



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

(भारत सरकार का उपक्रम)

BHARAT HEAVY ELECTRICALS LIMITED

(A Govt. of India Undertaking)

Ref: PSER:SCT:BAR-C1962:7544

Date: 02-05-2019

NOTICE INVITING TENDER

NOTE: INTENDING BIDDER TO PARTICIPATE MAY DOWNLOAD FROM WEB SITES

Sealed offers in two part bid system are invited from reputed & experienced bidders meeting **PRE QUALIFICATION CRITERIA** as mentioned in Annexure-1 **through E-Procurement Portal <https://bhel.abcprocure.com> only**, for the subject job by the undersigned on the behalf of BHARAT HEAVY ELECTRICALS LIMITED as per the tender document. Issue/ forwarding intimation regarding tender to any bidder shall not construe that the bidder is considered to be qualified. Consideration of their offer is subject to compliance of loading criteria as per clause no. 8.0 of NIT etc. specified below. Following points relevant to the tender may please be noted and complied with.

1.0 Salient Features of NIT

SL NO	ISSUE	DESCRIPTION
i	TENDER NUMBER	PSER:SCT:BAR-C1962:19
ii	Broad Scope of job	APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,
iii	DETAILS OF TENDER DOCUMENT	
a	Volume-IA	General conditions of contract (Supply) Not Applicable.
b	Volume-IB	General conditions of contract (Service) Applicable.
c	Volume-IC	Special conditions of contract (Supply) Not Applicable.
d	Volume-ID	Special conditions of contract (Service) Applicable.
e	Volume-IE	Forms and Procedures etc. Applicable.
f	Volume-IF	Technical Conditions of Contract (TCC) (CML, TS & DRG for PSER and ISG part) Applicable.
g	Volume-III	Price Schedule (Absolute value) – Rev-00 Applicable.
iv	ISSUE OF TENDER DOCUMENTS	This is an E-tender floated online through our E-Procurement Site https://bhel.abcprocure.com . Start date of the tender: 02-05-2019
v	DUE DATE & TIME OF OFFER SUBMISSION	Date: 16-05-2019, Time: 15-00 Hrs. The bidder should respond by submitting their offer online in our e-Procurement platform at https://bhel.abcprocure.com only. Offers are invited in two-parts only. Hard copy bid or bids through email/fax shall not be accepted.
vi	OPENING OF TENDER	Date: 16-05-2019 1 hour after the latest due date and time of Offer submission Notes: (1) In case the due date of opening of tender becomes a non-working day, tenders shall be opened on next working day at the same time. (2) Bidder may depute representative to witness the opening of tender.

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POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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vii	EMD AMOUNT	Rs.905460 /-	Applicable.
viii	COST OF TENDER	Rs. 2500/-.	Applicable.
ix	LAST DATE FOR SEEKING CLARIFICATION	Date:8/05/2019 Along with soft version also, addressing to undersigned & to others as per contact address given below	Applicable.
x	SCHEDULE OF Pre Bid Discussion (PBD)	08/05/2019 Time : 15:30 hrs Venue: BHELP SER KOLKATA Office	Applicable
xi	INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)	IEM DETAILS: Refer Clause No 34.0 below.	Not Applicable.
xii	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com) ; CPP portal & E-Procurement Site https://bhel.abcpocure.com only. Bidders to keep themselves updated with all such information.	Shall be intimated to bidder.

- 2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly digitally signed & stamped on each page, as part of offer. Rates/Price including discounts/rebates, if any, mentioned anywhere/ in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.
- 3.0 Unless specifically stated otherwise, bidder shall remit cost of tender (non-refundable) and courier charges if applicable, in the form of Demand Draft drawn in favour of Bharat Heavy Electricals Ltd, payable at Kolkata, issuing the Tender, along with techno-commercial offer.
- 4.0 Unless specifically stated otherwise, bidder shall have to deposit EMD through Demand Draft/Pay Order in favour of Bharat Heavy Electricals Ltd, payable at Kolkata. For other details please refer General Conditions of Contract.
Bidders may please be noted that "OEMD" provision stands deleted. Hence, bidders who have deposited Rs. 2 Lakh as OEMD are also requested to submit fresh EMD as mentioned in sl no vii under clause no 1.0 of NIT.
- 5.0 Procedure for Submission of Tenders: The Tenderers must submit their Tenders as detailed below:

DOCUMENTS TO BE UPLOADED & MODALITY OF UPLOADING

Sl no	Description	Remarks
PART-I A	(TECHNO COMMERCIAL BID)	
	CONTAINING THE FOLLOWING:-	
i.	Covering letter/Offer forwarding letter of Tenderer. (To be attached in relevant Attachment section)	
ii.	Duly filled-in 'No Deviation Certificate' as per prescribed format. (To be attached in relevant Attachment section) <u>Note:</u> a. In case of any deviation, the same should be submitted	

