropriate emergency measures, first aid and damage containment measures have been taken, every effort shall be made by the committee to:

- Preserve physical evidence
- Take photographs
- Take statement from incident victim(s) and eyewitnesses and anyone who may have knowledge of possible cause(s) of incidents

The committee shall also recommend corrective measures to prevent recurrence of similar incidents

13.2 Initial Incident Response:

In the event of an accident/incident, the supervisor and employees at the work site must:

- Stop work and make the work area safe (mitigate or remove the exposure to the hazard)
- Provide first aid and activate other emergencies e.g. Ambulance/ emergency vehicle, fire or security, as required,
- Ensure the injured worker is transported to Hospital/HPCL medical facilities for medical attention if necessary,
- Secure the site to ensure the protection of employees and the public and to aid with the investigation,
- Report the incident immediately to BHEL-RCM.

13.3 Incident Investigation Report:

The investigation committee on completion of the all investigations shall prepare and submit the report to the RCM. The report shall also include corrective measures with assigned responsibility to be taken at site to prevent similar incidents in future. The RCM shall forward the copy of the investigation report to customer

13.4 Data Analysis

The site HSE team shall maintain the records and incident data shall be analyzed at regular interval so as to check the trend which will, in turn, trigger corrective measures

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14.0 House-keeping:

BHEL shall ensure the following points subject space availability at the site and the approach to the site:

- 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 of 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 various work area locations
- 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

14.1 WASTE MANAGEMENT

During construction, there will be generation of wastes- some hazardous, some non-hazardous.

These waste generated shall be collected from area of generation and moved to a scrap yard. Bins shall be placed at all areas of generation with labels –hazardous or non-hazardous.

Hazardous wastes: Waste oil, Empty chemical containers, soaked clothes, Batteries, waste wool, chemicals (if not neutralized) etc.

Non-hazardous Wastes: Packing wood, cuts & bits of M.S. Plates, used papers/stationaries etc.

The Hazardous wastes shall be kept under shed and on a cemented flooring so that there is leaching of soil.

15.0 HSE Measures

15.1 Permit to Work Procedure

15.1.1 Type of PERMITS:

- ☐ General Permit to Work
- ☐ Hot work
- ☐ Confined Space Work
- ☐ Work at Height
- ☐ Excavation permit
- ☐ Radiation Work
- ☐ Critical Lift
- ☐ Log Out Tag Out (LOTO)

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15.1.2 GENERAL:

A Permit to Work (PTW) shall be applied by trained and authorized person (permit receiver) and approved by authority (permit issuer) from BHEL/EIL/Owner before the start of work for all identified hazardous works.
All persons required to work under this procedure shall be trained in their roles and responsibilities.

HSE officers shall

- ☐ Confirm the precautions and safety methods on the Permit to Work by Signing off the Permit to Work.
- ☐ Monitor the onsite activities of assigned contractors;
- ☐ Confirm and monitor the execution performance of Permit to Work Procedure and report to Project/Construction Management.
- ☐ Withdraw the Permit when work condition changed, or nonconformance to Permit Requirement was found.

15.1.3 PTW Training

PTW Awareness Training will be integrated into the PROJECT Safety Induction Course. HSE Department will provide the specific PTW training to all construction supervisors, engineer or other site employees as needs.

15.1.4 Permit to Work Guidelines

Applicant

The Applicant is the responsible person for the work to be conducted under the PTW. The Applicant may be the responsible construction supervisor or PTW Recipient. A PTW will not be authorized for any work unless the Applicant is physically present during all phases of the proposed work.

Should the PTW require two or more responsible persons, then the nominated responsible persons are to be included in the Applicant's request, and are to participate in the Desktop Review and followed preparation activities.

15.1.5 Request for PTW by Applicant

The Applicant shall prepare the PTW request and all supporting documentation. The package shall contain the following:

- ☐ BHEL Permit to Work Form
- ☐ Hazard identification and risk assessment Document
- ☐ Safe Work Method Statement
- ☐ Marked up Plot and Isometric Drawings if applicable.

No matter the area is defined as green field or revamping area, the applicant should apply BHEL permit and the PTW shall be firstly signed by the Authorized person on completion of his review and physical walk around when necessary.

The request for a PTW will include all details of the work to be completed. The PTW and request package shall be pre-approved by Construction Management and HSE Management before the submittal to BHEL Approving Authorities.

15.1.6 Hazard Analysis Document

☐ For high risk and dangerous work identified, the Applicant shall complete and submit a Hazard Analysis Document together with the PTW request. It will be a JSA (Job Safety Analysis) or Preliminary Hazard Analysis Checklist. And it shall be reviewed and approved by respective Construction and HSE Representatives.

☐ Issues such as work interface, coordination, drawings, toolbox meetings and work type/duration shall be detailed and included with supporting documentation for the Applicant's request for PTW.

☐ If applicable, Hazard Analysis Document shall be used as the foundation for development of Safe Work Method statement. Each hazard identified shall be addressed in the Safe Work Method Statement and be submitted as part of the Applicant's submittal package.

Gas Testing (For Confined Space)

For the operations need to perform the Gas Testing, the test shall be conducted prior to approving all permits by the Authorized person's and confirmed by Applicant or representing party unless otherwise instructed. During the risk assessment the duration and frequency of gas tests will be defined and stated on the permit. Once the PTW is approved the Applicant is responsible for conducting the stated gas testing in accordance with the Authorizing Party's instruction and comments.

Isolation

The Authorized Person shall confirm that all the necessary isolations are in place, have been tagged with an OUT OF SERVICE/DO NOT OPERATE tag and locked where appropriate. The isolation procedure shall be strictly followed.

Personal Danger Tags and Personal Locks

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Each Recipient must attach his/her own Personal Danger tags/locks after confirming all isolation before signing Permit and commencing work. Personal Danger tags and locks shall stay in place only while the individual owning them is actively working on the specific job.

All Personal Danger tags/locks must be removed at completion.

Lock out/tag out system should be strictly followed.

PTW Numbering

A unique numbering system shall be used to identify each PTW. All PTW shall be filed properly then the numbering should be provided.

Physical Inspection

After the review of PTW request, all parties will physically inspect the proposed PTW work environment. All parties will identify and assess the following:

- ☐ The equipment to be worked on
- ☐ The area to be worked in and the risk assessment
- ☐ The surrounding contractors' proposed schedules during the intended work period
- ☐ The Safe Work Method Statement
- ☐ Any additional or relevant procedures such as electrical isolations etc.

On completion of the physical inspection and acceptance of the Safe Work Method Statement the Authorized person's may sign the PTW.

Safety Materials and Equipment

Generally the Applicant shall provide all safety materials and equipment. In exceptional circumstances, the Authorized person may provide safety materials and equipment.

PTW Approved

After review of PTW and physical inspection of the area to be worked, the PTW will be signed by the Authorized person's and the Applicant. In general, the duration of an approved PTW may not exceed one shift (exact approved duration shall be clearly stated on the PTW Sheet by Authorizing Party)

The agreed time frame will be clearly stated on both the PTW and Safe Work Method Statement and be the PTW be signed over during each subsequent shift/work crew change over by both the Authorized person and the Applicant. Once authorized to commence work, the Applicant must brief the surrounding areas' responsible persons. This ensures that the surrounding work and personnel are aware of the work to be undertaken and plan their work accordingly. Documented proof of this brief is to be included with the PTW at the work location. Once all surrounding/affected parties have been briefed, the work must be completed in accordance with the PTW conditions and Safe Work Method Statement.

All authorized Permit to Work shall be registered into the [Work Permit Register](#) as quick reference.

PTW Not Approved

At any stage during the review of PTW and physical inspection the PTW may be given a non-approval. Should this occur, the issue identified as being unacceptable must be addressed, The Applicant must then submit documentation supporting the mitigation of the issue with a revised PTW request in accordance with this procedure.

PTW Cancelled

At any time the Applicant and/or the Authorized person/OPGCL may cancel the PTW. This may occur for a vary of reasons. However, should this occur the Applicant is to stop work, make the area safe and report to the Area In charge immediately informing them of the reasons why the PTW was cancelled.

Once cancelled, a PTW cannot be reused (shall be properly closed-out) and subsequent requests for a PTW by the applicant must be made in accordance with this procedure.

Completion of Work

On completion of work the Applicant shall sign off the PTW as being closed and return the PTW for final signature and Closer.

In the event that work is not completed in the time frame specified by the PTW, the Applicant is to request a time extension for the PTW. PTW's will not be extended past the time frame specified without written authority from the Authorized person for the issuing the permit.

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Both the Applicant and Authorizing person's will re-inspect the work area to verify that all required safety provisions are still in place and that work area conditions have not changed.

Any new safety requirements (such as lights for night work) shall be noted on the request.

Once the new requirements are in place, the Applicant and Authorized person will sign off the extension section on the PTW form.

15.2 Personal Protective Equipment (PPEs)

- BHEL workmen shall be permitted entry inside the project premises only with proper PPEs.
- BHEL shall ensure that all their staff, workers and visitors including their BHEL(s) have been issued (records to be kept) & wear appropriate PPEs like nape strap type safety helmets preferably with head & sweat band with $\frac{3}{4}$ " cotton chin strap (made of industrial HDPE), safety shoes with steel toe cap and antiskid sole, full body harness (CE marked and conforming to EN361), protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications/ CE or other applicable international standards. BHEL shall implement a regular regime of inspecting physical conditions of the PPEs being issued / used by the workmen of their own & also its sub-agencies and the damaged / unserviceable PPEs shall be replaced forthwith.
- BHEL shall use the color scheme for Helmets as detailed in a table below
- Fluorescent jackets with BHEL logo to be worn by BHEL workmen with different color coding for categories like supervisor and workmen – Green for supervisory and above cadre, Red for workmen (PI see pic below)
- For shot blasting, the usage of protective face shield and helmets, gauntlet and protective clothing is mandatory. Such protective clothing should conform relevant IS Specification.
- For off-shore jobs/contracts, BHEL shall provide PPEs (new) of all types to EIL & Owner's personnel, at his (BHEL's) cost. All personnel shall wear life jacket at all time.
- An indicative list of HSE standards/codes is given under **Appendix-A**.
- BHEL shall ensure procurement & usage of following safety equipment's/ accessories (conforming to applicable IS mark / CE standard) by their staff, workmen & visitors all through the span of project construction / pre-commissioning/ Commissioning: according to hazards associated with their jobs. **List is not exhaustive.**
 - a. PPEs (Helmet with company name/logo, Spectacle, Ear-muff, Face shield, Hand gloves, Safety Shoes, Gum boot)
 - b. Barricading tape / warning signs
 - c. Rechargeable Safety torch (flame-proof)
 - d. Safety nets (with tie-chords)
 - e. Fall arresters
 - f. Portable ladders (varying lengths)
 - g. Life-lines (steel wire-rope, dia not less than 8.0 mm)
 - h. Full body harness (double lanyard)
 - i. Lanyard
 - j. Karabiner
 - k. Retractable fall arresters (various length)
 - l. Portable fire extinguishers (DCP type) – 5 kg capacity
 - m. Portable Multi Gas detector
 - n. Sound level meter

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- o. Digital Lux meter
- p. Fire hoses & flow nozzles
- q. Fire blankets / Fire retardant cloth (with eyelets)

Proposed colour codes of helmets and coverall / jackets to be implemented at VRMP

Sl. No	Designation	Helmet	Reflective Jacket
1	Staffs / Visitors / Vendors	White (For visitors/vendors " VISITOR" to be stencilled with RED, both on front & back side)	Green
2	HSE Personnel	Green	Green
3	Workers	Orange	Yellow
4	Riggers	Orange ('RIGGERS' to be stencilled in RED on back side)	Orange
5	Electrician	Red	Red
6	Scaffolding Inspector	Orange (with Green strap on both side)	Orange
7	Housekeeping Personnel	Purple	Orange

Sample to be approved by customer



15.3 Working at height

- BHEL shall issue permit for working (PFW) at height after verifying and certifying the checkpoints as specified in the attached permit (Format No. HSE-6). He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence of personal protective equipment's. BHEL's Safety Officer and subsequently BHEL's safety officer shall verify compliance status of the items of permit document after implementation of action is completed by BHEL's & BHEL's execution / field engineers at work site. HIRAC for specific works at height

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duly commented by EIL/Owner, shall be kept attached with particular Permit for Work (PFW) at site for ready reference & follow-up.

- Such PFW shall be initially issued for one single shift or expected duration of normal work and extended further for balance duration, if required. EIL/Owner can devise block-permit system at any specific area, in consultation with project specific HSE Committee to specify the time-period of validity of such PFW or its renewal. This permit shall be applicable in areas where specific clearance from Owner's Operation Deptt./ Safety Deptt. is not required. EIL / Owner's field Engineers/ Safety Officers/ Area Coordinators may verify and counter sign this permit (as an evidence of verification) during the execution of the job.
- All personnel shall be medically examined & certified by registered doctor, confirming their 'medical fitness for working at height. The fitness examination shall be done once in six months.
- In case work is undertaken without taking sufficient precautions as given in the permit, BHEL or EIL/ Owner Engineers may exercise their authority to cancel such permit and stop the work till satisfactory compliance/rectification is arranged made. BHEL shall maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.
- BHEL shall arrange (at his cost) and ensure use of Fall Arrester Systems by his workers. Fall arresters are to be used while climbing/descending tall structures or vessels / columns etc. These arresters should lock automatically against the anchorage line, restricting free fall of the user. The device is to be provided with a double security opening system to ensure safe attachment or release of the user at any point of rope. In order to avoid shock, the system should be capable of keeping the person in vertical position in case of a fall.
- BHEL shall ensure that Full body harnesses conforming EN361 and having authorized CE marking is used by all personnel while working at height. The lanyards and life lines should have enough tensile strength to take the load of the worker in case of a fall. One end of the lanyard shall be firmly tied with the harnesses and the other end with life line. The harness should be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself.
- BHEL shall provide Roof Top Walk Ladders for carrying out activities on sloping roofs in order to reduce the chances of slippages and falls.
- BHEL shall ensure that a proper Safety Net System is used wherever the hazard of fall from height is present. The safety net, preferably a knotted one with mesh ropes conforming to IS 5175/ ISO 1140 shall have a border rope & tie cord of minimum 12mm dia. The Safety Net shall be located not more than 6.0 meters below the working surface extending on either side upto sufficient margin to arrest fall of persons working at different heights.
- In case of accidental fall of person on such Safety Net, the bottom most portion of Safety Net should not touch any structure, object or ground.
- Grade separators shall be provided in Pipe-rack/Tech-structures to arrest falling objects like welding spatters, welding rods, nuts, bolts, tools etc. and to facilitate U/G and A/G works simultaneously.
- Beam Clamps may be used for construction of localized temporary working platforms, sheds for welding booths etc. at height in all types of steel structure due to faster installation and requirement of less scaffolding materials.
- Hanging Platform, manufactured by Standard HSE equipment vendors must be encouraged for painting of Buildings etc.
- All the tools used at height (like spanner, screw driver etc.) shall be provided with securing arrangement like back-pack/waist pouch to prevent accidental slippage from worker hand.
- BHEL shall install temporary lightening arrester in tall structures during construction to save human life and to avoid damage to equipment & machineries.
- BHEL shall ensure positive isolation while working at different levels like in the pipe rack areas. The working platforms with toe boards & hand rails shall be sufficiently strong & shall have sufficient space to hold the workmen and tools & tackles including the equipment's required for executing the job. Such working platforms shall have mid-rails, to enable people work safely in sitting posture.