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	separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be attached in relevant attachment section of the e –procurement portal. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. b. BHEL reserves the right to accept/reject the deviations without assigning any reasons, and BHEL decision is final and binding. i). In case of acceptance of the deviations, appropriate loading shall be done by BHEL ii). In case of unacceptable deviations, BHEL reserves the right to reject the tender	
iii.	Supporting documents/ annexures / schedules/ drawing etc as required in line with Pre-Qualification criteria. It shall be specifically noted that all documents as per above shall be attached in relevant attachment section and credential certificates issued by clients shall distinctly bear the name of organization, contact ph no, FAX no, etc.	
iv.	All Amendments/Correspondences/Corrigenda/Clarifications/Changes/ Errata etc pertinent to this NIT. (To be attached in relevant Attachment section)	
v.	Integrity Pact Agreement (Duly signed by the authorized signatory)	Applicable.
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification/NIT (To be attached in relevant Attachment section)	
vii.	Notice inviting Tender (NIT) (To be attached in relevant Attachment section)	
viii.	Volume – I F: Technical Conditions of Contract (TCC) (To be attached in relevant Attachment section)	
ix.	Volume – I D: Special Conditions of Contract (SCC)-Service (To be attached in relevant Attachment section)	
x.	Volume – I B : General Conditions of Contract (GCC)-Service (To be attached in relevant Attachment section)	
xii.	Volume – I E: Forms & Procedures etc. (To be attached in relevant Attachment section)	
xiii.	Volume–III - (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item. (To be attached in Unpriced Bid Attachment section)	
xiv.	Any other details preferred by bidder with proper indexing. (To be attached in relevant Attachment section)	

PART-I B	EMD/ COST OF TENDER (To be submitted offline within due date of offer submission)	
	CONTAINING THE FOLLOWING:-	
i.	1. Earnest Money Deposit (EMD) in the form as indicated in this Tender 2. Cost of Tender (Demand Draft or copy of Cash Receipt as the case may be)	

PART-II	PRICE BID	

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	(TO BE ATTACHED IN PRICE BID ATTACHMENT SECTION)	
	CONTAINING THE FOLLOWING:-	
i	Covering letter/Offer forwarding letter of Tenderer enclosed in Part-I	
ii	Volume III – PRICE BID (Duly Filled in Schedule of Rates – rate/price to be entered in words as well as figures) Any other document uploaded in the price bid, apart from above tender format, shall not be taken into cognizance for evaluation of offer.	

SPECIAL NOTE:

- A) Your offer & documents submitted along with offer shall be digitally signed & stamped in each page by your authorised representative. No overwriting/ correction in tender documents by bidders shall be allowed. However, if correction is unavoidable, the same may be signed by authorized signatory.
- B) The credentials/ documents submitted towards compliance of Pre-qualification requirement shall be physically signed by the authorized signatory & stamped before uploading/submission with the offer in the e-procurement portal.
- C) All documents/ annexures submitted with the offer shall be properly attached in the respective sections. BHEL shall not be responsible for any missing documents.

6.0 No Deviation with respect to tender clauses and no additional clauses/ suggestions/ in Techno-commercial bid/ Price bid shall normally be considered by BHEL. Bidders are requested to positively comply with the same.

7.0 BHEL reserves the right to accept or reject any or all Offers without assigning any reasons thereof. BHEL also reserves the right to cancel the Tender wholly or partly without assigning any reason thereof. Also BHEL shall not entertain any correspondence from bidders in this matter (except for the refund of EMD).

8.0 Assessment of Capacity of Bidders:

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

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

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

Total number of Packages in hand = Load (P)

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

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

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

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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:

- $P_1, P_2, P_3, P_4, P_5, \dots, P_N$ etc. be the packages (under execution/ executed during the 'Period of Assessment' in all Regions 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. $P_T = P_1 + P_2 + P_3 + P_4 + \dots + P_N$)
- Number of Months ' T_1 ' for which 'Monthly Performance Evaluation' as per relevant formats, should have been done in the 'Period of Assessment' for the corresponding similar package P_1 . Similarly T_2 for package P_2 , T_3 for package P_3 , etc. for the tendered scope. Now calculate cumulative total months ' T_T ' for total similar Packages ' P_T ' for all Regions (i.e. $T_T = T_1 + T_2 + T_3 + T_4 + \dots + T_N$)
- Sum ' S_1 ' of 'Monthly Performance Evaluation' Scores ($S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, S_{1-5}, \dots, S_{1-T_1}$) for similar package P_1 , for the 'period of assessment' ' T_1 ' (i.e. $S_1 = S_{1-1} + S_{1-2} + S_{1-3} + S_{1-4} + S_{1-5} + \dots + S_{1-T_1}$). Similarly, S_2 for package P_2 for period T_2 , S_3 for package P_3 for period T_3 etc. for the tendered scope for all Regions. Now calculate cumulative sum ' S_T ' of 'Monthly Performance Evaluation' Scores for total similar Packages ' P_T ' for all Regions (i.e. ' S_T ' = $S_1 + S_2 + S_3 + S_4 + S_5 + \dots + S_N$)
- 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

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

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

- 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.
- 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)
	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)

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Sl. No.	Item Description	Details for all Regions							Total
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
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
- 36 months preceding and including the cut-off month

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

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

Sl. no.	Overall Performance Rating (R _{BHEL})	Corresponding value of 'L'
1	=60	NA
2	> 60 and ≤ 65	0.4
3	> 65 and ≤ 70	0.35
4	> 70 and ≤ 75	0.25
5	> 75 and < 80	0.2
6	≥ 80	NA

III. 'Assessment of Capacity of Bidder':

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

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

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Note:

- i). In case the value of P_{Max} results in a fraction, the value of P_{Max} is to be rounded off to next whole number
- ii). For $R_{BHEL} = 60$, $P_{Max} = '1'$
- iii). For $R_{BHEL} \geq 80$, 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)

IV. Explanatory note:

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

Table-1

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

- iii). Bidders who have not been evaluated for at least six package months in the last 36 months preceding and including the Cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions, shall be considered "NEW VENDOR".

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

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

The "FIRST TIMER" tag shall remain till completion of all the contracts against which vendor has been tagged as First Timer or availability of 6 evaluation scores within last 36 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'.

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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:
- Up to execution of 90% of anticipated Contract Value in case of Civil, MM, Structural and Turbo Blower Packages
 - Up to Steam Blowing in case of Boiler/ESP/Piping Packages
 - 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 -
- Short hold: Evaluation shall not be applicable for this period, however Loading will be considered.
 - 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 8 above is applicable to prime bidder and Consortium partner (or Technical tie up partner) for their respective scope of work.

- 9.0 Since the job shall be executed at site, bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.
- 10.0 For any clarification on the tender document, the bidder may seek the same in writing, through e-mail or through E-Procurement Site <https://bhel.abcpocure.com>, 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 any delay. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.
- 11.0 BHEL may decide holding of pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.
- 12.0 In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer else BHEL's interpretation shall prevail.
- 13.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.
- 14.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), along with techno - commercial bid. This pact shall be considered as a preliminary qualification for further participation. The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (xi) of 1 above.
- 15.0 The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the Pre Qualification Criteria specified in this NIT as per Annexure-1 (as applicable), past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right not to consider offers of parties under HOLD.
- 16.0 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 as case, price bid (Volume-III) uploaded in E-procurement Site <https://bhel.abcpocure.com> will be opened.
- 17.0 Validity of the offer shall be for six months from the latest due date of offer submission (including extension, if any) unless specified otherwise.
- 18.0 BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

However, if reverse auction process is not adopted or is unsuccessful for whatsoever reason, absolute value

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

फैक्स/Fax : (033) 23211960

फोन/Phone : बोर्ड/EPABX : 23211691/ 23398000

price bid (Volume-III) uploaded in E-Procurement Site <https://bhel.abcpocure.com> will be opened for deciding the successful bidder. BHEL's decision in this regard will be final & binding on bidder.

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

The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. The envelope sealed price bid of successful L 1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.

If it is found that L 1 bidder has quoted higher in online seal 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).

As a reminder to the bidders, system will flash following message (in Red Color) during the course of 'online sealed bid':

"Bidders to submit online sealed bid less than or equal to their envelope sealed bid already submitted to BHEL"

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

- 19.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.
- 20.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.
- 21.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.
- 22.0 Consortium Bidding (or Technical Tie up) shall be allowed only if specified in Pre Qualifying Requirement (PQR) criteria, and in such a case the details to be complied with is enclosed herewith as per Annexure-5 UNLESS SPECIFIED OTHERWISE IN PQR.
- 23.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements' duly self certified and stamped/ digitally signed (as applicable) 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.
- 24.0 The bidder may have to produce original document for verification if so decided by BHEL.
- 25.0 The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL Website (www.bhel.com).

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

a) Commitment by BHEL:

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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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.

b) Commitment by Bidder/ Supplier/ Contractor:

b.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.

b.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.

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

26.0 It may please be noted that Guidelines/Rules in respect of Suspension of business dealings (Hold- 12 to 24 Months/ Banning – 3 years etc), Vendor Evaluation formats, quality, safety and HSE guidelines , standard T&P hire charges of BHEL etc may undergo change from time to time and the latest one shall be followed. Latest “Guidelines for Vendor Evaluation” is web based, quality, safety & HSE”; standard T&P hire charges shall be available at site and shall be given to the successful vendors/ subcontractors during execution.

27.0 MSE suppliers can avail the intended benefits in respect of the procurements related to the Goods and Services only (Definition of Goods and Services as enumerated by Govt. of India vide Office Memorandum F. No. 21(8)/2011-MA dtd. 09/11/2016 office of AS & DC, MSME) if they submit along with the offer, attested copies of either EM II certificate having deemed validity (five years from the date of issue of acknowledgement in EM II) or valid NSIC certificate or Udyog Aadhar Memorandum (UAM) & Acknowledgement or EM II certificate along with attested copy of a CA certificate (Format enclosed at Annexure – C where deemed validity of EM II certificate of five years has expired) applicable for the relevant financial year (latest audited). Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of their bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazetted officer.