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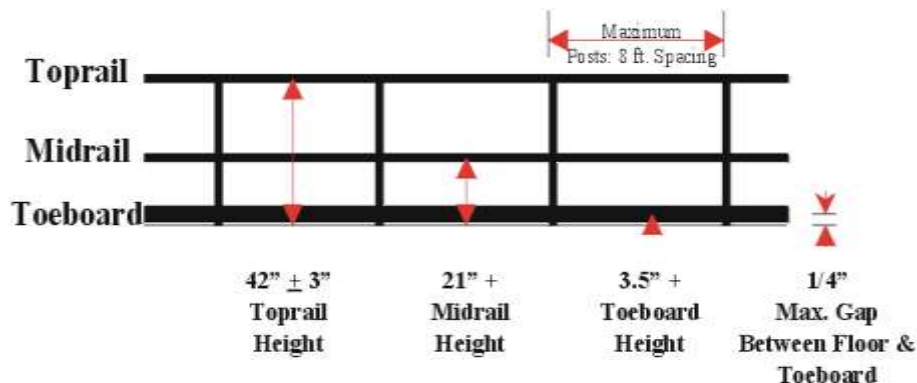
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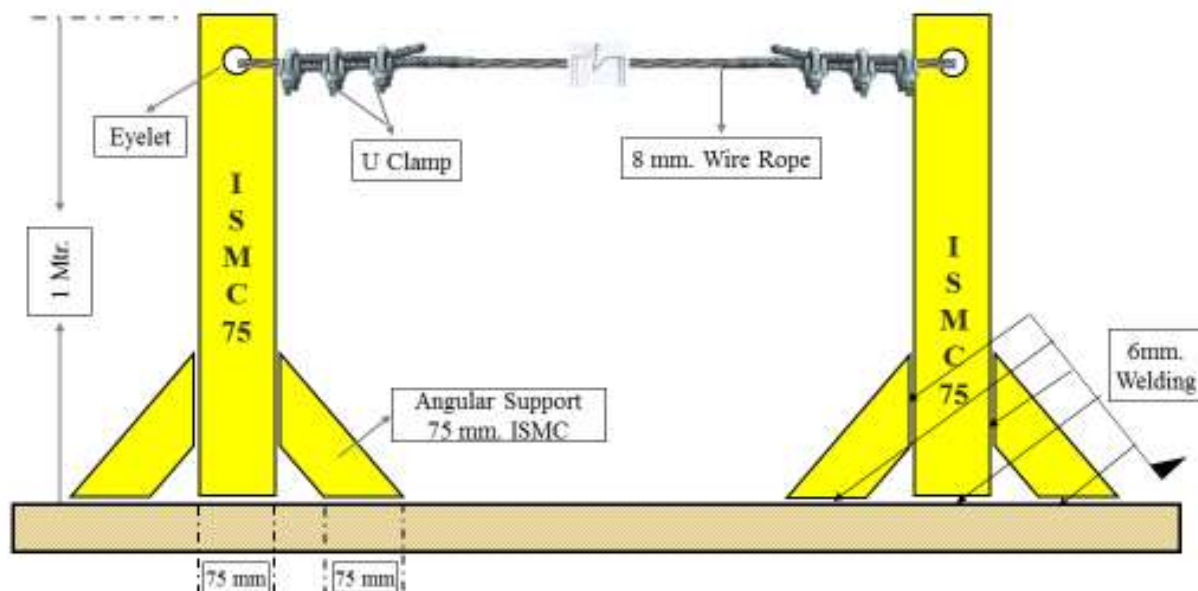
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Guardrail system



ALL OPENINGS AT HEIGHT SHALL BE BARRIACDED BY PIPES OR STRUCTURALS. TAPE BARRICADE OR THOSE MADE WITH REBAR SHALL NOT BE ACCEPTED.

DIAGRAM : LIFELINE POST

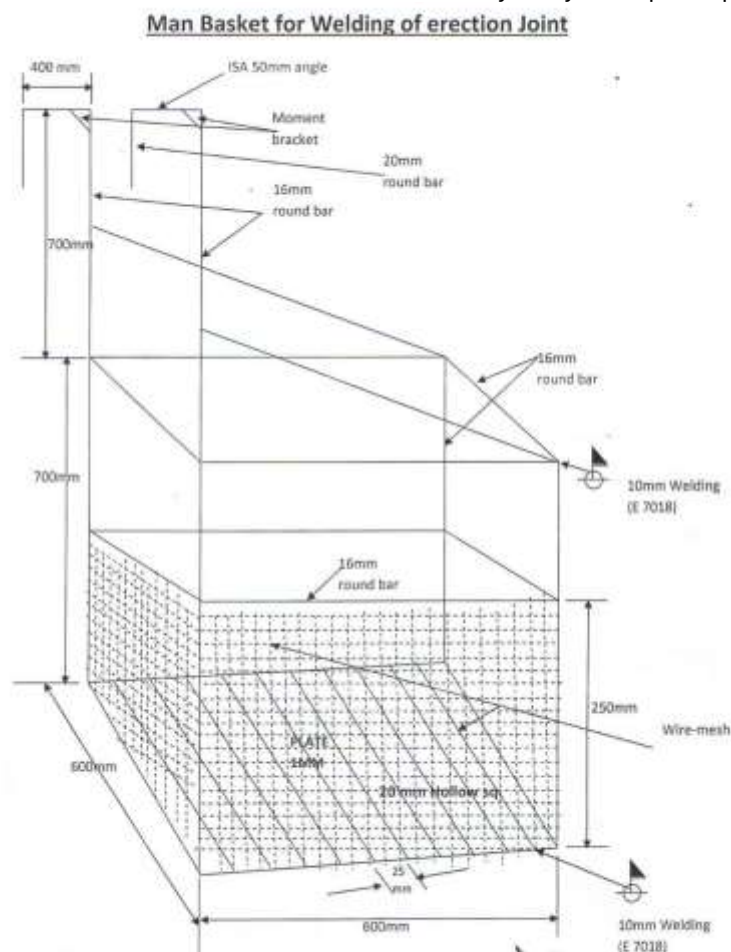


- The Support at Vertical Post shall be fixed at End-to-End. The maximum length of one end to another end shall be 18 Mtrs.
- If the length of Lifeline is more than 18 Mtrs. then Intermediate Vertical Post(s) are to be used. Such Intermediate Post(s) will act as supports and the Lifeline Rope should simply pass through the eyelets (holes) of such supports without being anchored.
- The Lifeline need not be wrapped/clamped to any Intermediate Post.
- Such Intermediate Posts must be used at an interval of every 18 Mtrs.
- The Post(s) in which the horizontal Lifeline is to be installed should be capable of sustaining a tensile stress of 5000 Lbs.(2268 Kgs.).
- In a horizontal Lifeline installation maximum allowable sagging is 500-600 NM.
- For a Single Spun Lifeline no more than 2 persons are allowed to work; for more than two workmen another Lifeline should be installed.
- Horizontal Lifeline should be so installed that it does not impede safe movement of workers.
- All the installation work must be carried out by competent persons with adequate knowledge.

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15.3.1 Personnel Lifts (Man-Basket): (To be treated as a T&P item)

A Personnel Man-Basket permit shall be completed prior to lifting any people, along with a rigging plan. Man-basket shall be used where access through ladders or scaffolding is not feasible. Man-baskets shall be designed and engineered by a manufacturer (job made man-baskets are not allowed, unless designed and tested by a certified engineer), and built robust with MS Angles and flats or plates or channels or round bar only. **REBAR not permitted at all.** Guard rails top and mid, must be in place and screened-in to avoid material from falling out of basket. The factor of safety shall be 200%. It shall have a door with double latches and shall open inside. Anchor points shall be identified within the man-basket. The man-basket shall be thoroughly inspected and load tested and a trial run performed without personnel before being put to job. It shall be treated as a lifting tool and shall undergo same certification cycle and inspection as other lifting equipments. An additional sling of required lifting capacity shall be fixed the man-basket main lifting point and attached to the crane above the ball or block. While lifting man-basket, the crane shall maintain a uniform speed of lift without any swing. Once man-basket reaches the destination, the lift brakes shall be locked as long as the basket remains at that point. The same care shall be taken in its descent. As for hanging man-basket, the same shall be hung off a rigid structure with help U-shaped handle welded to man-basket. This shall be tested once in a year by a competent person.



15.4 Scaffoldings& Barricading

- Suitable steel scaffoldings only shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that can be safely done using ladders or certified (by 3rd party competent person) man-basket. When a ladder is used, an extra workman shall always be engaged for holding the ladder.

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- BHEL shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. BHEL shall always furnish duly approved construction-design details of scaffold & SWL (from competent designers) free of charge, before they are being installed / constructed at site. Owner/EIL and BHEL reserves the right to ask BHEL to submit certification and or design calculations from his Head office/ Design/ Engineering expert regarding load carrying capacity of the scaffoldings. All scaffolds shall be inspected by a competent Scaffolding Inspector of the sub-Contractor. He shall paste a GREEN tag (duly signed by competent Scaffolding Inspector) on each scaffold found safe and a RED tag (duly signed by competent Scaffolding Inspector) on each scaffold found unsafe. Scaffolds with GREEN tag only shall be permitted to be used and Scaffolds with RED ones shall immediately be made inaccessible. Work being found continuing on scaffolds with RED tag shall be considered unauthorized work by BHEL and may invite penalization from BHEL/EIL/Owner. For every 120-125 m² /m³ area / volume or its parts there of minimum one TAG shall be provided.
- The sub-Contractor shall ensure positive barricading (indicative as well as protective) of the excavated, radiography, heavy lift, high pressure hydrostatic & pneumatic testing and other such areas. Sufficient warning signs shall be displayed along the barricading areas.
- Scaffolding shall be constructed using foot seals or base plates only.



15.5 Electrical installations

- All electrical installations/ connections shall be carried out as per the provisions of latest revision of following codes/standards, in addition to the requirements of Statutory Authorities and IE/applicable international rules& regulations:
 - OISD STD 173 : Fire prevention & protection system for electrical installations
 - SP 30 (BIS) : National Electric Code
- All electrical installations shall be approved by the concerned statutory authorities.
- All temporary electrical installations/ facilities shall be regularly checked by the licensed/ competent electricians of BHEL and appropriate records shall be maintained in format no: HSE-12" Inspection of temporary electrical booth/ installation at project construction site". Such inspection records are to be made available to EIL/Owner, whenever asked for.

15.5.1 BHEL shall meet the following requirements:

- Shall make Single Line Diagram (SLD) for providing connection to each equipment's & machinery and the same (duly approved by EIL/Owner) shall be pasted on the front face of DBs (distribution boards) or JBs (Junction boxes) at every site. (A typical Switch Board Sketch is attached as Appendix -G).

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b. Ensure that electrical systems and equipment including tools & tackles used during construction phase are properly selected, installed, used and maintained as per provisions of the latest revision of the Indian Electrical/ applicable international regulations.

c. Shall deploy qualified & licensed electricians for proper & safe installation and for regular inspection of construction power distribution system/points including their earthing. A copy of the license shall be submitted to EIL / Owner for records. Availability of at least one competent (ITI qualified) / licensed electrician (by State Elec. authorities) shall be ensured at site round the clock to attend to the normal/emergency jobs.

d. All switchboards / welding machines shall be kept in well-ventilated & covered shed/ with rain shed protection. The shed shall be elevated from the existing ground level to avoid water logging inside the shed. Installation of electrical switch board must be done taking care of the prevention of shock and safety of machine.

e. No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment / switchboard. Adequate clearances and operational space shall be provided around the equipment.

f. Fire extinguishers and insulating mats shall be provided in all power distribution centers.

g. Temporary electrical equipment shall not be employed in hazardous area without obtaining safety permit.

h. Proper housekeeping shall be done around the electrical installations.

i. All temporary installations shall be tested before energizing, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.

j. All welders shall use hand gloves irrespective of holder voltage.

k. Multilingual (Hindi, English and local language) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name & telephone No. of contact person in emergency shall be provided in substations and near all distribution boards / local panels.

l. Operation of earth leakage device shall be checked regularly by temporarily connecting series test lamp (2 bulbs of equal rating connected in series) between phase and earth. ELCB tester /test meter shall be used for testing ELCBs.

Inspection of installations for fitness of ELCB prior to start of job shall be ensured. (Ref. **Format HSE-12**).

15.5.2 The following features shall also be ensured for all electrical installations during construction phase by BHEL:

- Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 M. The main switch shall be connected to the point of supply by means of armoured cable.
- The outgoing feeders shall be double or triple pole switches with fuses / MCBs. Loads in a three phase circuit shall be balanced as far as possible and load on neutral should not exceed 20% of load in the phase.
- The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be HRC type. Use of rewirable fuses shall be strictly prohibited. The earth leakage device shall have an operating current not exceeding 30 mA.
- All connections to the hand tools / welding receptacles shall be taken through proper switches, sockets and plugs.
- All single phase sockets shall be minimum 3 pin type only. All unused sockets shall be provided with socket caps.

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- Only 3 core (P+N+E) overall sheathed flexible cables with minimum conductor size of 1.5 mm² copper shall be used for all single phase hand tools.
- Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used.
- All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multi-strand wires / cables.
- Cables shall be free from any insulation damage.
- Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route.
- When laid above ground, cables shall be properly cleated or supported on rigid poles of at least 2.1 M high. Minimum head clearance of 6 meters shall be provided at road crossings.
- Underground road crossings for cables shall be avoided to the extent feasible. In any case no underground power cable shall be allowed to cross the roads without pipe sleeve.
- All cable joints shall be done with proper jointing kit. No taped/temporary joints shall be used.
- An independent earthing facility should preferably be established within the temporary installation premises. All appliances and equipment shall be adequately earthed. In case of armoured cables, the armour shall be bonded to the earthing system.
- All cables and wire rope used for earth connections shall be terminated through tinned copper lugs.
- In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour.
- Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in any case.
- ON/OFF position of all switches shall be clearly designated / painted for easy isolation in emergency.

15.6 Welding/ Grinding/ Gas cutting

- BHEL shall ensure that flash back arrestors conforming to BS:6158 or equivalent are installed on all gas cylinders as well as at the torch end of the gas hose, while in use.
- All cylinders shall be mounted on trolleys and provided with a closing key. Empty & filledup gas cylinders shall be stored separately with TAG, protecting them from direct sun or rain. Minimum 2 nos. of Portable DCP type fire extinguishers (10 kg) shall be maintained at the gas cylinder stores. Stacking & storing of compressed gas cylinders shall be arranged away from DG set, hot works, Elect. Panels / Elec. boards, etc.
- The burner and the hose placed downstream of pressure reducer shall be equipped with Flash Back Arrester/ Non Return Valve device.
- The hoses for acetylene and oxygen cylinders must be of different colours. Their connections to cylinders and burners shall be made with a safety collar.
- At end of work, the cylinders in use shall be closed and hoses depressurized.

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- Cutting of metals using gases, other than oxygen & acetylene, shall require written concurrence from Owner.
- Grinding activity shall not be carried out in confined spaces without a valid work permit.
- All grinding/cutting machines shall be guarded and fitted with Dead-Man switch and this shall not be bypassed any time.
- All welding/grinding machines shall have effective earthing at least at distinctly isolated two points.
- In order to help maintain good housekeeping, and to reduce fire hazard, live electrode bits shall be contained safely and shall not be thrown directly on the ground.
- The hoses of Acetylene and Oxygen shall be kept free from entanglement & away from common pathways / walkways and preferably be hanged overhead in such a manner which can avoid contact with cranes, hydra or other mobile construction machinery.
- Hot spatters shall be contained / restricted appropriately (by making use of effective fire-retardant cloth/fabric) and their flying-off as well as chance of contact with near-by flammable materials shall be stopped.
- BHEL shall arrange adequate systems & practices for accumulation / collection of metal & other scraps and remnant electrodes and their safe disposal at regular interval so as to maintain the fabrication and other areas satisfactorily clean & tidy.
- All gas cylinders must have a cylinder cap on at all times when not in use. Cylinders shall be kept in vertical position only with proper support and shall not be rolled/ dropped at all. It shall be stored in a covered and ventilated space. Steel cage shall be used to carry cylinders to and from height. Only industrial grade of gas shall be used.
- Grinding machines shall have wheel guards and the cutting wheels shall be within expiry date and free from crack or any defect.

15.7 Ergonomics and tools & tackles

- BHEL shall assign to his workmen, tasks commensurate with their qualification, experience and state of health. There shall be an experienced Lifting Supervisor/Signal Man deployed for lifting a load to a height. The rigger shall also be adequately experienced. BHEL shall provide sufficient **walky-talky** to the lifting supervisor and rigger at a height/distance where these persons cannot communicate clearly due to noise level/distance.
- All lifting tools, tackles, equipment, trailers, trucks/dumpers, accessories including cranes shall be tested periodically by statutory/competent authority for their condition and load carrying capacity. Valid test & fitness certificates from the applicable authority shall be submitted to BHEL & Owner/EIL for their review/acceptance before the lifting tools, tackles, equipment, trailers, trucks/dumpers, accessories and cranes are used. All the cranes and lifting tools & tackles shall be inspected on daily basis and as well as formal monthly by The last date of Third Party Inspection and the next Due date shall be conspicuously displayed on all cranes. A copy of certificate shall be pasted on operator's cabin of all the lifting equipment.
- Load testing of Cranes must be made mandatory after each modification/alteration of crane configuration/change in boom length.
- BHEL shall not be allowed to use defective equipment or tools not adhering to safety norms.
- BHEL shall arrange non-sparking tools for project construction works in operating plant areas / hydrocarbon prone areas.

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- Wherever required BHEL shall make use of Elevated Work Platforms (EWP) or Aerial Work Platforms (mobile or stationary) to avoid ergonomical risks and workmen shall be debarred to board such elevated platform during the course of their shifting/ transportation.
- BHEL shall ensure installation of Safe Load Indicator (SLI) on all cranes (while in use) to minimize overloading risk. SLI shall have capability to continuously monitor and display the load on the hook, and automatically compare it with the rated crane capacity at the operating condition of the crane. The system shall also provide visual and audible warnings at set capacity levels to alert the operator in case of violations.
- BHEL shall be responsible for safe operations of different equipment's mobilized and used by him at the workplace like transport vehicles, engines, cranes, mobile ladders, scaffoldings, work tools, etc.
- BHEL shall arrange periodical training for the operators of hydra, crane, excavator, mobile machinery, etc. at site by utilizing services from renowned manufacturers.
- The manufacturer's instruction for maintenance shall also be followed. All safety measures shall be followed. All tools tackles, lifting appliances; material-handling equipment etc. used by the sub-contractor shall be of safe design and construction. The operators, slingers and signalers shall be qualified as per IS 13367 (part-1):2003 "Safe use of cranes- code of practices". There shall be a person responsible for co-ordination among cranes where multiple cranes are used, and lifting over 75% of the crane capacity to be avoided.