Any Bidder falling under MSME category, shall furnish the following details & submit documentary evidence/Govt. Certificate etc. in support of the same along with their techno-commercial offer: -

Type under MSME	SC/ST owned	Others
Micro		
Small		
Medium		

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

फैक्स/Fax : (033) 23211960

फोन/Phone : बोर्ड/EPABX : 23211691/ 23398000

Note: - If the bidder does not furnish the above, offer shall be processed construing that the bidder is not falling under MSME category.

- 28.0 The bidder along with its associates/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website 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.
- 29.0 The contractor shall, at all stages of work deploy skilled/ semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute/ Industrial Training Institute/ National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed/ certified by State/ Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled/ semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.
- 30.0 Annexure-A -Amendment to GCC/SCC shall be read in conjunction with GCC-Volume-IB & SCC-Volume-ID. This Annexure-A (Amendment to GCC/SCC) of NIT shall not be considered as part of the NIT but addendum/corrigendum to the GCC/SCC only.
- 31.0 Annexure-B - Terms & conditions of Reverse Auction is enclosed herewith.
- 32.0 Annexure-D – Specific Clause w.r.t. BOCW Act & Cess Act is enclosed herewith.
- 33.0 Annexure-E- Statewise GST Registration nos. is enclosed herewith.
- 34.0 Duly filled & signed Annexure- CPP-GST/I to be submitted by bidders along with their techno-commercial offer.
- 35.0 Integrity Pact (IP) –

(a) 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
NOT APPLICABLE FOR THIS TENDER.			

(b) 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.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

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- (c) Please refer Section-8 of 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 provided below:

Details of contact person(s):

Name	Sriparna Mukherjee	Subrata Sen
Dept	SCT Dept, BHEL PSER, Kolkata	SCT Dept, BHEL PSER, Kolkata
Address	DJ-9/1, Sector – II, Salt Lake, Kolkata – 700091	DJ-9/1, Sector – II, Salt Lake, Kolkata – 700091
Phone	033-2339 8228	033-2339 8226
Email	sriparna@bhel.in	subrata.sen@bhel.in
FAX	033-2321 1960	033-2321 1960

- 36.0 Bidders falling under the purview of Public Procurement (preference to Make In India) order 2017 by Govt of India, vide order no P-45021/2/2017-B.E.-II, dated 15th June,2017, & all subsequent clarifications, can avail the intended benefits on submission of requisite documents as per the provisions of the order, subject to Minimum Local Content of 50%, Margin of Purchase Preference of 20% & modality of application of preference to Make In India as per aforesaid order.
- 37.0 It may please be noted that Bid should be free from correction, overwriting, using corrective fluid, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid, else bid shall be liable for rejection.

All overwriting/ cutting, etc will be numbered by bid opening officials and announced during bid opening.

37.0 Order of Precedence

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

- Amendments/Clarifications/Corrigenda/Errata etc issued in respect of the tender documents by BHEL
- Notice Inviting Tender (NIT)
- Price Bid-Volume-III
- Technical Conditions of Contract (TCC) -- Volume-IF
- Special Conditions of Contract (SCC) —Volume-ID
- General Conditions of Contract (GCC) —Volume-IB
- Forms and Procedures —Volume-IE

for BHARAT HEAVY ELECTRICALS LTD

Mgr (SCT)

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

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फोन/Phone : बोर्ड/EPABX : 23211691/ 23398000

Agency	Contact details	
BHEL, PSER, Kolkata	Address	DJ-9/1, Sector – II, Salt Lake, Kolkata – 700 091
	Phone no	033-2339 8228 (D)/ 8000
	FAX no	033-23211960
	E-mail	sriparna@bhel.in ; gargi@bhel.in ; subrata.sen@bhel.in

Enclosure

01. Annexure-1: Pre Qualification Criteria.
02. Annexure-2: Format for No deviation Certificate.
03. Annexure-3: Format for seeking clarification.
04. Annexure-4: Check List.
05. Annexure-5: Conditions for consortium/tie up.
06. Annexure –A- Amendment to GCC/SCC.
07. Annexure -B- Terms & conditions of Reverse Auction.
08. Annexure –C- CA certificate Format.
09. Annexure-D – Specific Clause w.r.t. BOCW Act & Cess Act.
10. Annexure-E- Statewise GST Registration nos.
11. Annexure– CPP-GST/I.
12. Integrity Pact Agreement Format (Separate).
13. Other Tender documents as per this NIT.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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ANNEXURE-1PRE QUALIFICATION CRITERIA

JOB	APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,
TENDER NO	PSER:SCT:BAR-C1962:19