15.7.1 Color Coding Procedure

Inspections and tests shall be documented by means of color coding which shall verify that inspections or testing are current and that all receptacles, portable Power tools, Lifting Tools & Tackles have been inspected and tested as required.

Colour code of Inspection Tag

S. No	Months	Colour
1	January / July	RED
2	February / August	GREEN
3	March / September	ORANGE
4	April / October	YELLOW
5	May / November	BLUE
6	June / December	PINK

-
- The cycle of colors shall be Monthly. The color code tape / Sticker shall be clearly visible to designate the period for which the inspections and tests were conducted.
- Following the initial inspection, the equipment must be color-coded quarterly as per color-coding instructions that will be issued by the SUB-CONTRACTOR.
- Fire extinguisher with the current month color-coding inspection sticker must be provided and secured in the platform.
- All slings shall be regularly inspected in accordance with the requirement of the project for frequent and periodic inspections and removed from the job site if they fail to meet the minimum requirements of the project.
- The SUB-CONTRACTOR'S SFO shall ensure that all PPE is inspected prior to its issue. He is to ensure all SUBCONTRACTOR personnel are using safe and proper PPE equipment. Regular inspections on the PPE shall be carried out and personnel not adhering to those inspections shall be removed immediately from the SITE.

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- A five (5) day interval period shall be given into each monthly color code change. During this five (5) day period either color shall be acceptable.

SAMPLE TAG:



15.8 Hazardous substances

- Hazardous, inflammable and/or toxic materials such as solvent coating, thinners, anti-termite solutions, water proofing materials shall be stored in appropriate containers preferably with lids having spillage catchment trays and shall be stored in a good ventilated area. These containers shall be labelled with the name of the materials highlighting the hazards associated with its use and necessary precautions to be taken. Respective MSDS (Material Safety Data Sheet) shall be made available at site & may be referred whenever problem arises.
- Where contact or exposure of hazardous materials are likely to exceed the specified limit or otherwise have harmful effects, appropriate personal protective equipment's such as gloves, goggles/face-shields, aprons, chemical resistant clothing, respirator, etc. shall be used.
- The work place shall be checked prior to start of activities to identify the location, type and condition of any asbestos materials which could be disturbed during the work. In case asbestos material is detected, usage of appropriate PPEs by all personnel shall be ensured and the matter shall be reported immediately to BHEL

15.9 Radiation exposure

- All personnel exposed to physical agents such as ionizing & non-ionizing radiation, including ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with the type of exposure involved.
- For Open Field Radiography works, requirements of Bhabha Atomic Research Centre (BARC)/ Atomic Energy Regulatory Board (AERB) shall be followed. There shall be requisite approval of the agency by BARC and the same shall be furnished to BHEL prior to requesting for work permit.
- BHEL shall implement an effective system of control (as described in the AERB regulations) at site for handling radiography-sources & for avoiding its misuse & theft.
- BHEL shall generate the Format No: HSE-8 "Permit for radiation work" before start of work.
- Radiography shall be carried out in night time only. In exceptional case, the radiography work has to be carried out at day time, suitable methodology to be used so that other works, people are not affected.

15.10 Road Safety

- BHEL shall ensure adequately planned road transport safety management system.

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- The vehicles shall be fitted with reverse warning alarms & flashing lights / fog-lights and usage of seat belts shall be ensured.
- BHEL shall also ensure a separate pedestrian route for safety of the workers and comply with all traffic rules & regulations, including maintaining speed limit of 20 KMPH or indicated by owner for all types of vehicles / mobile machinery. The maximum allowable speed shall be adhered to.
- In case of an alert or emergency, BHEL must arrange clearance of all the routes, roads, access. BHEL shall deploy sufficient number of traffic controllers at project site routes / roads/ accesses, to alert reversing movement of vehicles & machinery as well as pedestrians.
- Dumpers, Tippers, etc. shall not be allowed to carry workers within the plant area and also to & from the labour colony to & from project sites.
- **Hydras of model-F-15 or TRX or equivalent design** shall only be allowed for handling the materials at fabrication/ storage yards and in no case shall be allowed to transport the materials over project / plant roads. It shall be used only for loading and unloading of materials and marching shall be restricted to 10metre only. There shall be one FLAGMAN with Red and Green flags, attached to each crane. Back-hoe shall not be used for shifting/lifting of materials other than what it is meant for.
- BHEL shall not deploy any such mobile machinery / equipment, which do not have competent operator and / or experienced banks-man/ signal-man. Such machinery/ equipment shall have effective limit-switches, reverse-alarm, front & rear-end lights etc. and shall be maintained in good working order.
- BHEL shall not carry-out maintenance of vehicles / mobile machinery occupying space on project / plant roads and shall always arrange close supervision for such works.
- For pipeline jobs, BHEL shall submit a comprehensive plan covering transportation, loading / unloading of pipes, movement of side booms, movement of vehicles on the ROW, etc.
- BHEL shall arrange/ install visible road signs, diversion boards, caution boards, etc. on project roads for safe movement of men and machinery.

15.11 Confined Space Entry

A hazard assessment must be completed prior to any entry into a confined space. The hazard assessment must identify the sequence of work to be performed in the confined space, the specific hazards known or anticipated, and the control measures to be implemented to eliminate or reduce each of the hazards to an acceptable level. No entry must be permitted until the hazard assessment has been reviewed and discussed by all persons engaged in the activity. Personnel who enter confined spaces must be trained per role e.g. entrant (worker), confined space supervisor & attendant, and must be informed of known or potential hazards associated with the confined spaces to be entered. Number of persons entering shall be kept at minimum. All confined spaces must be inventoried at site and kept on file. Confined spaces must be posted at the entrance with similar type wording "DANGER - Do Not Enter – Confined Space - Permit Required".

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BHEL shall generate a work permit (Format No. HSE -7) before entering a confined space. People, who are permitted to enter into confined space, must be medically examined & certified by registered doctor, confirming their 'medical fitness for working in confined space'. All necessary precautions mentioned therein shall be adhered to. An attendant shall be positioned outside a confined space for extending help during an emergency. Effective communication shall be maintained between personnel in confined space and outside by combination of visual/voice or portable radio. Compressed gas cylinders shall not be taken into confined space. Entry Register for confined space to be maintained with the name and time of entry/exit. All appropriate PPEs and air quality parameters shall be checked before entering a confined space. It shall be ensured that the piping of the equipment which has to be opened is pressure-free by checking that blinds are in place, vents are open and volume is drained. Inside confined space works, only electrical facilities/installations of 24V shall be permitted. Contactor shall ensure usage of safe & suitable arrangement of oxygen supply for individual workmen (during the course of work in confined space), if oxygen concentration is found to be less than 19.5% (v/v) there.

The confined space shall be cleared off all cables, machines, cylinders, materials at the end of the day's work as far as possible.

Once the confined space work has been completed, the entry permit must be cancelled. A copy of the cancelled permit must be given to the HSE Manager.

15.12 Heavy Lifts

- BHEL shall submit detailed rigging studies plan for BHEL & EIL/ Owner approval prior to lifting equipment which cannot be erected with a crane of approx. 100 MT capacity due to constraints of its dimensions, location of foundation height, approach & weight.
- BHEL shall generate the format no:HSE-15 "Permit for heavy lift/critical erection"
- The Safe Working Load (SWL) and manufacturer's serial numbers shall be clearly marked on the slings and the lifting gears, either by tagging, stamping, engraving or embossing.
- Prior to actual lifting activities, BHEL shall check the validity of the crane inspection certificate issued by statutory/ competent authority. This requirement shall also apply to all rigging equipment's utilized for the job.
- BHEL shall, at all times, be responsible for all rigging activities.

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- BHEL shall ensure medical fitness of all workmen who are engaged / involved in erection of equipment's, vessels etc. and such fitness checks shall be carried-out every six months interval with the help of a registered medical practitioner & record shall be maintained
- Adequate safety measures such as positive barricading, usage of appropriate PPEs, permit to work, etc. shall be taken during all heavy or critical lifts.
- For lifting any material (irrespective of shape, size or volume), at any height, it is always advisable to prepare a Plan of Erection (PoE) taking into consideration hazards & risks associated therein – this can enable people to put their own experiences of various natures & side-by-side establish a practical method for risk-free erection / lifts. BHEL shall prepare PoE & shall document the same, when risks are identified as “medium” or “high” and the same shall be approved by its competent / qualified engineer.

15.13 Civil works:

BHEL shall obtain permission from competent authorities prior to excavation wherever required.

BHEL shall locate the position of buried utilities (water line, cable route, etc.) by referring to project / plant drawing / in consultation with EIL/Owner. BHEL shall start digging manually to locate the exact position of buried utilities & thereafter use mechanical means.

BHEL shall keep soil heaps at least 1.5 M away from edge or a distance equal to depth of pit (whichever is more).

All excavated pits greater than 10 Sq.M plan area and depth more than 1.5M shall have at least two access routes for ingress and egress. Also, additional access routes shall be provided such that distance between any two access routes shall not be more than 20M.

BHEL shall maintain sufficient “angle of repose” during excavation – shall also provide slope or suitable bench as decided by EIL / Owner.

BHEL shall arrange “battering” or “benching” wherever required for preventing collapse of edge of excavations.

BHEL shall identify & arrange de-watering pump or well-point system to prevent earth collapse due to heavy rain / influx of underground water.

BHEL shall arrange protective fencing/ barricading with warning signal around excavated pits, trenches, etc. along with minimum 2 (two) entries, exits/ escape ladders.

BHEL must avoid “underpinning” / under-cutting to prevent collapse of chunk of earth during excavation

BHEL shall use “stoppers” to prevent over-run of vehicle wheels at the edge of excavated pits/ trenches.

BHEL shall arrange strengthening of “shoring” & “strutting” proactively to avoid collapse of earth/ edges due to vehicular movement in close proximity of excavated areas/ pits/ trenches, etc.

15.13.1 EXCAVATION

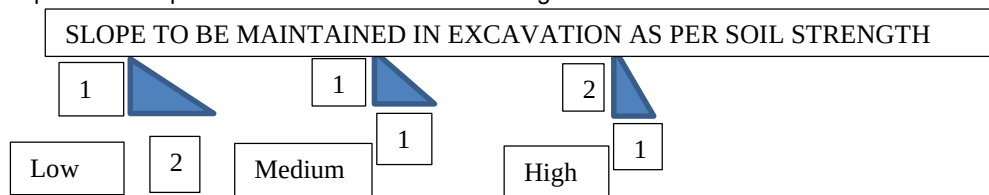
Excavation is the essential element of the construction process for making foundations, drainage work and site re-grading of all kinds.

In carrying out excavations the soil condition can vary widely, often in short distances. No soil whatever its nature can be relied upon to support its own weight for any length of time. Even a small fall of earth is capable of inflicting serious injury even if it does not kill. Unless and until the excavation is battered, the sides need supporting to prevent the possibility of collapse.

The following safety measures are to be ensured before and during excavation.

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- Check for underground utilities like electrical / telephone cables, sewage, water lines and proper care has to be exercised to protect and prevent damage to it
- Proper and adequate slope is maintained while excavating
- Adequate shoring or sheeting is done wherever require to prevent soil sliding
- Safe access through ladder or steps for exit & entry to excavation
- No material /excavated soil is kept within one meter from the edge
- Safe way is planned and provided for movement of HEM /transport equipment near excavation
- Safety helmet and shoes/gum boots are provided and worn by the workmen at excavation works
- Hard Barricade using pipes or structural is provided around excavated pits
- Danger signs /Caution boards are displayed at work spot
- Dewatering arrangement is made where water seepage is prevailed.
- Stop blocks are provided to avoid vehicles reversing into the excavated trenches



15.13..2 Piling

It is the first and foremost activity of construction where load bearing capacity of soil is inadequate for foundation. The working condition of piling rig and other associated tackles is a significant contributing factor for prevention of equipment failure during operation.

Ensure the following precautionary measures before starting piling works

- Inspection of piling equipment by responsible person for its condition before initiating piling operation.
- Testing and its certification wire ropes, slings, D-shackles, chain pulley blocks using in the process of piling work by competent person
- Adequate support and secured foundation of the piling equipment to avoid toppling
- Hoses should be lashed and adequately secured
- Proper work platform is to be provided on piling frame
- Safe work procedures and close supervision to prevent unsafe acts of operators/any unsafe conditions that may arise
- Only experienced and trained operators are engaged for the piling operation
- Provision of Personal Protective Equipment (PPE) like safety shoes/gumshoes/safety helmet/safety belt etc. and its use by their workmen.
- Special care and precautions If work is near electrical live cables/ electrical equipment
- Cordoning of work area to prevent un authorized entry
- Guarding of revolving parts
- Specific measures to prevent over turning of pile driver/missing of hammer/ hammer movement out of range

16.0 Fire prevention, protection & preparedness -

The Fire Prevention, Protection and Preparedness Program is an integral part of the overall HSE Program. Effort and consideration must be given to safety, life and potential for delays in construction schedules and plant startup, as well as protection of property on a given project.

The purpose of which is to prevent -

- Inception of fire
- Loss of life or personal injury



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- Loss of Property
- Interruption of operations

Site-in-charge / Safety Officer will make periodical review of the site Fire Protection, Prevention Preparedness Programme, Site conditions and available fire protection equipment. It is very imperative that the Sub-BHELs along with BHEL to establish good contact with Local fire station for availability of Fire tender in case of emergencies, in additionan to their own fire equipment.

Fire Protection, Prevention and Preparedness Inspections - BHEL will be required to make frequent fire prevention inspections of his work site and operating facilities. Deficiencies will be corrected at once.

Area where Hot work activities are carried out (Gas cutting / Welding/ any other spark producing work) above a working spot, a GI / fire-resistant non-asbestos sheet or suitable material shall be placed to prevent the fall of hot sparks. A bucket of water shall be kept nearby while doing hot work

- Hot work shall be preferably carried out in a designated area with a standing Hot Work Permit, to be renewed monthly. The designated area shall have fire extinguishers.
- Any hot work outside designated area shall require a Hot Work permit and fire watch.

No flammable material shall be stored within 35 feet from any fire load.

- Necessary fire extinguishers shall be kept at accessible area as per the chart below:

Fire Extinguisher Chart						
Extinguisher		Type of Fire				
Colour	Type	Solids (wood, paper, cloth, etc)	Flammable Liquids	Flammable Gasses	Electrical Equipment	Cooking Oils & Fats
	Water	✓ Yes	✗ No	✗ No	✗ No	✗ No
	Foam	✓ Yes	✓ Yes	✗ No	✗ No	✓ Yes
	Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No
	Carbon Dioxide (CO2)	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes

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In addition, ABC type extinguisher also can be used for any of above types of fire

- Emergency telephone number to be displayed at all conspicuous places.

General flammable material storage requirements:

- All flammable material shall be stored in deigned areas and/or in flammable storage cabinets, as necessary.
- Fire extinguishers shall be located nearby and have unobstructed access.

17.0 Environment Protection

- BHEL shall ensure proper storage and utilization methodology of materials that are detrimental to the environment. Where required, BHEL shall ensure that only the environment friendly materials are selected and emphasize on recycling of waste materials, such as metals, plastics, glass, paper, oil & solvents. The waste that cannot be minimized, reused or recovered shall be stored in the area earmarked for such purpose. Disposal shall be as per instruction by BHEL.. In no way, toxic spills shall be allowed to percolate into the ground. BHEL shall not use the empty areas for dumping the wastes outside identified scrap yard. All hazardous material shall be kept in a covered and well ventilated space with cemented flooring so as to prevent leaching into soil. Wherever such liquid material is stored, a secondary containment shall be provided so that any spill is contained. There shall be sand buckets, cotton waste, cotton cloths in such storage area so that in case of any spillage, the same shall be promptly cleaned up and the used sand/ cloths soaked with the spill shall be treated as hazardous as well and stored/ disposed off accordingly.
- BHEL shall strive to conserve energy and water wherever feasible.
- BHEL shall ensure dust free environment at workplace by sprinkling water on the ground in its work area and also in common area, if so instructed by BHEL at frequent intervals. The air quality parameters for dust, poisonous gases, toxic releases, harmful radiations, etc. shall be checked by BHEL on daily basis and whenever need arises.
- BHEL shall not be allowed to discharge chemicals, oil, silt, sewage, sullage and other waste materials directly into the controlled waters like surface drains, streams, rivers, ponds. A discharge plan suggesting the methods of treating the waste before discharging shall be submitted to BHEL for approval.

17.1 Noise Mitigation

High noise is harmful to the human health and it can cause impairment if exposed for long duration at regular intervals, and also cause disruption in nearby communities.

- Noise monitoring shall be carried out in all construction locations periodically.
- Use of silent DG is allowed at site during construction.
- Low noise generation equipment's to be preferred
- Acoustic enclosure to be used in case noise level is high for particular equipment or system.
- Work areas where noise levels exceed the 85db shall be posted as hearing protection required.
- Use of PPEs / ear plug/ear muff for personnel entering into high noise area.
- Activities generation High noise will be planned in day shift.