SLNO	CRITERIA
1	FINANCIAL CRITERIA
1.1 (a)	BIDDER SHOULD HAVE AVERAGE MINIMUM ANNUAL FINANCIAL TURNOVER RS. 135.82 LAKH DURING LAST 3 (THREE) YEARS, ENDING ON 31.03.2018 AND HAVING POSITIVE NET WORTH AS ON LATEST AUDITED ACCOUNTS AS SUBMITTED FOR PARA 1(C).
(b)	BIDDER MUST HAVE EARNED PROFIT IN ANY ONE OF THE LAST THREE FINANCIAL YEARS ENDING ON 31.03.2018. AUDITED BALANCE SHEET AND PROFIT & LOSS ACCOUNT OF THE COMPANY FOR LAST 3 (THREE) FINANCIAL YEARS, ENDING ON 31.03.2018 NEED TO BE SUBMITTED IN SUPPORT OF ABOVE.
(c)	IN CASE AUDITED BALANCE SHEET AND PROFIT & LOSS ACCOUNT HAS NOT BEEN SUBMITTED FOR ALL THREE YEARS INDICATED ABOVE THEN THE APPLICABLE FINANCIAL AUDITED STATEMENTS SUBMITTED BY THE BIDDERS AGAINST THE REQUISITE THREE YEARS WILL BE AVERAGED FOR THREE YEARS.
(d)	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.
2	TECHNICAL CRITERIA
2.1	BIDDER SHOULD HAVE EXECUTED CIVIL/STRUCTURAL WORKS OR CHIMNEY OR RCC COOLING TOWER OR RCC SILO OR MILL BUNKER OR BOILER OR HRSG OR LINING WORK IN EQUIPMENT OR ANY COMBINATION OF THESE WORK FOR POWER PROJECTS/INFRASTRUCTURE PROJECTS/INDUSTRIAL PROJECTS DURING LAST SEVEN YEARS, ENDING ON THE LAST DATE OF SUBMISSION OF BID, VALUE OF WHICH SHOULD BE ONE OF THE FOLLOWING: A) 1 (SINGLE) WORK OF VALUE NOT LESS THAN RS 362.18 LAKH. OR B) 2 (TWO) WORKS OF VALUE NOT LESS THAN RS 226.37 LAKH EACH OR C) 3 (THREE) WORKS OF VALUE NOT LESS THAN RS 181.10 LAKH EACH RELEVANT DOCUMENT IN SUPPORT OF ABOVE SHALL BE SUBMITTED.
3.0	BIDDER SHOULD HAVE VALID PAN. RELEVANT DOCUMENT IN SUPPORT OF ABOVE SHALL BE SUBMITTED.
4.0	CONSORTIUM / JV BIDDING IS NOT ALLOWED.
	GENERAL
1.0	'EXECUTED' MEANS BIDDER SHOULD HAVE ACHIEVED THE CRITERIA SPECIFIED ABOVE EVEN IF THE CONTRACT HAS NOT BEEN COMPLETED OR CLOSED..
2.0	BIDDER SHOULD FURNISH INFORMATION REGARDING PROJECTS IN HAND, CURRENT LITIGATION, ORDERS REGARDING EXCLUSION/ EXPULSION OR BLACK LISTING.
3.0	AFTER SATISFACTORY FULFILLMENT OF ALL THE ABOVE CRITERIA, OFFER SHALL BE CONSIDERED FOR FURTHER EVALUATION AS PER NIT AND ALL OTHER TERMS OF THE TENDER SUBJECT TO APPROVAL OF CUSTOMER.
4.0	CONSIDERATION OF OFFER WILL BE SUBJECT TO CUSTOMER'S APPROVAL OF BIDDER
5.0	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.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

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Explanatory Notes for the PQR (unless otherwise specified in the PQR):

1. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated along with all annexures.
2. In case audited Financial statements have not been submitted for all the three years as indicated, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e total divided by three.
3. NETWORTH : Shall be calculated based on the latest Audited Accounts as furnished. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated in case of companies)
4. PROFIT : shall be NET profit (PAT + Non cash expenditure viz depreciation) earned during any one of the three financial years.
5. 'Additional' Criteria in respect of 'Technical' criteria of PQR for Civil, Electrical, CI, unless otherwise specified:
 - i) 'Similar' work means
 - a. Piling or Civil or Structure or 'Civil and Structural works' or RCC Chimney or RCC Cooling Tower or RCC Silo or Mill Bunker or any combination of these shall be considered similar works for all packages mentioned under 'CIVIL WORKS'
 - b. Electrical or C&I or 'Electrical and C&I' shall be considered similar works for all packages mentioned under 'ELECTRICAL AND C&I WORKS'
6. Time period for achievement of the 'Technical' criteria of PQR will be the last 7 years ending on the 'latest date' of Bid submission
7. 'EXECUTED' means the bidder should have achieved the criteria specified in the Technical criteria of PQR even if the Contract has not been completed or closed
8. Unless otherwise specified, for the purpose of 'Technical' criteria of PQR, the word 'EXECUTED' means achievement of milestones as defined below:
 - a. "ACHIEVEMENT OF PHYSICAL QUANTITIES" as per respective PQRs.
 - b. "READINESS FOR COAL FILLING" in respect of Mill Bunker.
 - c. "CHARGING" in respect of Power Transformers / Bus Ducts / "HT/LT Switchgears" / "HT / LT Cabling".
 - d. For C&I works: "SYNCHRONISATION" in case of power project and "WORK COMPLETION of the value as defined in PQR" in case of industry.
 - e. "BOILER LIGHT UP" in respect of Boiler / CFBC / ESP.
 - f. "GAS IN" in respect of HRSG.
 - g. "STEAM BLOWING COMPLETION" in respect of Power Cycle Piping.
 - h. "HYDRAULIC TEST" of the system in respect of Pressure parts / LP Piping / CW Piping.
 - i. "FULL LOAD OPERATION OF THE UNIT" in respect of Insulation work.
 - j. "SYNCHRONISATION" in respect of STG / GTG.
 - k. "SPINNING" in respect of HTG.
 - l. "COMPLETION AND HANDING OVER FOR MECHANICAL ERECTION" in respect of STG Deck and Machine/Equipment foundation.
9. Boiler means HRSG or WHRB or any other types of Steam Generator
10. Power Cycle piping means Main Steam, Hot Reheat, Cold Reheat, HP Bypass
11. For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5TPH where ever rating of HRSG/BOILER is mentioned in MW. Similarly, where ever rating of Gas Turbine is mentioned in terms of Frame size, ISO rating in terms of MW shall be considered for evaluation.
12. In case the experience/PO/WO certificate enclosed by bidders do not have separate break up prices for the E&C portion of Electrical and CI Works, (i.e. the certificates enclosed are for composite order for supply and erection of Electrical & CI and other works if any), then value of Erection and Commissioning for the Electrical & CI portion shall be considered as 15% of the supply & erection of Electrical & CI, unless otherwise specifically indicated in the PQR.
13. Scope for capital overhaul of STG shall cover Bearing Inspection work and overhauling of all cylinders of the Turbine.
14. In case the tendered scope is not a Pulverised Fuel Boiler, experience of Oil/Gas Fired Boilers also can be considered.
15. Value of work is to be updated with indices for "All India Avg. Consumer Price index for industrial workers" and "Monthly Whole Sale Price Index for All Commodities" with base month as per last month of work execution and indexed up to three (3) months prior to the month of latest due date of bid submission as per following formula-

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

Where

P = Updated value of work

R = Value of executed work

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

फैक्स/Fax : (033) 23211960

फोन/Phone : बोर्ड/EPABX : 23211691/ 23398000

X_N = All India Avg. Consumer Price index for industrial workers for three months prior to the month of latest due date of bid submission (e.g. If latest bid submission date is 02-Mar-17, then bid submission month shall be reckoned as March'17 and index for Dec'2016 shall be considered).

X_0 = All India Avg. Consumer Price index for industrial workers for last month of work execution

Y_N = Monthly Whole Sale Price Index for All Commodities for three months prior to the month of latest due date of bid submission (e.g. If latest bid submission date is 02-Mar-17, then bid submission month shall be reckoned as March'17 and index for Dec'2016 shall be considered).

Y_0 = Monthly Whole Sale Price Index for All Commodities for last month of work execution

16. PROFIT shall be PBT earned during any one year of last three financial years as mentioned in PQR.

17. For evaluation of PQR, the credentials of the Bidder alone, and not that of the Group Company shall be considered.

18. "Executed" means the bidder should have achieved the criteria specified in the PQR even if the Contract has not been completed or closed.

19. 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.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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ANNEXURE - 2**FORMAT FOR NO DEVIATION CERTIFICATE**
(To be submitted in the bidder's letter head)

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector - Eastern Region,
Plot no 9/1, DJ Block, Sector – II, Salt Lake City,
Kolkata – 700 091

Sub	No Deviation Certificate.	
Job	APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE	
Ref	1.0	Tender no PSER:SCT:BAR-C1962:19
	2.0	BHEL's NIT, vide reference no PSER:SCT:BAR-C1962:7544 Date: 02-05-2019
	3.0	All other pertinent issues till date.

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed/ modified the tender documents as appeared in the website/ issued by you and in case of such observance at any stage, it shall be treated as null and void.

We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT. We hereby confirm our unqualified acceptance to all terms & conditions, unqualified compliance to technical specification, integrity pact (if applicable) and acceptance to reverse auctioning process.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted/uploaded offer/documents in accordance with tender instructions with acceptance of the terms & conditions of the tender by us and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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फोन/Phone : बोर्ड/EPABX : 23211691/ 23398000

ANNEXURE - 3**FORMAT FOR SEEKING CLARIFICATION**

JOB	APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE
TENDER NO	PSER:SCT:BAR-C1962:19

Sl no	Reference clause of tender document	Existing provision	Bidder's query	BHEL's clarification

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ANNEXURE - 4**CHECK LIST**

NOTE:- Tenderers are required to fill in the following details and no column should be left blank