Noise Level Chart

Parameter	Night Noise level dB	Daytime Noise Level dB
At 1-meter from each piece of equipment	85	85

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At Property boundary	70	70

18.0 Key Performance Indicators

BHEL shall measure an activity in both leading & trailing indicators for statistical and performance measurement. The activities pertaining to key performance indicators are covered in Monthly HSE Report (Format No. HSE-5). BHEL shall try to achieve a statistically fair record and strive for its continual improvement.

Leading Indicators viz :-

- Number of Safety Inductions carried-out at site (for workmen & staff members)
- Number of HSE inspections carried out
- Number of "Safety Walk Through" carried-out by site-head.
- Number of HSE shortfalls / lapses identified per BHEL& closed-out in time.
- Number of Safety Meetings conducted (in-house / with BHELs)
- Number of HSE Audits made (internal & external) vis-à-vis non conformances raised
- Number of HSE Awareness / Motivational program conducted by BHELs
- Number of HSE Trainings conducted at site for supervisors & workmen
- Study of Near miss case reported
- Encouragements / Awards / Recognitions to workmen, job supervisors & field engineers.
- Suggestions for improvement

Trailing Indicators viz :-

- Calculation of HSE statistics viz frequency rate, severity rate, LTA free manhours, etc.
- Analysis of incidents / accidents (nature, severity, types etc.)
- Study of Incident / Accident with respect to :-
 - ☐ Variety
 - ☐ Period of the year / project span
 - ☐ Timings of the incident / accident
 - ☐ Age profile of victims
 - ☐ Body parts involved
 - ☐ Penalty levied for causing incident / accident

19.0 Tool Box Talks (TBT)

BHEL shall conduct daily TBT with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is given below. The TBT is to be conducted by the immediate supervisor of the workers

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BHEL shall conduct TBT before start of every morning or evening shift or night shift activities, for alerting the workers on specific hazards and their appropriate dos & don'ts. BHEL shall provide sufficient rests to the site workmen and their foremen to avert fatigue & thereby endangering their lives during the course of site works.

TOOLBOX TALK RECORDING SHEET		
Date & Time		
Work Location		
Subject (Nature of work)		
Presenter		
Hazards involved		
Precautions to be taken		
Worker's Name	Signature	Section
Remarks, in any		

The topics during TBT shall include

- Hazards related to work assigned on that day and precautions to be taken.
- Any forthcoming HSE hazards/events/instruction/orders, etc.

The above record can be kept in local language, which workers can read. These records shall be made available to EIL/ Owner whenever demanded.

20.0 HSE Promotion

BHEL shall encourage his workforce to promote HSE efforts at workplace by way of organizing workshops/ seminars/ training programmes, celebrating HSE awareness weeks, monthly Safety day & National Safety Day, conducting quizzes & essay competitions, distributing pamphlets, posters & material on HSE, providing incentives for maintaining good HSE practices and granting incentives / bonus for completing the job without any lost time accident. While BHELs are welcome to carryout HSE promotion independently, they shall have to participate in joint programmes as well. In this case, expenses shall be proportionately borne by BHELs.

21.0 Lock Out and Tag Out (LOTO) for Isolation of Energy Source

- BHEL shall follow the LOTO/ Isolation procedure of owner for all energy source isolations installed/under purview by/of owner i.e. "Brown field"
- For all the other energy source (not under purview of client/owner) i.e. "Green field" BHEL shall develop a system to ensure the isolation of equipments, pipelines, Vessel, electrical panels from the energy source covering following as minimum:-

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- Identification of all energy source viz electrical, mechanical, hydraulic, pneumatic, chemical, thermal, gravitational, radiation and other forms of stored or kinetic energy.
- Establishing the energy isolation devices viz: manually operated electrical circuit breakers, disconnection switches, blind flanges, etc.
- Installation of Lock Out devices for preventing the inadvertent release of stored energy and Tag Out devices ("Danger", "Do Not operate" or Do not Remove" tags) to indicate that testing, maintenance or servicing is underway and the device cannot be operated until the tag out device is removed.
- Lock Out and Tag out log book
- Permit for isolation and de-isolation of energy source as per format NO: HSE-16
- Availability of competent persons like experienced operators at substations, pump house, units, etc, supervisors etc.
- BHEL shall ensure that all the sources are locked out and tagged properly before giving clearance to start the job.
- After the completion of job, BHEL shall ensure all tools and tackles are removed and nobody is present in the working area and signing on LOTO log book.
- Only on confirmation of above BHEL will remove their lock and tag from the isolation points and give instructions for energizing the same. Only the person carrying out the task shall himself carry the key for the lock in /Lock out.

22 RECORDS

At the minimum, BHEL/ contractor shall maintain/ submit HSE records in the following reporting formats:

- Safety Walk Through Report HSE-1
- Accident/ Incident Report HSE-2
- Supplementary Accident/ Incident Investigation report HSE-3
- Near Miss Incident Report HSE-4
- Monthly HSE Report HSE-5
- Permit for working at height HSE-5
- Permit for working in confined space HSE-7
- Permit for radiation work HSE-8
- Permit for demolishing/ dismantling HSE-9
- Safety checklist HSE-10
- Housekeeping Assessment & compliance HSE-11
- Inspection of temporary electrical booth/installation HSE-12
- Inspection for scaffolding HSE-13
- for erection/modification & dismantling of scaffolding HSE-14
- Permit for heavy lift/critical erection. HSE-15
- Permit for Energy isolation and de-isolation. HSE-16
- Permit for Excavation HSE-17
- Inspection reports of Equipment/tools/tackles *
- Report of Toolbox talks As indicated in specification
- PPE issue report/register *
- Site inspection reports *
- Training records *

(*) The formats shall be developed in consultation with EIL/Owner.



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APPENDIX

THESE ARE PROVIDED BY CUSTOMER.

IN ADDITION, SOME MORE
FORMATS/DOCUMENTS WILL BE
AVAILABLE AT BHEL-SITE HSE TEAM
FOR USE.

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**APPENDIX-A
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A. IS CODES ON HSE

SP: 53 Safety code for the use, Care and protection of hand operated tools.
IS: 838 Code of practice for safety & health requirements in electric and gas welding and cutting operations
IS: 1179 Eye & Face precautions during welding, equipment etc.
IS: 1860 Safety requirements for use, care and protection of abrasive grinding wheels.
IS: 1989 (Pt -II) Leather safety boots and shoes
IS: 2925 Industrial Safety Helmets
IS: 3016 Code of practice for fire safety precautions in welding & cutting operation.
IS: 3043 Code of practice for earthing
IS: 3764 Code of safety for excavation work
IS: 3786 Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents
IS: 3696 Safety Code of scaffolds and ladders
IS: 4083 Recommendations on stacking and storage of construction materials and components at site
IS: 4770 Rubber gloves for electrical purposes
IS: 5121 Safety code for piling and other deep foundations
IS: 5216 (Pt-I) Recommendations on Safety procedures and practices in electrical works
IS: 5557 Industrial and Safety rubber lined boots
IS: 5983 Eye protectors
IS: 6519 Selection, care and repair of Safety footwear
IS: 6994 (Pt-I) Industrial Safety Gloves (Leather & Cotton Gloves)
IS: 7293 Safety Code for working with construction Machinery
IS: 8519 Guide for selection of industrial safety equipment for body protection
IS: 9167 Ear protectors
IS: 11006 Flash back arrestor (Flame arrestor)
IS: 11016 General and safety requirements for machine tools and their operation
IS: 11057 Specification for Industrial safety nets
IS: 11226 Leather safety footwear having direct moulded rubber sole
IS: 11972 Code of practice for safety precaution to be taken when entering a sewerage system
IS: 13367 Code of practice-safe use of cranes
IS: 13416 Recommendations for preventive measures against hazards at working place

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B. INTERNATIONAL STANDARDS ON HSE

Safety Glasses : ANSI Z 87.1, ANSI ZZ 87.1, AS 1337, BS 2092,
 BS 1542, BS 679, DIN 4646/ 58311
 Safety Shoes : ANSI Z 41.1, AS 2210, EN 345
 Hand Gloves : BS 1651
 Ear Muffs : BS 6344, ANSI S 31.9
 Hard Hat : ANSI Z 89.1/89.2, AS 1808, BS 5240, DIN 4840
 Goggles : ANSI Z 87.1
 Face Shield : ANSI Z 89.1
 Breathing Apparatus : BS 4667, NIOSH
 Welding & Cutting : ANSI Z49.1
 Safe handling of compressed:P-1 (Compressed Gas Association Gases in cylinders 1235
 Jefferson Davis Highway,
 Arlington VA 22202 - USA)
 Full body harness : EN-361
 Lanyard : EN-354
 Karabiner : EN-362 and EN-12275



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APPENDIX-B

DETAILS OF FIRST AID BOX

SL. NO.	DESCRIPTION	QUANTITY
1.	Small size Roller Bandages, 1 Inch Wide (Finger Dressing small)	6 Pcs.
2.	Medium size Roller Bandages, 2 Inches Wide (Hand & Foot Dressing)	6 Pcs.
3.	Large size Roller Bandages, 4 Inches Wide (Body Dressing Large)	6 Pcs.
4.	Large size Burn Dressing (Burn Dressing Large)	4 Pkts.
5.	Cotton Wool (20 gms packing)	4 Pkts.
6.	Antiseptic Solution Dettol (100 ml.) or Savlon	1 Bottle
7.	Mercurochrome Solution (100 ml.) 2% in water	1 Bottle
8.	Ammonia Solution (20 ml.)	1 Bottle
9.	A Pair of Scissors	1 Piece
10.	Adhesive Plaster (1.25 cm X 5 m)	1 Spool
11.	Eye pads in Separate Sealed Pkt.	4 pcs.
12.	Tourniquet	1 No.
13.	Safety Pins	1 Dozen
14.	Tinc. Iodine/ Betadin (100 ml.)	1 Bottle
15.	Polythene Wash cup for washing eyes	1 No.
16.	Potassium Permanganate (20 gms.)	1 Pkt.
17.	Tinc. Benzoine (100 ml.)	1 Bottle
18.	Triangular Bandages	2 Nos.
19.	Band Aid Dressing	5 Pcs.
20.	Iodex/Moov (25 gms.)	1 Bottle
21.	Tongue Depressor	1 No.
22.	Boric Acid Powder (20 gms.)	2 Pkt.
23.	Sodium Bicarbonate (20 gms.)	1 Pkt.
24.	Dressing Powder (Nebasulf) (10 gms.)	1 Bottle
25.	Medicinal Glass	1 No.
26.	Duster	1 No.
27.	Booklet (English& Local Language)	1 No. each
28.	Soap	1 No.
29.	Toothache Solution	1 No.
30.	Vicks (22 gms.)	1 Bottle
31.	Forceps	1 No.
32.	Note Book	1 No.
33.	Splints	4 Nos.
34.	Lock	1 Piece
35.	Life Saving/Emergency/Over-the counter Drugs	As decided at site

Box size: 14" x 12" x 4"

Note : The medicines prescribed above are only indicative. Equivalent medicines can also be used.
A prescription, in this regard, shall be required from a qualified Physician.



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APPENDIX-C

TYPE OF FIRES VIS-À-VIS FIRE EXTINGUISHERS

Fire ↓ Fire Extinguisher →	Water	Foam	CO ₂	Dry Powder	Multi-purpose (ABC)
Originated from paper, clothes, wood	✓	✓	can control minor surface fires	can control minor surface fires	✓
Inflammable liquids like alcohol, diesel, petrol, edible oils, bitumen	✗	✓	✓	✓	✓
Originated from gases like LPG, CNG, H ₂	✗	✗	✓	✓	✓
Electrical fires	✗	✗	✓	✓	✓

LEGEND : ✓ : CAN BE USED

 ✗ : NOT TO BE USED

Note: Fire extinguishing equipment must be checked atleast once a year and after every use by an authorized person. The equipment must have an inspection label on which the next inspection date is given. Type of extinguisher shall clearly be marked on it.

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APPENDIX-D

List of Statutory Acts & Rules Relating to HSE

- The Indian Explosives Act and Rules
- The Motor Vehicle Act and Central Motor Vehicle Rules
- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules
- The Indian Electricity Act and Rules
- The Indian Boiler Act and Regulations
- The Water (Prevention & Control & Pollution) Act
- The Water (Prevention & Control of Pollution) Cess Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Atomic Energy Act
- The Radiation Protection Rules
- The Indian Fisheries Act
- The Indian Forest Act
- The Wild Life (Protection) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Manufacturing, Storage & import of Hazardous Chemicals Rules
- The Public Liability Act
- The Building and Other Construction Workers (Regulation of Employment and Condition of service) Act
- Other Statutory Acts like EPF, ESIS, Minimum Wage Act.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
(A) EXCAVATION Pit Excavation upto 3.0m	Falling into pit	Personal injury	Provide guard rails/ barricade with warning signal. Provide at least two entries/ exits. Provide escape ladders.
	Earth Collapse	Suffocation/ Breathlessness Buried	Provide suitable size of shoring and strutting, if required. Keep soil heaps away from the edge equivalent to 1.5m or depth of pit whichever is more. Don't allow vehicles to operate too close to excavated areas. Maintain atleast 2m distance from edge of cut. Maintain sufficient angle of repose. Provide slope not less than 1:1 and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock. Battering/benching the sides.
	Contact with buried electric cables Gas/ Oil Pipelines	Electrocution Explosion	Obtain permission from competent authorities, prior to excavation, if required. Locate the position of buried utilities by referring to plant drawings. Start digging manually to locate the exact position of buried utilities and thereafter use mechanical means.
Pit Excavation beyond 3.0m	Same as above Plus Flooding due to excessive rain/ underground water	Can cause drowning situation	Prevent ingress of water. Provide ring buoys. Identify and provide suitable size dewatering pump or well point system.
	Digging in the vicinity of existing Building/ Structure	Building/Structure may collapse Loss of health & wealth	Obtain prior approval of excavation method from local authorities. Use under-pining method. Construct retaining wall side by side.
	Movement of vehicles/ equipment's close to the edge of cut.	May cause cave-in or slides. Persons may get buried.	Barricade the excavated area with proper lighting arrangements. Maintain at least 2m distance from edge of cut and use stop blocks to prevent over-run. Strengthen shoring and strutting.



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CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
Narrow deep excavations for pipelines, etc.	Same as above Plus Frequent cave-in or slides	May cause severe injuries or prove fatal	Battering/ benching of sides. Provide escape ladders.
	Flooding due to Hydro- static testing	May arise drowning situation	Same as above plus Bail out accumulated water. Maintain adequate ventilation.
Rock by excavation blasting	Improper handling of explosives	May prove fatal	Ensure proper storage, handling & carrying of explosives by trained personnel. Comply with the applicable explosive acts & rules.
	Uncontrolled explosion	May cause severe injuries or prove fatal	Allow only authorized persons to perform blasting operations. Smoking and open flames are to be strictly prohibited.
	Scattering of stone pieces in atmosphere	Can hurt people	Use PPE like goggles, face mask, helmets etc.
Rock excavation by blasting (Contd.)	Entrapping of persons/ animals.	May cause severe injuries or prove fatal	Barricade the area with red flags and blow siren before blasting.
	Misfire	May explode suddenly	Do not return to site for atleast 20 minutes or unless announced safe by designated person.
Piling Work	Failure of piledriving equipment	Can hurt people	Inspect Piling rigs and pulley blocks before the beginning of each shift.
	Noise pollution	Can cause deafness and psychological imbalance.	Use personal protective equipments like ear plugs, muffs, etc.
	Extruding rods/casing	Can hurt people	Barricade the area and install sign boards. Provide first-aid.
	Working in the vicinity of 'Live-Electricity'	Can cause electrocution/ Asphyxiation	Keep sufficient distance from Live-Electricity as per IS code. Shut off the supply, if possible. Provide artificial/rescue breathing to the injured.
(B) CONCRETING	Air pollution by cement	May affect Respiratory system	Wear respirators or cover mouth and nose with wet cloth.
	Handling of ingredients	Hands may get injured	Use gloves & other PPE.
	Protruding reinforcement rods.	Feet may get injured	Provide platform above reinforcement for movement of workers or provide end caps for protection on reinforcement bars.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	Earthing of electrical mixers, vibrators, etc. not done.	Can cause electrocution/ asphyxiation	Ensure earthing of equipments and proper functioning of electrical circuit before commencement of work.
	Falling of materials from height	Persons may get injured	Use hard hats. Remove surplus material immediately from work place. Ensure lighting arrangements during night hours.
	Continuous pouring by same gang	Cause tiredness of workers and may lead to accident.	Insist on shift pattern. Provide adequate rest to workers between subsequent pours.
	Revolving of concrete mixer/ vibrators	Parts of body or clothes may get entrapped.	Allow only mixers with hopper. Provide safety cages around moving motors. Ensure proper mechanical locking of vibrator.
Super-structure	Same as above plus Deflection in props or shuttering material	Shuttering/props may collapse and prove fatal	Avoid excessive stacking on shuttering material. Check the design and strength of shuttering material before commencement of work. Rectify immediately the deflection noted during concreting.
	Passage to work place	Improperly tied and designed props/planks may collapse	Ensure the stability and strength of passage before commencement of work. Do not overload and stand under the passage.
(C) REINFORCEMENT	Curtailment and binding of rods	Persons may get injured	Use PPE like gloves, shoes, helmets, etc. Avoid usage of shift tools.
	Carrying of rods for short distances/at heights	Workers may get injured their hands and shoulders.	Provide suitable pads on shoulders and use safety gloves. Tie up rods in easily liftable bundles. Ensure proper staging.
	Checking of clear distance/ cover with hands	Rods may cut or injure the fingers	Use measuring devices like tape, measuring rods, etc.
	Hitting projected rods and standing on cantilever rods.	Persons may get injured and fell down	Use safety shoes and avoid standing unnecessarily on cantilever rods. Avoid wearing of loose clothes.



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CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	Falling of material from height	May prove fatal	Use helmets. Provide safety nets.
	Transportation of rods by trucks/ trailers	Protruded rods may hit the persons	Use red flags/lights at the ends. Do not protrude the rods in front of or by the side of driver's cabin. Do not extend the rods 1/3rd of deck length or 1.5m whichever is less.
(D) WELDING AND GAS CUTTING	Welding radiates invisible ultraviolet and infra-red rays	Radiation can damage eyes and skin.	Use specified shielding devices and other PPE of correct specifications. Avoid thoriated tungsten electrodes for GTAW.
	Improper placement of oxygen and acetylene cylinders	Explosion may occur	Move out any leaking cylinder. Keep cylinders in vertical position. Use trolley for transportation of cylinders and chain them. Use flashback arrestors
	Leakage/ cuts in hoses	May cause fire	Purge regulators immediately and then turn off. Never use grease or oil on oxygen line connections and copper fittings on acetylene lines. Inspect regularly gas carrying hoses. Always use red hose for acetylene & other fuel gases and black for oxygen.
	Opening-up of cylinder	Cylinder may burst	Always stand back from the regulator while opening the cylinder. Turn valve slowly to avoid bursting. Cover the lug terminals to prevent short circuiting.
	Welding of tanks, container or pipes storing flammable liquids	Explosion may occur	Empty & purge them before welding. Never attach the ground cable to tanks, container or pipe storing flammable liquids. Never use LPG for gas cutting.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
(E) RADIOGRAPHY	Ionizing radiation	Radiations may react with the skin and can cause cancer, skin irritation, dermatitis, etc.	Ensure Safety regulations as per BARC/AERB before commencement of job. Cordon off the area and install Radiation warning symbols. Restrict the entry of unauthorized persons. Wear appropriate PPE and film badges issued by BARC/AERB.
	Transportation and Storage of Radiography source	Same as above	Never touch or handle radiography source with hands. Store radiography source inside a pit in an exclusive isolated storage room with lock and key arrangement. The pit should be approved by BARC/AERB. Radiography source should never be carried either in passenger bus or in a passenger compartment of trains. BARC/AERB has to be informed before source movement. Permission from Director General of Civil Aviation is required for booking radio isotopes with airlines.
	Loss of Radio Isotope	Same as above	Try to locate with the help of Survey Meter. Inform BARC/AERB (*)
(F) ELECTRICAL INSTALLATION AND USAGE	Short circuiting	Can cause Electrocutation or Fire	Use rubberized hand gloves and other PPE. Don't lay wires under carpets, mats or door ways. Allow only licensed electricians to perform on electrical facilities. Use one socket for one appliance. Ensure usage of only fully insulated wires or cables. Don't place bare wire ends in a socket. Ensure earthing of machineries and equipments Do not use damaged cords and avoid temporary connections. Use spark-proof/ flame proof type field distribution boxes.

(*) Atomic Energy Regulatory Board (AERB),
Bhabha Atomic Research Centre (BARC)
Anushaktinagar, Mumbai – 400 094



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CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			Do not allow open/bare connections. Provide all connections through 30mA ELCB. Protect electrical cables/equipments from water and naked flames. Check all connections before energizing.
	Overloading of Electrical System	Bursting of system can occur which leads to fire	Display voltage and current ratings prominently with 'Danger' signs. Ensure approved cable size, voltage grade and type. Switch off the electrical utilities when not in use. Do not allow unauthorized connections. Ensure proper grid wise distribution of Power.
	Improper laying of overhead and underground transmission lines/cables	Can cause electrocution and prove fatal	Do not lay unarmoured cable directly on ground, wall, roof of trees. Maintain at least 3m distance from HT cables. All temporary cables should be laid at least 750 mm below ground on 100 mm fine sand overlying by brick soling. Provide proper sleeves at crossings/ intersections. Provide cable route markers indicating the type and depth of cables at intervals not exceeding 30m and at the diversions/ termination.
(G) FIRE PREVENTION AND PROTECTION	Small fires can become big ones and may spread to the surrounding areas	Cause burn injuries and may prove fatal	In case a fire breaks out, press fire alarm system and shout "Fire, Fire". Keep buckets full of sand & water/ fire extinguishing equipment near hazardous locations Confine smoking to 'Smoking Zones' only. Train people for using specific type of fire fighting equipments under different classes of fire. Keep fire doors/ shutters, passages and exit doors unobstructed. Maintain good housekeeping and first-aid boxes (for details refer Appendix-B). Don't obstruct access to Fire extinguishers. Do not use elevators for evacuation during fire. Maintain lightning arrestors for elevated structures. Stop all electrical motors with internal combustion.



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CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)

ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			Move the vehicles from dangerous locations. Remove the load hanging from the crane booms. Remain out of the danger areas.
	Improper selection of Fire extinguisher	It may not extinguish the fire	Ensure usage of correct fire extinguisher meant for the specified fire (for details refer Appendix-C). Do not attempt to extinguish Oil and electric fires with water. Use foam cylinders/ CO2/ sand or earth.
	Improper storage of highly inflammable substances	Same as above	Maintain safe distance of flammable substances from source of ignition. Restrict the distribution of flammable materials to only min. necessary amount. Construct specifically designed fuel storage facilities. Keep chemicals in cool and dry place away from heat. Ensure adequate ventilation. Before welding operation, remove or shield the flammable material properly. Store flammable materials in stable racks, correctly labeled preferably with catchment trays. Wipe off the spills immediately.
	Short circuiting of electrical system	Same as above Can cause Electrocutation	Don't lay wires under carpets, mats or door ways. Use one socket for one appliance. Use only fully insulated wires or cables. Do not allow open/bare connections. Provide all connections through 30mA ELCB. Ensure earthing of machineries and equipments
(H) VEHICULAR MOVEMENT	Crossing the Speed Limits (Rash driving)	Personal injury	Obey speed limits and traffic rules strictly. Always expect the unexpected and be a defensive driver. Use seat belts/ helmets. Blow horn at intersections and during overtaking operations. Maintain the vehicle in good condition. Do not overtake on curves, bridges and slopes.
	Adverse weather condition	Same as Above	Read the road ahead and ride to the left. Keep the wind screen and lights clean. Do not turn at speed. Recognize the hazard, understand the defense and act correctly in time.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	Consuming alcohol before and during the driving operation	Same as above	Alcohol and driving do not mix well. Either choose alcohol or driving. If you have a choice between hitting a fixed object or an on-coming vehicle, hit the fixed object. Quit the steering at once and become a passenger. Otherwise take sufficient rest and then drive. Do not force the driver to drive fast and round the clock. Do not day dream while driving.
	Falling objects/ Mechanical failure	May prove fatal	Ensure effective braking system, adequate visibility for the drives, reverse warning alarm. Proper maintenance of the vehicle as per manufacturer instructions.
(I) PROOF TESTING (HYDROSTATIC/ PNEUMATIC TESTING)	Bursting of piping Collapse of tanks Tanks flying off	May cause injury and prove fatal	Prepare test procedure & obtain EIL/ Owner's approval. Provide separate gauge for pressurizing pump and piping/equipment. Check the calibration status of all pressure gauges, dead weight testers and temperature recorders. Take dial readings at suitable defined intervals and ensure most of them fall between 40-60% of the gauge scale range. Provide safety relief valve (set at pressure slightly higher than test pressure) while testing with air/ nitrogen. Ensure necessary precautions, stepwise increase in pressure, tightening of bolts/nuts, grouting, etc. before and during testing. Keep the vents open before opening any valve while draining out of water used for hydro-testing of tanks. Pneumatic testing involves the hazard of released energy stored in compressed gas. Specific care must therefore be taken to minimize the chance of brittle failure during a pneumatic leak test. Test temperature is important in this regard and must be considered when the designer chooses the material of construction.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 KPa (50 psi) or 10% of the test pressure. The gas used as test fluid, if not air, shall be nonflammable and nontoxic.
(J) WORKING AT HEIGHTS	Person can fall down	May sustain severe injuries or prove fatal	Provide guard rails/barricade at the work place. Use PPE like full body harness, life line, helmets, safety shoes, etc. Obtain a permit before starting the work at height above 3 meters. Fall arrest and safety nets, etc. must be installed. Provide adequate working space (min. 0.6 m). Tie/weld working platform with fixed support. Use roof top walk ladder while working on a slopping roofs. Avoid movement on beams.
		May hit the scrap/material stacked at the ground or in between	Keep the work place neat and clean. Remove the scrap immediately.
	Material can fall down	May hit the workers working at lower levels and prove fatal	Same as above plus Do not throw or drop materials or equipment from height i.e. do not <i>bomb</i> materials. All tools to be carried in a tool-kit Bag or on working uniform. Remove scrap from the planks. Ensure wearing of helmet by the workers working at lower levels.
(K) CONFINED SPACES	Suffocation/ drowning	Unconsciousness, death	Use respiratory devices, if reqd. Avoid over crowding inside a confined space. Provide Exhaust fans for ventilation Do not wear loose clothes, neck ties, etc. Fulfill conditions of the permit.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
			Check for presence of hydrocarbons, O ₂ level. Obtain work permit before entering a confined space. Ensure that the connected piping of the equipment which is to be opened is pressure free, fluid has been drained, vents are open and piping is positively isolated by a blind flange.
	Presence of foul smell and toxic substances	Inhalation can pose threat to life	Same as above plus Check for hydrocarbon and Aromatic compounds before entering a confined space. Depute one person outside the confined space for continuous monitoring and for extending help in case of an emergency.
	Ignition/ flame can cause fire	Person may sustain burn injuries or explosion may occur	Keep fire extinguishers at a hand distance. Remove surplus material and scrap immediately. Do not smoke inside a confined space. Do not allow gas cylinders inside a confined space. Use low voltage (24V) lamps for lighting. Use tools with air motors or electric tools with max. voltage of 24V. Remove all equipments at the end of the day.
(L) HANDLING AND LIFTING EQUIPMENTS	Failure of load lifting and moving equipment's	Can cause accident and prove fatal	Avoid standing under the lifted load and within the operating radius of cranes. Check periodically oil, brakes, gears, horns and tyre pressure of all moving machinery. Check quality, size and condition of all chain pulley blocks, slings, U-clamps, D-shackles, wire ropes, etc. Allow crane to move only on hard, firm and leveled ground. Allow lifting slings as short as possible and check gunny packings at the friction points. Do not allow crane to tilt its boom while moving. Install Safe Load Indicator. Ensure certification by applicable authority.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
	Overloading of lifting equipments	Same as above	Safe lifting capacity of derricks and winches written on them shall be got verified The max. safe working load shall be marked on all lifting equipment's Check the weight of columns and other heavy items painted on them and accordingly decide about the crane capacity, boom and angle of erection Allow only trained operators and riggers during crane operation.
	Overhead electrical wires	Can cause electrocution and fire	Do not allow boom or other parts of crane to come within 3m reach of overhead HT cables. Hook and load being lifted shall preferably remain in full visibility of crane operators.
(M) SCAFFOLDING FORMWORK AND LADDERS	Person can fall down	Person May sustain severe injuries and prove fatal	Provide guard rails for working at height. Face ladder while climbing and use both hands. Ladders shall extend about 1m above landing for easy access and tying up purpose. Do not place ladders against movable objects and maintain base at 1/4 unit of the working length of the ladder. Suspended scaffolds shall not be less than 500 mm wide and tied properly with ropes. No loose planks shall be allowed. Use PPE, like helmets, safety shoes, etc.
	Failure of scaffolding material	Same as above	Inspect visually all scaffolding materials for stability and anchoring with permanent structures. Design scaffolding for max. load carrying capacity. Scaffolding planks shall not be less than 50x250 mm full thickness lumber or equivalent. These shall be cleated or secured and must extend over the end supports by at least 150mm and not more than 300mm. Don't overload the scaffolds. Do not splice short ladders to make a longer one. Vertical ladders shall not exceed 6m.
	Material can fall down	Persons working at lower level gets injured	Remove excess material and scrap immediately. Carry the tools in a tool-kit bag only. Provide safety nets.



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ACTIVITY	TYPE OF HAZARD	EFFECT OF HAZARD	PREVENTIVE MEASURES
(N) STRUCTURAL WORKS	Personal negligence and danger of fall	Can cause injury or casualty	Do not take rest inside rooms built for welding machines or electrical distribution system. Avoid walking on beams at height. Wear helmet with chin strap and full body harness while working at height. Use hand gloves and goggles during grinding operations. Cover or mark the sharp and projected edges. Do not stand within the operating radius of cranes.
	Lifting/ slipping of material	Same as above	Do not stand under the lifted load. Stack properly all the materials. Avoid slippage during handling. Control longer pieces lifted up by cranes from both ends. Remove loose materials from height. Ensure tightening of all nuts & bolts.
(O) PIPELINE WORKS	Erection/ lowering failure	Can cause injury	Do not stand under the lifted load. Do not allow any person to come within the radii of the side boom handling pipes. Check the load carrying capacity of the lifting tools & tackles. Use Safe Load Indicators (SLI) Use appropriate PPEs.
	Other	Same as above	Wear gum boots in marshy areas. Allow only one person to perform signaling operations while lowering of pipes. Provide night caps on pipes. Provide end covers on pipes for stoppage of pigs while testing/ cleaning operations.
(P) GRIT BLASTING	Pollution in neighboring area, hit by grits and high pressure air	Can cause personal injury	Ensure the blasting is done in enclosed shed. Keep safe distance while blasting operations. Wear positive pressure blast hood or helmet with view-window, ear-muff/plug, gloves, overall or leather coat /apron, rubber shoes.

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APPENDIX-F

TRAINING SUBJECTS / TOPICS

(For contractors' personnel)

1. The Law & Safety – Statutory Requirement / Applicable statutes / Duties of employer / employee
2. Policy & Administration – Why HSE? / Duties & Responsibilities of Safety Personnel at project site / Effect of incentive on accident prevention
3. HSE & Supervision – Duties of Supervisor / HSE integrated supervision/ Who should be held responsible for site accidents?
4. Safety Budget / Cost of Accidents – Direct costs / Indirect costs
5. Hazard Identification / Type of hazards / HIRAC
6. Behavioural Safety & Motivation
7. Housekeeping – Storage / Stacking / Handling of materials / Hydra handling
8. Occupational Health in Construction sector
9. Personal Protective Equipments – Respiratory & Non- respiratory
10. Electricity & Safety – ELCB / Fuse / Powered tools / Project illumination
11. Handling of Compressed Gas – Transportation / Storage / FBAs / Fire prevention
12. Machine Safety – Machine guarding / Maintenance
13. Transportation – Hazards & risks in transp. of materials / ODC consignments
14. Cranes & Other Lifting machinery – Legal requirements vis-à-vis essential safety requirements.
15. Communication – HSE Induction/ TBTs/ Safety Committee/ Safety meeting/ Safety propaganda/ Publicity.
16. Excavation – Risks & Dangers / Safety measures
17. Working at Heights – Use of ladder / Work on roofs / Scaffolds / Double harness lanyards / Lifeline / Fall arrester / Safety Nets / Floor openings
18. Hazards in Welding & important safety precautions
19. Gas Cutting – Hazards & safety measures
20. Fire prevention & fire protection



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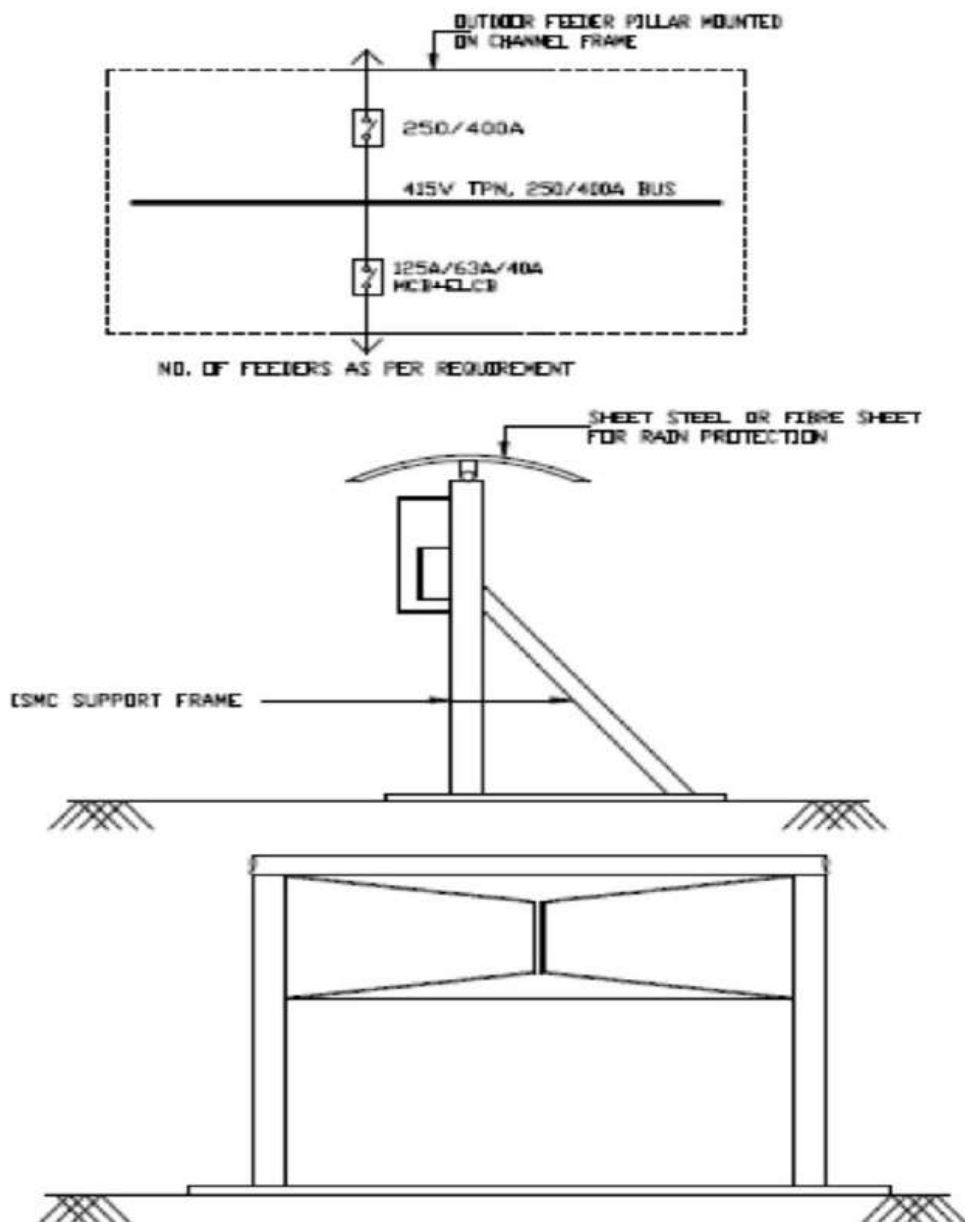
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CONSTRUCTION POWER BOARD (typ.)