1	Name and Address of the Tenderer		
2	Details about type of the Firm/Company		
3.a	Details of Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:	
3.b	Details of alternate Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:	
4	EMD DETAILS	DD No: Date : Bank : Amount: <u>Please tick (√) whichever applicable:-</u> ONE TIME EMD / ONLY FOR THIS TENDER	
5	Validity of Offer	TO BE VALID FOR SIX MONTHS FROM DUE DATE	
		APPLICABILITY(BY BHEL)	ENCLOSED BY BIDDER
6	Whether the format for compliance with PRE QUALIFICATION CRITERIA (ANNEXURE-I) is understood and filled with proper supporting documents referenced in the specified format	Applicable	YES / NO
7	Audited profit and Loss Account for the last three years	Applicable/Not Applicable	YES/NO
8	Copy of PAN Card	Applicable/Not Applicable	YES/NO
9	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable/Not Applicable	YES/NO
10	Integrity Pact	Applicable/Not Applicable	YES/NO
11	Declaration by Authorised Signatory	Applicable/Not Applicable	YES/NO
12	No Deviation Certificate	Applicable/Not Applicable	YES/NO
13	Declaration confirming knowledge about Site Conditions	Applicable/Not Applicable	YES/NO
14	Declaration for relation in BHEL	Applicable/Not Applicable	YES/NO
15	Non Disclosure Certificate	Applicable/Not Applicable	YES/NO
16	Bank Account Details for E-Payment	Applicable/Not Applicable	YES/NO
17	Capacity Evaluation of Bidder for current Tender	Applicable/Not Applicable	YES/NO
18	Tie Ups/Consortium Agreement are submitted as per format	Applicable/Not Applicable	YES/NO
19	Power of Attorney for Submission of Tender/Signing Contract Agreement	Applicable/Not Applicable	YES/NO
20	Analysis of Unit rates	Applicable/Not Applicable	YES/NO
21	Undertaking regarding Bankruptcy Code Proceedings (IBC) by NCLT or under Liquidation / BIFR	Applicable/Not Applicable	YES/NO

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

DATE :

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

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ANNEXURE-5CONDITIONS TO BE COMPLIED WITH FOR CONSORTIUM BIDDING (TECHNICAL TIE UP)

- 1 Prime Bidder and Consortium Partner or partners are required to enter into a consortium agreement with a validity period of six months initially. In case the consortium is awarded the contract, then the Consortium Agreement between the Prime Bidder and Consortium Partner or partners shall be extended till contractual completion period including extension periods if any applicable.
- 2 Standalone' bidder cannot become a 'Prime Bidder' or a 'Consortium bidder' or 'Technical Tie up bidder' in a consortium (or Technical Tie up) bidding. Prime bidder shall neither be a consortium partner to other prime bidder nor take any other consortium partners. However, consortium partner may enter into consortium agreement with other prime bidders. In case of non compliance, consortium bids of such Prime bidders will be rejected.
- 3 Number of partners for a consortium Bidding (or Technical Tie up) shall be as specified in the PQR.
- 4 Prime Bidder shall be as specified in the Pre Qualification Requirement, else the bidder who has the major share of work.
- 5 In order to be qualified for the tender, Prime Bidder and Consortium partner or partners shall satisfy (i) the Technical 'Pre Qualifying Requirements' specified for the respective package, (ii) "Assessment of Capacity of Bidder" as specified in clause 8.0
- 6 Prime Bidder shall comply with additional 'Technical' criteria of PQR as defined in 'Explanatory Notes for the PQR'
- 7 Prime Bidder shall comply with all other Pre Qualifying criteria for the Tender unless otherwise specified
- 8 In case customer approval is required, then Prime Bidder and Consortium Partner or partners shall have to be individually approved by Customer for being considered for the tender.
- 9 Prime Bidder shall be responsible for the overall execution of the contract
- 10 In case of award of job, Performance shall be evaluated for Prime Bidder and Consortium Partner or partners for their respective scope of work(s) as per prescribed formats
- 11 In case the Consortium partner or partners back out, their SDs shall be encashed by BHEL. In such a case, other consortium partner or partners meeting the PQR have to be engaged by the Prime Bidder, and if not, the respective work will be withdrawn and executed on risk and cost basis of the Prime Bidder. The new consortium partner or partners shall submit fresh SDs as applicable.
- 12 In case the prime Bidder withdraws, the whole contract shall be considered cancelled and short closed.
- 13 After execution of work, the work experience shall be assigned to the Prime Bidder and the consortium partner or partners for their respective scope of work. After successful execution of two similar works with the same consortium partner or partners under direct orders of BHEL, the Prime Bidder shall be eligible for becoming a 'stand alone' bidder for similar works, subject to certification from BHEL about the active involvement of the Prime Bidder for satisfactory execution of the works.
- 14 The consortium partner shall submit SD equivalent to 1% of the total contract value in addition to the SD to be submitted by the prime Bidder for the total contract value. In case there are two consortium partners, then each partner shall submit SD equivalent to 0.5% of the total contract value in addition to the SD to be submitted by the prime Bidder for the total contract value.
- 15 In case of a Technical Tie up, all the clauses applicable for the Consortium partner shall be applicable for the Technical Tie up partner also.

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Annexure - AAmendment to GCC/SCC

1. Introduction of Clause No 1.15.13 in GCC as below:

Clause No 1.15.13: Additional security deposit (SD) has to be submitted by the successful bidder with value as follows:

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

Additional Security Deposit = 30 % of (A-B) limited to a maximum of 10% of the 'Total Price/Contract Value', where,

A = 80% of BHEL estimate

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

OR

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

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

The BHEL's estimated value shall be disclosed to the successful bidder (on their request) at appropriate juncture in case 'Additional Security Deposit' is applicable."