APPENDIX - G



NOTES:-

1. CONTRACTOR TO INSTALL TEMPORARY CONST. POWER BOARD AS SHOWN IN THE DRG. ITS LOCATION SHALL BE EASILY ACCESSABLE.
2. POWER DISTRIBUTION BOARD SHALL BE EARTHED AT TWO POINTS BY MINIMUM 40X5MM GI STRIP FROM THE AVAILABLE GRID OR DIRECTLY CONNECTED TO TWO DIRECTLY DRIVEN EARTH ELECTRODES.
3. DISTRIBUTION BOARD SHALL BE FABRICATED BY USING 14MM CRCA SHEET STEEL WITH HINGED DOORS AND ALL COMPONENT MOUNTED IN IT.
4. ALL INCOMING AND OUTGOING CABLES SHALL HAVE BOTTOM ENTRY.



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SAFETY WALK-THROUGH REPORT

(Name & signature of walk through performer to be inserted at the bottom of each page)

Project : _____ Report no. : _____
Date : _____ Contractor : _____
Inspection by : _____ Owner : _____
Frequency : Monthly Job no. : _____

Note : Write 'NA' wherever the item is not applicable

SL. NO.	ITEM	Satisfactory/ Yes	Non satisfactory/ No	Remarks	Action
1.	HOUSEKEEPING				
a)	Waste containers provided and used				
b)	Sanitary facilities adequate and Clean				
c)	Passageways and Walkways Clear				
d)	General neatness of working areas				
e)	Other				
2.	PERSONNEL PROTECTIVE EQUIPMENT				
a)	Goggles; Shields				
b)	Face protection				
c)	Hearing protection				
d)	Foot protection				
e)	Hand protection				
f)	Respiratory Masks etc.				
g)	Full body harness conforming to CE, EN 361				
h)	Hard hat (HDPE)				
i)	Other				
3.	EXCAVATIONS/ OPENINGS				
a)	Openings properly covered or barricaded				
b)	Excavations shored				
c)	Excavations barricaded				
d)	Overnight lighting provided				
e)	Other				

Safety walk-through performer (Name & Signature)



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SL. NO.	ITEM	Satisfactory/ Yes	Non satisfactory/ No	Remarks	Action
4.	WELDING & GAS CUTTING				
a)	Gas cylinders chained upright				
b)	Cables and hoses not obstructing				
c)	Screens or shields used				
d)	Flammable materials protected				
e)	Live electrode bits contained properly				
f)	Fire extinguisher (s) accessible				
g)	Other				
5.	SCAFFOLDING & BARRICADING				
a)	Fully decked platforms				
b)	Guard and intermediate rails in place				
c)	Toe boards in place				
d)	Adequate shoring				
e)	Adequate access				
f)	Positive barricading for critical activities				
g)	Installation of warning signs				
h)	Other				
6.	LADDERS				
a)	Extension side rails 1 m above				
b)	Top of landing				
c)	Properly secured				
d)	Angle + 70° from horizontal				
e)	Other				

Safety walk-through performer (Name & Signature)



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SL. NO.	ITEM	Satisfactory / Yes	Non satisfactory /No	Remarks	Action
7.	HOISTS, CRANES AND DERRICKS				
a)	Condition of cables and sheaves OK				
b)	Condition of slings, chains, hooks and eyes O.K.				
c)	Inspection and maintenance log-books maintained				
d)	Outriggers used				
e)	Reverse horn installed / active / coupled with gear				
f)	Signs/barricades provided				
g)	Signals observed and understood				
h)	Qualified operators				
i)	Other				
8.	MACHINERY, TOOLS AND EQUIPMENT				
a)	Proper instruction				
b)	Safety devices				
c)	Proper cords				
d)	Inspection and maintenance				
e)	Other				
9.	VEHICLE AND TRAFFIC				
a)	Rules and regulations observed				
b)	Inspection and maintenance				
c)	Licensed drivers				
d)	Other				

Safety walk-through performer (Name & Signature)



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SL. NO.	ITEM	Satisfactory / Yes	Non satisfactory /No	Remarks	Action
10.	TEMPORARY FACILITIES				
a)	Emergency instructions posted				
b)	Fire extinguishers provided				
c)	Fire-aid equipment available				
d)	Secured against storm damage				
e)	General neatness				
f)	In accordance with electrical requirements				
g)	Other				
11.	FIRE PREVENTION				
a)	Personnel trained & instructed to make use of facility				
b)	Fire extinguishers checked periodically & record maintained				
c)	No smoking in Prohibited areas.				
d)	Fire Hydrants not obstructed				
e)	Regular fire drill conducted				
12.	ELECTRICAL				
a)	Use of 3-core armored cables everywhere				
b)	Usage of 'All insulated' or 'double-insulated' electrical tools				
c)	All electrical connection are routed through ELCB				
d)	Natural Earthing at the source of power (Main DB)				
e)	Continuity and tightness of earth conductor				
f)	Effective covering of junction boxes, panels and other energized wiring places				
g)	Ground fault circuit interrupters provided				
h)	Prevention of tripping hazards maintained				
f)	DCP extinguishers arranged & licensed electrician engaged at site				

Safety walk-through performer (Name & Signature)



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SL. NO.	ITEM	Satisfactory/ Yes	Non satisfactory/ No	Remarks	Action
14.	HANDLING AND STORAGE OF MATERIALS				
a)	Safely stored or stacked				
b)	Passageways clear / free from obstructions				
c)	Fire fighting facility in place				
15.	FLAMMABLE GASES AND LIQUIDS				
a)	Containers clearly identified / protected from fire				
b)	Safe storage & transportation arrangement made				
c)	Fire extinguishers positioned nearby				
d)	Facilities kept away from electric spark, hot spatters & ignition source.				
16.	WORKING AT HEIGHT				
a)	Approved Erection plan and work permit in place				
b)	Safe access, Safe work platform & Safety nets provided				
c)	Life lines, Fall arrester, Full body harness with double lanyards used;				
d)	Health Check record available for workers going up?				
e)	Protective handrails arranged around floor openings				
17.	CONFINED SPACE				
a)	Work Permit obtained from requisite authority				
b)	Test for toxic gas and sufficient availability of oxygen conducted & status				
c)	Supervisor present at site & at least one person outside the confined space for monitoring deputed				
d)	Availability of safe means of entry, exit and ventilation (register for entry & exit maintained)				
e)	Fire extinguisher and first-aid facility ensured				
f)	Lighting provision made by using 24V Lamp				
g)	Proper usage of PPEs ensured				
18.	RADIOGRAPHY				
a)	Proper storage and handling of source as per BARC/ AERB guidelines (authorized radiographer available)				
b)	Work permit obtained				

Safety walk-through performer (Name & Signature).....



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SL. NO.	ITEM	Satisfactory / Yes	Non satisfactory /No	Remarks	Action
c)	Cordoning of the area done				
d)	Use of appropriate PPE's ensured				
e)	HSE training to workers/supervisors imparted during the fortnight (indicate topic)				
f)	Minimum occupancy of workplace ensured				
19.	HEALTH CHECKS				
a)	All Workers medically examined and found be fit for working at heights (slinging, rigging, painting etc.) in confined space in excavation / trenching in shot blasting				
b)	Availability of First Aid box with contents				
c)	Proper sanitation at site, office and labour camps				
d)	Arrangement of medical facilities.				
e)	Measures for dealing with illness at site & labour camps.				
f)	Availability of Potable drinking water for workmen & staff.				
g)	Provision of crèches for children.				
h)	Stand by vehicle / ambulance available for evacuation of injured				
20.	ENVIRONMENT				
a)	Chemical and Other Effluents properly disposed				
b)	Cleaning liquid of pipes disposed off properly				
c)	Seawater used for hydro-testing disposed off as per agreed procedure				
d)	Lubricant Waste/ Engine oils properly disposed				
e)	Waste from Canteen, offices, sanitation etc. disposed properly				
f)	Disposal of surplus earth, stripping materials, Oily rags and combustible materials done properly				
g)	Green belt protection				

Safety walk-through performer (Name & Signature)



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ACCIDENT / INCIDENT REPORT

(To be submitted by Contractor after every Incident / Accident within 24 hours to EIL/ Owner)

Report No.: _____ Date: _____

Project site: _____ Name of work: _____

Contractor's name: _____ Contractor's Job Engineer (name) _____

Non-disabling injury (Non-LTA)	Hospitalized but resumed duty before end of 48 hrs	
Disabling injury (other LTA)	Hospitalized & failed to resume duty within next 48 hrs	
Fatal (LTA):	Death / Expiry	
First Aid case (non LTA)	Resume duty after first aid	

Name of the injured: _____ Father's name of victim: _____

Sub Contractor's Name:

Gate Pass No.: Age: _____ Yrs. Victim's medical fitness exam. (Pre-empl.) date: _____

Date & time of Accident / Incident: _____

Names of Witnesses: (1) _____ (2) _____ (3) _____

Profession of victim:

Bar bender		Carpenter		Meson	
Fitter		Helper		Gas cutter	
Grinder		Welder		Electrician	
Driver		Rigger		M/c. operator	
Engineer		Manager		Other/ specify	

Qualification

No formal education		Non-Matriculate		Matriculate	
Graduate		Post- grad		Other/specify	

Job Experience

NIL		Less than 2 yrs		2-5 yrs	
5-10 yrs		11-15 yrs		15 years and above	

Location where the incident happened: _____



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Activity / Works that were continuing during incident / accident: -

Excavation		Demolition		Concrete carrying	
Concrete pouring		Transportation of materials (manually)		Transportation of materials (mechanically)	
Work on or adjacent to water		Work at height (+2.0 mts)		Scaffold preparation	
Scaffold dismantling		Piling works		Welding	
Grinding		Gas-cutting		Pipe fit-ups & fabrication	
Structural fabrications		Machine works		Hydro-testing works	
Electrical works		Erection activities		Other/specify	

What exactly the victim was doing just before the incident / accident?

.....
.....

Nature of injury:

Bruise or Contusion		Abrasion (superficial wound)		Sprains or strains	
Cut or Laceration		Puncture or Open wound		Burn	
Inhalation of toxic or Poisonous fumes or gases		Absorption		Amputation	
Fracture		Other/specify			

Parts of body involved in incident / accident

Head		Face		Eyes	
Throat		Arm (above wrist)		Hand (including wrist)	
Fingers		Trunk (Abdomen / Back / Chest / Shoulder)		Throat	
Leg (above ankle)		Foot (incl. ankle)		Toes	
Multiple				Other/specify	

Accident type:

Struck against		Struck by		Fall from Elevation	
Fall on same level		caught in		caught under	
caught in between		Rubbed or abraded		Contact with (Electricity)	
Contact with (Temp./ extremes)		Contact with chemicals or oils		Vehicle accident	
Other/specify					

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Medical Aid provided:- (indicate specific aids / treatment etc.)

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Actions taken to prevent recurrence of similar incident / accident:

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Intimation to local authorities (Dist. Collector / Local Police Station / ESI authority): Yes / No / NA.

If yes, to whom

Safety Officer
(Signature and Name)
Stamp of Contractor

Site Head / Resident Construction Manager
(Signature and Name)

To : Owner
 : RCM/Site-in-charge EIL (3 copies)

→ Divisional Head (Constn.) through RCM
 → Project Manager, EIL, through RCM



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SUPPLEMENTARY INCIDENT / ACCIDENT INVESTIGATION REPORT
TICK THE APPROPRIATE ONE AS APPLICABLE (furnish within 72 hours)

Supplementary to Incident / Accident Report No: _____ (Copy enclosed)

Report No.: _____ Date: _____

Project site: _____ Name of work: _____

Contractor's name: _____ Contractor's Job Engineer (name) _____

Non-disabling injury (Non-LTA)	Hospitalized but resumed duty before end of 48 hrs	
Disabling injury (other LTA)	Hospitalized & failed to resume duty within next 48 hrs	
Fatal (LTA):	Death / Expiry	
First Aid case (non LTA)	Resume duty after first aid	

Name of the injured: _____ Father's name of victim: _____

Sub Contractor's Name: _____

Gate Pass No.: _____ Age: _____ Yrs. Victim's medical fitness exam. (Pre-empl.) date: _____

Date & time of Accident / Incident: _____

Names of Witnesses: (1) _____ (2) _____ (3) _____

Profession of victim:

Bar bender		Carpenter		Meson	
Fitter		Helper		Gas cutter	
Grinder		Welder		Electrician	
Driver		Rigger		M/c. operator	
Engineer		Manager		Other/specify	

Qualification

No formal education		Non-Matriculate		Matriculate	
Graduate		Post- grad		Other/specify	

Job Experience

NIL		Less than 2 yrs		2-5 yrs	
5-10 yrs		11-15 yrs		15 years and above	

Location where the incident happened: _____



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Activity / Works that were continuing during incident / accident: -

Excavation		Demolition		Concrete carrying	
Concrete pouring		Transportation of materials (manually)		Transportation of materials (mechanically)	
Work on or adjacent to water		Work at height (+2.0 mts)		Scaffold preparation	
Scaffold dismantling		Piling works		Welding	
Grinding		Gas-cutting		Pipe fit-ups & fabrication	
Structural fabrications		Machine works		Hydro-testing works	
Electrical works		Erection activities		Other/specify	

What exactly the victim was doing just before the incident / accident?

Particular of tools & tackles being used and condition of the same after incident/accident:

Description of Incident/Accident (How the incident was caused):

Nature of injury:

Bruise or Contusion		Abrasion (superficial wound)		Sprains or strains	
Cut or Laceration		Puncture or Open wound		Burn	
Inhalation of toxic or Poisonous fumes or gases		Absorption		Amputation	
Fracture		Other/specify			

Parts of body involved in incident / accident

Head		Face		Eyes	
Throat		Arm (above wrist)		Hand (including wrist)	
Fingers		Trunk (Abdomen / Back / Chest / Shoulder)		Throat	
Leg (above ankle)		Foot (incl. ankle)		Toes	
Multiple				Other/specify	



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Accident type:

Struck against		Struck by		Fall from Elevation	
Fall on same level		caught in		caught under	
caught in between		Rubbed or abraded		Contact with (Electricity)	
Contact with (Temp./ extremes)		Contact with chemicals or oils		Vehicle accident	
Other/specify					

Name & Designation of person who provided First-Aid to the victim:

Name & Telephone number of Hospital where the victim was treated

Mode of transport used for transporting victim – Ambulance / Private car / Tempo / Truck / Others

How much time taken to shift the injured person to Hospital

In case of FATAL incident, indicate clearly the BOCW Registration No. of the victim/ Company

Comments of Medical Practitioner, who treated / attended the victim/injured (attached / described here)

What actions are taken for investigation of the incident, please indicate clearly – (Video film / Photography / Measurements taken etc.)

Immediate cause (Please tick the right applicable) –

Hazardous methods or procedures inadequately guarded		Poor housekeeping		Inadequate or improper PPE	
Environmental hazards (excess noise/ space constraint/ inadequate ventilation)		improper illumination/ Moving on oval surface		Working on dangerous equipment	



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Failure to secure		Horse-play		Failure to use PPE	
Inattention to surroundings		Improper use of hands & body-parts		By-passing safety devices	
Unsafe mixing or placement of tools & tackles		Bypassing standard procedures		Failure in communication	
Operating without authority		Improper use of equipment or tools & tackles		drug or alcoholic influence	
excessive haste		Others(specify)			

Basic cause

Over confidence		Impulsiveness		over-exertion	
Faulty judgement or poor understanding		Failing to keep attention constantly		Nervousness & Fear	
Fatigue		Defective vision		Ill health or sickness	
Slow reaction		Others(specify)			

Root cause

Inadequate Engg		Improper Design		Inadequate Planning & organization	
Inadequate knowledge		Inadequate skill		Inadequate training	
Inadequate supervision		Improper work procedure		Inadequate compliance with standard	
Substandard performance		Inadequate maintenance		Improper inspection	
Others(specify)					

Loss of man days and impact on site works, (if any) –

Remarks from Contractor's Safety Officer/ Engineer –

Was the victim performing relevant tasks for which he was engaged /employed?

Yes / No

Was the Supervisor present on work-site during the incident?

Yes / No

Have the causes of incident rightly identified?

Yes / No

Cause of Accident was _____



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Remedial measures recommended by Safety Officer of Contractor for avoiding similar incident in future :

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Intimation to local authorities (Dist. Collector / Local Police Station / ESI authority): Yes / No / NA.

If yes, to whom

.....

Safety Officer
(Signature and Name)

Site Head / Resident Construction Manager
(Signature and Name)
Stamp of Contractor

To : Owner
: RCM / Site-in-charge of EIL (3 copies)
→ Divisional Head (Constn.) through RCM
→ Project Manager EIL, through RCM



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NEAR MISS INCIDENT/ DANGEROUS OCCURRENCE SUGGESTED PROFORMA
(to be submitted within 24 hours)

- **Near Miss** : Human injury escaped & no damage to property, equipment or interruption to work.
- **Dangerous Occurrence**: Damage to property, equipment or interruption of work, but not resulting in personal injury/ illness, e.g. Fire incident, collapse of structure, crane failure, etc.

Report No.: _____

Name of Site: _____

Date: _____

Name of work: _____

Contractor: _____

Incident reported by : _____

Date & Time of Incident : _____

Location : _____

Brief description of incident

Probable cause of incident

Suggested corrective action

Steps taken to avoid recurrence

Yes ☐

No ☐

To : Owner
RCM/Site-in-charge EIL (3 copies)

- Divisional Head (Constn.) through RCM
- Project Manager EIL, through RCM



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MONTHLY HEALTH, SAFETY & ENVIRONMENTAL (HSE) REPORT

(To be submitted by each Contractor)

Actual work start Date: _____ For the Month of: _____

Project: _____ Report No: _____

Name of the Contractor: _____ Status as on : _____

Name of Work : _____ Job No : _____

(Contractor in consultation with EIL shall generate the reports through web based package(www3.eil.co.in/eilhse)only.

ITEM	UPTO PREVIOUS MONTH	THIS MONTH	CUMULATIVE
1) Average number of Staff & Workmen (average daily headcount, not man days)			
2) Total Man-hours worked			
3) Number of Induction programmes conducted			
4) Number of HSE meetings organized at site			
5) Number of HSE awareness programmes conducted at site			
6) Number of Tool Box Talks conducted			
7) Number of Lost Time Accidents (LTA)	Fatal		
	Other LTA		
8) Number of Loss Time Injuries (LTI)	Fatalities		
	Other LTI		
9) Number of Non-Loss Time Accidents			
10) Number of First Aid Cases			
11) Number of Near Miss Incidents			
12) No. of unsafe acts/ practices detected			
13) No. of disciplinary actions taken against staff/ workmen			
14) Man-days lost due to accidents			
15) LTA Free man-hours i.e. LTA free man-hours counted from the Last LTA (enter date: _____)			
16) Frequency Rate (No. of LTA per 2 lacs man-hours worked)			
17) Severity Rate (No. of man days lost per 2 lacs man-hours worked)			
18) Loss Time Injury Frequency (No. of LTI per 2 lacs man-hours worked)			
19) No. of activities for which HIRAC completed			
20) No. of incentives/ awards given			
21) No. of occasions on which penalty imposed by EIL/ Owner			
22) No. of Audits conducted			
23) No. of pending NCs in above Audits			
24) Compensation cases raised with Insurance			
25) Compensation cases resolved and paid to workmen			
26) No of Vehicular Accident cases			
27) No of fire/Explosion cases			
28) Whether workmen compensation policy taken		Yes	No
29) Whether workmen compensation policy is valid		Yes	No
30) Whether workmen registered under ESI Act, as applicable		Yes	No
31) Whether HIRAC Register prepared and updated		Yes	No
32) Whether Environment Aspect Impact Register prepared and updated		Yes	No
33) Whether Legal Register prepared and updated		Yes	No
Remarks, if any			

Date:

Prepared by Safety Officer

(Signature and Name)

To : - OWNER

- RCM EIL (2 copies)

Approved by Site Head / Resident Construction Manager

(Signature and Name)



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PERMIT FOR WORKING AT HEIGHTS (ABOVE 2.0 METER)

(In duplicate to be issued daily for site and for office)

Permit No. Name of Main Contractor

Name of work executing agency / sub agency / vendor

Date Exact Location of work

Nature of work Duration of work (from) (to)

Number of workers covered within this permit

(List enclosed with name & gate pass numbers.)

Sl. No.	Items / Subjects	Status of compliance (Yes / No)	
1	Work areas / Equipments inspected		
2	Work area cordoned off		
3	Adequate lighting is provided		
4	Precautions against public traffic taken		
5	Concerned persons in & around have been alerted & cautioned		
6	Hazards / risks involved in routine / non-routine task assessed and control measures have been implemented at specific task		
7	ELCB provided for electrical connection & found working		
8	Ladder safely attached / fixed		
9	Scaffoldings are checked and TAGs are found used correctly		
10	Working platforms are provided and are found sound /safe for use		
11	Safe access & egress arrangements (e.g. ladders, fall arresters, life-lines etc.) are satisfactorily incorporated		
12	a. Openings on platform / floors are effectively cordoned / covered		
	b. Safety Nets are provided wherever required		
13	Use of following safety gadgets by people working at area under this permit, is checked and found satisfactory - Safety helmet Safety harness (full body) with double lanyard Safety Shoes Safety gloves Safety goggles		
14	Housekeeping of work area found satisfactorily tidy / clean & clear		
15	Adequate measures have been taken for works being continued at the ground level, when simultaneous works are permitted overhead at that very location.		
16	Materials are not thrown from heights on to ground		
17	Medical examination of workers are made & found satisfactory		
18	Responsible job engineer / supervisor found physically present at work spot for overall administration of work as well as safety of people.		

Above items have been checked & compliance has been found in place. Hence work is permitted to start / continue at the above-mentioned location. Work shall not start till identified lapses are rectified.

Additional Precautions, if any

Work Permit issued by
Contractor Engineer/ RCM

Verification By
Contractor Safety Officer

AT THE END OF THE DAY/WORK:

All works at height are completed & workmen have returned safely from work location at (time)
..... (date)

(Sig. Contractor Engineer)



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CONFINED SPACE ENTRY PERMIT

Project site _____

Name of the work _____

Name of Contractor _____

Exact location of work _____

Sr. No. _____

Date _____

Nature of work _____

Safety Requirements POSITIVE ISOLATION OF THE VESSEL IS MANDATORY

(A) Has the equipment been ?

Y	NR	Y	NR	Y	NR
☐	☐	☐	☐	☐	☐
☐	Isolated from power/steam/air	☐	water flushed &/or steamed	☐	radiation sources removed
☐	isolated from liquid or gases	☐	Man ways open & ventilated	☐	proper lighting provided
☐	depressurized &/or drained	☐	cont. inert gas flow arranged	☐	
☐	blanked/ blinded/ disconnected	☐	adequately cooled	☐	

(B) Expected Residual Hazards

☐	lack of O ₂	☐	combustible gas/ liquid	☐	H ₂ S / toxic gases
☐	corrosive chemicals	☐	pyrophoric iron / scales	☐	electricity / static
☐	heat/ steam / frost	☐	high humidity	☐	ionizing radiation
☐		☐		☐	

(C) Protection Measures

☐	gloves	☐	ear plug / muff	☐	goggles / face shield
☐	protective clothing	☐	dust / gas / air line mask	☐	personal gas alarm
☐	grounded air duct/ blower/ AC	☐	attendant with SCBA/air mask	☐	rescue equipment/ team
☐	Fire fighting arrangements	☐	safety harness & lifeline	☐	communication equipment
☐		☐		☐	

Authorization / Renewal (It is safe to enter the confined space)

No. of persons allowed	Name of persons allowed	Signature			Time		Signature Workman
		Contractor's Supervisor	Contractor's Safety Officer		From	To	

Permit Closure :

(A) Entry ☐ was closed ☐ stopped ☐ will continue on

(B) ☐ Site left in a safe condition ☐ Housekeeping done

(C) Multilock ☐ removed ☐ key transferred
☐ Ensured all men have come out ☐ Man-ways barricaded

Remarks, if any:



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RADIATION WORK PERMIT

Project : Sr. No. :
Name of the work : Date :
Name of site contractor : Job No. :

Location of work :

Source strength :

Cordoned distance (m) :

Name of Radiography agency :

Approved by Owner/EIL ☐

No. of workers engaged :
(List enclosed with name & gate pass numbers.)

The following items have been checked & compliance shall be ensured during currency of the permit:

S. No.	Item description	Done
	Safety regulations as per BARC/AERB ensured while source in use/in transit & during storage	☐
	Area cordoned off / safe working platform provided	☐
	Lighting arrangements for working during nights ensured	☐
	Warning signs/ flash lights installed	☐
	Cold work permit taken (if applicable)	☐
	PPEs like film badges, dosimeters used	☐

Additional precautions, if any _____

(Radiography Agency's BARC/AERB authorized Supervisor)

Permission is granted.

Permit is valid from _____ AM/PM _____ Date to _____ AM/PM _____
Date

(Signature of permit issuing authority of site contractor)

Name: _____ Designation: _____ Date: _____

Permit renewal:

Permit extended upto		Additional precautions required, if any	Sign. of issuing authority with date (of site contractor)	
Date	Time			

Work completed/ stopped/ area cleared at _____ Hrs of Date _____
(Sign. of permit issuing authority)

Name & Signature of site contractor:



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DEMOLISHING/DISMANTLING WORK PERMIT**

Project : Sr.No. :
Name of the work : Date :
Name of contractor : Job No. :

Name of sub-contractor : No. of workers to be engaged:
(List enclosed with name & gate pass numbers.)

Line No./ Equipment No./ Structure to be dismantled :

Location details of dismantling/ demolition with sketch : (clearly indicate the area)

The following items have been checked & compliance shall be ensured during currency of the permit:

S. No.	Item description	Done	Not Applicable
	Services like power, gas supply, water, etc. disconnected	☐	☐
	Dismantling/ Demolishing method reviewed & approved	☐	☐
	Usage of appropriate PPEs ensured	☐	☐
	Precautions taken for neighbouring structures	☐	☐
	First-Aid arrangements made	☐	☐
	Fire fighting arrangements ensured	☐	☐
	Precautions taken for blasting	☐	☐

(Contractor's Supervisor)

(Contractor's Safety Officer)

Permission is granted.

(Permit issuing authority)

Name :

Date :

Completion report :

Dismantling/ Demolishing is completed on _____ Date at _____ Hrs.

Materials/ debris transported to identified location ☐ Tagging completed (as applicable) ☐

Services like power, gas supply, water, etc. restored ☐

(Permit issuing authority)

CONTRACTOR's NAME



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DAILY SAFETY CHECKLIST

(To make use of before start of day's work)

Project :
Name of the work :
Name of contractor :
Sr. No. :
Date :
Job No. :

Description of Job decided to perform :-

- Use of PPE / Safety Gadgets

Sl. No	PPEs	Compliance (Yes / No)	Sl. No	PPEs	Compliance (Yes / No)
1	Safety Helmets		6	Face Shield	
2	Safety Shoes		7	Full body harness	
3	Hand Gloves		8	Fall Arrest System	
4	Dust Musk		9	Safety net	
5	Safety Goggles		10	Horizontal life-line made of steel wire, (dia not less than 8.0 mm.)	

(Serial No. 1 & 2 are compulsory for everyone. Specify & ensure use of other safety gadgets as required for the job)

- Identify following important unsafe conditions: -

Sl. No	Conditions	Yes / No
1	Access to work site / emergency escape clear	
2	Soil / Loose earth kept away from excavated pit / slope / ladder provided	
3	Electrical wire / welding lead lying entangled on ground / welding m/c. booth accessible	
4	Elevated work platform / open ends are protected	
5	Ground area cordoned off before lifting works or erection at height / ground area checked & cordoned-off before start of height works	
6	Structural members / erected pipes / wooden boards/pieces etc. are safely anchored at heights and are not likely to fall down on people when working beneath	
7	Rope ladders tied-up on tall steel structures, long before are removed to get rid of their use	
8	Any Other	

- Indicate actions taken, if status of any of the above items is found "No"
.....
- Specific Safety guidelines / precautions, if any (communicated thro' TBT)
.....
- Above conditions and PPE compliances are checked by undersigned and correct status are indicated after verification

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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HOUSEKEEPING ASSESSMENT& COMPLIANCE

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Name of contractor : Fortnightly

Sl. No.	Subjects of Review	Satisfactory/ Yes	Non-satisfactory/ No	Remarks	Action
1.	Cleanliness at the Main entry / access of site				
2.	Ground condition / floor areas free from water-logging / oil spillage				
3.	Ground & elevated floors free from rubbish / wastes / accumulated debris / scraps.				
4.	Manholes / openings are covered / fenced				
5.	Trenches are barricaded / walkways are in place				
6.	Drains are cleaned / not choked / not occupied by dumped materials				
7.	Sufficient CAUTION boards / instructions displayed				
8.	Construction machinery are maintained & parked in orderly manner.				
9.	Movement of site people are not obstructed because of dumping / storing of construction materials				
10.	Access/ egress to Electrical Distribution Boards/ Panels clear from wires / cables / earth-strips etc.				
11.	Electrical panel rooms / sheds / MCC / Control rooms / Substations etc. are clean & tidy and not used for storing dress / clothes, tiffin-box or bicycles.				
12.	Passage behind Elec. panels are free for access				
13.	Fire extinguishers / fire-buckets are accessible without any difficulty.				
14.	Stair-steps, platforms & landings are clear & tidy				
15.	Sheds / rooms & work areas have got sufficient illumination as well as ventilation.				
16.	Cables / Wires / welding leads are routed / hanged appropriately & are not creating unsafe condition.				
17.	Stacking / storing of insulation materials or their packing.				
18.	Removal or cleanliness of left-over sand, concrete, brick-bats, insulation-materials, excess earth, wastes etc.				
19.	Storing / stacking of sand, metal chips, re-bars, steel pipes, valves, fittings etc.				
20.	One escape route at ground & minimum two escape routes at elevation available.				



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Sl. No.	Subjects of Review	Satisfactory/ Yes	Non-satisfactory/ No	Remarks	Action
21.	Captions / Posters / Slogans on various safety instructions are displayed legibly in local language				
22.	Cable trenches are water-free or regular arrangement for taking out accumulated water exists.				
23.	Windows of rooms / offices are regularly cleaned				
24.	Facilities for cycle sheds, drinking water, washing, rest-rooms etc. are maintained in tidy manner.				
25.	Toilet, Urinals, Canteen / kitchen / pantry etc. are maintained & free from obnoxious smell.				
26.	Construction tools / tackles are stored systematically - the items are tagged / tested / certified by competent third party.				
27.	Sufficient numbers of Dust-bins / Waste-bins found at site and are regularly emptied.				

Additional remarks, if any -

.....
.....
.....

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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INSPECTION OF TEMPORARY ELECTRICAL BOOTH / INSTALLATION

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Sub Station No:/Booth No Location:

SL NO	SUBJECTS	OBSERVATION (YES /NO)	ACTION TAKEN
1	Switchboards installed properly are in order and protected from rain & water-logging.		
2	Adequate illumination provided for switchboard operation during night hours & the lamps are protected from direct human contact.		
3	Voltage ratings, DANGER signs, Shock-Treatment-Chart displayed in the installation / booth		
4	Fire extinguisher (DCP or CO ₂) & Sand Bucket kept in close vicinity of Switchboards		
5	Valid License & Competent Electrician / Wireman available & name/ license no. displayed at booth / installation.		
6	General housekeeping in & around booth / installation found in order.		
7	Cable-route-markers for U/G cables provided.		
8	Monthly inspection report of Electrical hand tools available in booth / installation.		
9	Insulated Mat provided in front of Elec. Panels.		
10	Rubber hand gloves available/ used by Electricians		
11	Availability of CAUTION boards for shutdown & / or repairing works.		
12	All incoming & outgoing feeders have proper MCCB / HRC fuses / Switches.		
13	Switchboards "earthed" at two distinctly isolated locations.		
14	Switchboards have adequate operating space at the front face & at the rear face too.		
15	All connections provided through 30mA ELCB.		
16	Testing records of all ELCBs available at site		
17	Only industrial type plugs & sockets are used.		
18	Temporary connections are 3-core double insulated & free from cuts & joints and 3 rd core is earthed at both ends		
19	Socket boards are properly mounted on stand & protected from water ingress.		
20	Electrical equipments operating above 250V have two earthing / double earthing.		
21	All incoming / outgoing cables are properly glanded & terminated with "lugs".		
22	Switch-boards are of industrial variety / type.		
23	Sketch for installation / connection (SLD) made & pasted& other safety labels/display boards		
24	Labeling of incoming / outgoing feeders made.		
25	All hand lamps are protected from direct contact.		
26	All electrical cable / joints are in safe condition		

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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INSPECTION FOR SCAFFOLDING

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :

Sl. No	Description	Yes	No	N.A	Actions taken
1	Whether work permit is obtained to take up work at height above 1.5 Mts?				
2	Whether atmospheric condition is "stormy" or "raining" and works at heights have been permitted?				
3	Whether steel pipes scaffoldings are used for units /off-site areas?				
4	Whether scaffolding has been erected on rigid/firm/leveled surfaces / ground? Whether "foot-seals" or "base-plates" are used beneath the up-rights (vertical steel pipes)				
5	Whether scaffold construction is as per IS specification with toe-board and hand-rails (top-rail as well as mid-rail)?				
6	Whether distance between two successive up-rights are less than 2.5 Mts (height of scaffold & load carrying capacity governs the distance between two uprights)				
7	Whether all uprights are extended at least 900 mm above the top most working platform (to enable fitting of handrails)?				
8	Whether vertical distance of two successive ledgers is satisfactory? (varying between 1.3 Mts. To 2.1 Mts)				
9	Whether the peripheral areas of working at height are cordoned-off? (for avoiding accident to people arising out of dropped / deflected materials)				
10	Whether platform is provided? Is it safely approachable?				
11	Whether end of scaffold platform / board are extended beyond transoms? (125mm to 150 mm)				
12	Whether CE / IS approved quality and worthy conditioned full-body safety harness (with double lanyard & karabiners) are used while working at heights?				
13	Whether life-line of safety harness is anchored to an independent secured support capable of withstanding load of a falling person?				
14	Whether the area around the scaffold is cordoned off to prohibit the entry of unauthorized person / vehicle?				
15	Whether clamps used are of good condition, of adequate strength and free from defects?				
16	Whether ladder is placed at secured and leveled surface?				
17	Whether water-pass and oil-spills are avoided around the scaffold structure?				
18	Whether ladder is extended 1.5mts. above the landing point at height?				
19	Whether more than one access/egress provided to the scaffold?				
20	Whether ladder used are of adequate length and overlapping of short ladders avoided?				
21	Whether metallic ladders are placed much away from near-by electrical transmission line?				
22	Whether rungs of ladder are inspected and found in good order?				
23	Whether fall-arresters provided on both the access/egress routes?				
24	Whether diagonal (cross) bracings are provided at regular interval on the scaffold?				
25	Whether working platform on the scaffold has been made free from "jolt" or "gap"?				
26	Whether tools or materials are removed after completion of the day's job at heights?				
27	Whether a valid Permit for Work (PFW) is obtained before taking up work over asbestos or fragile roof?				
28	Whether sufficient precaution is taken while working on fragile roof?				



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Sl. No	Description	Yes	No	N. A	Actions taken
29	Whether provision is made to arrange duck ladder, crawling board for working on fragile roof?				
30	Whether scaffold has been inspected by qualified civil engineers prior to their use?				
31	Whether the scaffolding has been designed for the load to be borne by the same?				
32	Whether the erection and dismantling of the scaffolding is being done by trained persons and under adequate supervision?				
33	Whether safety net with proper working arrangement and life-line has been provided?				
34	Whether TAGS (Green for acceptable and Red for incomplete/unsafe scaffolds) are used on scaffolds?				
35	Whether sufficient illumination is provided in and around the scaffold and access?				
36	Whether emergency rescue / response arrangements are made in place				

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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PERMIT FOR ERECTION / MODIFICATION & DISMANTLING OF SCAFFOLDING

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Nature of activities : Duration: From.....To.....

SL. No.	SUBJECTS / ITEMS	DONE	NOT DONE	REMARKS
1	Specific task of Erection / Modification / Dismantling of scaffolds, identified & TAGGED accordingly (before as well as after carrying-out jobs).			
2	People engaged in doing the job are identified & are certified by Job Engineer of Main Contractor as experienced / trained.			Names to be noted
3	Concerned persons are alerted by the Job Engineer of Main Contractor in connection with possible hazards & what the workmen MUST do / MUST not do.			
4	Verification by Job Engineer of Main Contractor made for confirming that all persons permitted to carry-out the jobs are making use of Helmet, Safety Shoes, Goggles, Gloves & Double lanyard safety harness and other relevant PPEs.			
5	Area of work is effectively cordoned-off / barricaded / illuminated.			
6	For taking-up / lowering down Scaffolding members / clamps / couplings etc. appropriate ropes / pulleys/ chains etc. have been arranged for use (not to throw any item) & the same have been verified as "fit for purpose".			
7	Items / members of scaffold, being lowered are removed from the area & stacked correctly.			
8	Ropes, chains, pulley blocks etc. being used for lifting or lowering scaffold items, are inspected by the Job Engineer & their certifications as well as physical conditions have been found O.K, before signing this PERMIT.			
9	Safety Net / Life-line / Fall Arresters etc. are arranged in position and Job Engineer has found working conditions favourable for activities to start.			
10	Scaffold erection or dismantling tasks are being supervised by Experienced Engineer / Competent person.			
11	Only competent & experienced people have been selected / engaged in Scaffolding erection, modification or dismantling tasks.			
12	Adequate & effective actions for traffic and movement of people around the cordoned-off area taken to avoid inadvertent incident			
13	Working platforms are protected with handrails & toe-boards.			
14	Access & Exit (for reach & escape) are safe for use by people.			
15	Tools, tackles to be used for above jobs are verified by job Engineers of Main contractor as genuinely good and tied-up at height (to prevent their fall).			
16	Site important Telephone Nos. are made known to everyone			
17	SOP (Safe Operating Procedure) for the specific task is made & followed too.			
18	Emergency vehicle has been arranged at work locations.			

- This permit for work shall be available at specific work location all the time.
- After completion of work, permit shall be returned to safety cell of main contractor, without fail.
- This Permit shall be issued maximum upto (Monday to Sunday).
- Additional Precautions, if any
-
• **ACCORD OF PERMISSION** (to be ticked) - YES () / NO ()

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer

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Everyday Site working conditions & performance of workmen shall be assessed / checked by Contractor
 Site Engr. and Safety Officer shall verify the same.

	Name / Sign.	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Site Engr.								
Safety Off.								



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PERMIT FOR HEAVY LIFT / CRITICAL ERECTION

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Nature of activities : Duration: From To
Location of work : Name /Type of crane :
Equipment/Structure to be erected: Wt. of equipment/ structure to be erected :

SL. NO.	Description of Item	COMPLIANCE STATUS			Remarks
		Yes	No	Not applicable	
1	Is the crane type suitable for lift or as per erection procedure?				
2	Is the crane have the correct number of counterweights fitted?				
3	Availability of Load Certification of crane from authorized agency.				
4	Is the load chart of crane available in crane cabin/or with Crane operator?				
5	Is the device to check the Wind speed in crane is working? Is the safety features in crane are working?				
6	Availability of Load certification of slings and other accessories from authorized agency				
7	Availability of Licensee/certificate for crane operator from authorized agency.				
8	Availability of approved HIRAC for the subject activities.				
9	Availability of approved erection/rigging procedures.				
10	Availability of temporary gratings/ platforms for critical lifting(as applicable)				
11	Tool Box conducted before erection?				
12	Has the area been cordoned off?				
13	Are the authorized persons during erection are identified?				
14	Does each person identified for erection understand their roles and responsibilities?				
15	Is the ground on which crane will rest or outrigger support are correct?				
16	Is hard stand requirement (if any) complied?				
17	Is the communication system (viz. walkie talkies, etc. are working properly?				
18	If more than one crane is lifting the load, is an Intermediate rigger will supervise the lift?				
19	If there is other obstruction within the operating radius of the crane, have correct precautions been taken to prevent collision?				
20	All the persons are wearing the requisite PPE?				

Inspected & Issued by
Contractor Engineer/RCM

Verification By
Contractor Safety Officer



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PERMIT FOR ENERGY ISOLATION & DE-ISOLATION

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :

ENERGY ISOLATION PERMIT

- Clearance required from: Hrs Date To Hrs Date
- Name of equipment/ energy source etc.
- Nature of job to be done:
- Area: Location:

PERMIT VALIDATION

I hereby authorize the personnel (performer) to isolate the above equipment/energy source from all sources of power and handover the equipment/energy source for maintenance/repair.

Issuing authority
Area –Incharge/RCM
Signature: Date:
Name:

PERFORMING AUTHORITY

The work and precautions will be carried out under my overall responsibility.(Testing/execution engineer)

Signature: Date:
Name:

SAFETY PRECAUTIONS FOR CLEARANCE

1. Notify workers of intent to de- energize ☐
2. Obtain lock, tag or locking/tagging devices ☐
3. Shut down, de-energize, dissipate any residual energies. ☐
4. Apply lock ,tag and locking and/or tagging devices ☐
5. *Any other job specific precautions ☐
6. Verify effectiveness of lockout by attempting to restart. ☐
7. Proper PPE is ensured ☐

I certify that the energy source mentioned above is isolated from all sources and is safe to start the work.

Tag No: Lock No:

Issuing authority
Area –Incharge /RCM
Signature: Date:
Name:

(*to be included by contractor in consultation with EIL/owner)

NORMALISING AFTER CLEARANCE

1. Notify workers of intent to re- energize ☐
2. Conduct visual inspection to confirm that the danger zone is clear of workers ☐
3. Conduct visual inspection to confirm that tools, equipment's danger zone is clear of workers ☐
4. Reposition the safety devices (interlocks, valves, guards, covers, sensors, as applicable, etc.) ☐
5. *Any other job specific normalizing details ☐
6. Remove lock, tag and locking and/or tagging devices. ☐
7. Re-energize. ☐
8. Confirm system is operating properly & safely.

I certify that the energy source mentioned above is isolated from all sources and is safe to start the work.

Tag No: Lock No:

Issuing authority
Area –Incharge /RCM
Signature: Date:
Name:

(*to be included by contractor in consultation with EIL/owner)

ENERGY DE-ISOLATION PERMIT

PERMIT VALIDATION

I hereby authorize the personnel (performer) to de- isolate the above equipment/energy source from all sources of power and handover the equipment/energy source for normal operation..

Issuing authority
Area –Incharge/RCM
Signature: Date:
Name:

PERFORMING AUTHORITY

I hereby certify that the equipment/energy source mentioned above has been de-isolated and is ready for normal operation. (Testing/execution engineer)

Signature: Date:
Name:

Countersigned by Issuing authority



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
HPCL- VISAKHAPATNAM**

Doc no.: HSEP:PSEER 14-HPCL-
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POWER SECTOR-EASTERN REGION

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PERMIT FOR EXCAVATION

(depth 2m and above)

(Sheet 1 of 2)

Project :
Name of the work :
Name of contractor :
Job Description :
Size of excavation :

Sr. No. :
Date :
Job No. :
Location:

SL. NO.	Description of Item	COMPLIANCE STATUS			Remarks
		Yes	No	Not applicable	
1	Suitable and sufficient risk assessments and method statements has been carried to ensure that the work shall be undertaken in accordance with specification and standard.				
2	Are plans/details of underground services available and the same has been reviewed?				
3	Has survey done to locate the services/obstacles etc.				
4	Has the live services (electrical, water line, air line, telephone line, etc.) has been disabled for carrying out the job.				
5	Is adequate barriers/ fences to protect the excavation are in place?				
6	Is Adequate warning signs are in place?				
7	Is Assessment of ground conditions done and remedial action (if any) taken?				
8	Safe access / egress (e.g. ramp / steps / ladders etc.) provided for site workmen & supervisors.				
9	Is the excavation work being undertaken in proximity of structure, etc.? If Yes, it's effect is considered?				
10	Availability of competent person for supervising the excavation work?				
11	Adequate safe arrangement to prevent collapse of edges (e.g. shoring / strutting / benching / sloping etc.) made at site.				
12	Hard barricades (at least 1.0M away from edge & for excavation near site access roads) with warning signs/caution boards are provided				
13	Accumulation / passage-ways of water at periphery of excavation / trench stopped/ restricted.				
14	Is the equipment being used for excavation has been checked for adequacy and is in good working condition having all the safety features?				
15	Age & fitness of workmen ensured by medical test before engagement in job?				
16	Arrangement of Monitoring of possible oxygen deficiency or obnoxious gases done & action taken?				

PERMIT GRANTED - Yes / No

(List enclosed with name & gate pass numbers.)

Name & Signature of Site Engr.
Contractor (Initiator)

Name & Signature of Safety Officer
Contractor (Issuing authority)



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PERMIT FOR EXCAVATION

(Sheet 2 of 2)

NOTES: -

1. Slopes or benches for excavation beyond 2.0M depth shall be designed & approved by Contractor's site head.
2. Excavated earth to be kept at least 1.5M away from edges.
3. Safety helmets, Safety shoes or gum-boots, gloves, goggles, Face shield, Safety Harness shall be essential PPEs.
4. Permit shall be made in **duplicate** and original shall be available at site of work.
5. Permit shall be issued for maximum **one week** only (Monday to Sunday).
6. After completion of works, permit shall be closed & preserved for record purpose.

GRANT OF PERMIT AND EXTENSIONS

Sl. No.	Validity period From ____ To ____	Working Time From ____ To ____	Initiator (site Engr. of Main Contractor)	Issuing authority (Safety Officer of Main Contractor)	Review by EIL / Owner (Remarks with date)
1.					
2.					
3.					
4.					
5.					
6.					
7.					

Additional safety instructions if any: -

- 1.
- 2.
- 3.



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POWER SECTOR-EASTERN REGION

IDENTIFICATION OF ENVIRONMENTAL ASPECTS, IMPACT ASSESSMENT AND CONTROL MEASURES

[illegible]

INITIAL ENVIRONMENT REVIEW TECHNIQUE

Environmental Impacts	AP = Air Pollution	WP = Water Pollution	LC = Land Contamination	DNR = Depletion of Natural Resources	NP = Noise Pollution

Scale	Quantity (A)	Occurrence (B)	Severity of Impact (C)	Detection (D)	Control (E)	Legal and other requirements (F)
1	Negligible	Very Rare	Negligible visual impact	Immediately	Available & effective at place	In compliance or not applicable
2	Low	Once a month or less	Causes Discomfort or Nuisance	Within 1 hour	Has in-built Secondary control	
3	Moderate	Once a day	Resource Depletion	Within 8 hours	Needs human Intervention	
4	High	Several times a Day	Affects Aquatic Life, flora, fauna or global issue	Within 24 hours	Mechanism in place but not reliable	
5	Excessive	Continuous	Human health effect	More than 24 hours	Absent or no effective control	Not in compliance

Risk Level - G : A x B x C x D x Ex F

Aspects with score of 100 and above are considered as significant.
Also, Irrespective of the score, all legal noncompliance's to be considered as significant

Condition	
N	NORMAL
A	ABNORMAL
E	EMERGENCY



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RISK IDENTIFICATION				DESIRED CONTROLS & EXISTING GAPS, IF ANY			RISK ASSESSMENT			RECOMENDED CONTROL ACTIONS TO REDUCE THE RISK LEVEL	ACTION BY	REMARKS
S. No.	Activity	Activity type (R/NR)	Hazards	Condition (N/A/N/E)	Associated Risk	Desired Control Measures	Gaps If Any	Probability (P)	Impact (I)	Risk R= P*I	Risk Classification	

Likelihood – Possibility of occurrence of risks based on present gaps (technological / operational / competence / measurement and monitoring);

UL: Unlikely, L: Likely, VL: Very Likely, FR: Frequent, C: Continuous

Impact –

SI: Slight Injury, MI: Minor Injury, MJ: Major Injury, SF: Single Fatality, MF: Multiple Fatalities

Level of consequence – Refer Guidance criteria for this i.e. possible degree of damage;

Condition- N: Normal, AN: Abnormal, E-Emergency

Activity Type: R- Routine, NR- Non Routine

RISK –

L: Low Risk, M: Moderate Risk, H: High Risk

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RECORD OF REVISION

CLAUSE No.	Rev No.	Brief of Revision	Date
All	00	New procedure introduced	31.03.2018
All	01	Customer Comments incorporated	17.05.2018
All	02	Customer Comments incorporated	19.05.2018