2. Clause no. 1.9.1(ii) of GCC shall be read as below:

The EMD may be accepted only in the following forms:

(a) Cash deposit as permissible under the extant Income Tax Act (before tender opening)

(b) Electronic Fund Transfer credited in BHEL account (before tender opening)

(c) Banker's cheque/ Pay order/ Demand draft, in favour of BHEL (along with offer)

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

In addition to above, the EMD amount in excess of Rs. 2 Lakh may also be accepted in the form of Bank Guarantee from scheduled bank. The Bank Guarantee in such cases shall be valid for atleast six months. EMD of successful tenderer will be retained as part of Security Deposit.

Clause no. 1.9.1(iv) & (v) of GCC stands deleted.

3. Clause no. 1.10.1 of GCC shall be read as below:

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

4. Clause no. 1.10.2 of GCC shall be read as below:

At least 50% of the required Security Deposit, including the EMD, should be furnished before start of the work. Balance of the Security Deposit can be deposited by deducting 10% of the gross amount progressively from each of the running bills of the Contractor till the total amount of the required Security Deposit is collected.

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The recoveries made from running bills (cash deduction towards balance SD amount) can be released against submission of equivalent Bank Guarantee in acceptable form, but only once, before completion of work, with the approval of competent authorities.

5. Clause no. 1.10.3 of GCC shall be read as below:

The balance amount to make up the required Security Deposit of 5% of the contract value may be accepted in the following forms:

- a) Cash (as permissible under the extant Income Tax Act)
- b) Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL
- c) Bank Guarantee from Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format should have the approval of BHEL
- d) Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL)
- e) Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL)

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

6. Introduction of Clause No. 1.10.8 in GCC as below:

Clause No 1.10.8: SDBG to be furnished by the vendor before start of work. No payment will be released till SDBG is submitted by the vendor.

If requested by the vendor, cash recovery equivalent to SDBG value to be made from bills submitted by the vendor.

Also recovery of interest calculated @SBI PLR +2% on amount equivalent to SDBG / PBG value to be made for the gap period (difference between date of start of work and date of submission of BG / cash recovery).

In case of delay in extension of SDBG, in case of validity expiry, SDBG shall be invoked. However if the vendor submits a new BG after invocation of the previous BG then, it shall be refunded and recovery for the gap period, i.e. the duration for which BG is not available shall be made as stated above.

7. Clause no. 1.11 of GCC shall be read as below:

Security Deposit shall be refunded/Bank Guarantee(s) released to the Contractor along with the 'Final Bill' after deducting all expenses / other amounts due to BHEL under the contract / other contracts entered into with them by BHEL upon fulfilment of contractual obligations as per terms of the contract.

8. Clause no. 2.8.3, 2.8.4 and 2.8.5 of GCC shall be read as below:

Clause no. 2.8.3: The contractor shall comply with all applicable State and Central Laws, Statutory Rules, Regulations, Notifications, etc. such as Payment of Wages Act, Minimum Wages Act, Workmen Compensation Act, Employer's Liability Act, Industrial Disputes Act, Employers Provident Act, Employees State Insurance Scheme, Contract Labour (Regulation and Abolition) Act, 1970, Payment of Bonus & Gratuity Act, Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, The Building and Other Construction Workers' Welfare Cess Act, 1996 and other Acts, Rules, and Regulations for labour/workers as applicable and as may be enacted by the State Government and Central Govt. during the tenure of the Contract and having force or jurisdiction at Site. The Contractor shall also comply with provisions of and give all such

notices to the local Governing Body, Police and other relevant Authorities as may be required by the Law.

Clause no. 2.8.4: The Contractor shall obtain independent License under the Contract Labour (Regulations and Abolition) Act, 1970 for engaging contract labour as required from the concerned Authorities based on the certificate (Form- V) issued by the Principal Employer/Customer.

Clause no. 2.8.5: The contractor shall pay and bear all taxes, fees, license charges, Cess, duties, deposits, tolls, royalties, commission or other charges which may be leviable on account of his operations in executing the contract.

9. Clause 2.12 of GCC (Overrun Compensation)

2.12 OVERRUN COMPENSATION (ORC)

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

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

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

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

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

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

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

2.12.3.3 For the purpose of calculation of ORC, executed value of work in the month shall be divided in Part-1 and Part-2 in proportion of percentage shortfall attributable to BHEL and contractor respectively, based on the last delay analysis as worked out in 2.12.3.2.

ORC shall be payable only on Part-1 and no ORC shall be payable on Part-2.

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

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

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

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

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

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

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

- i). Contractor has not been permitted by BHEL to de-mobilize
 - a) ORC amount of Rs. 1,00,000/- per month shall be applicable during the period of HOLD provided resources as planned are deployed (not demobilised) during the period of hold.
 - b) Subsequent to lifting of HOLD, Period of HOLD shall not be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.
- ii). Contractor has been permitted to demobilize and to remobilize after lifting of HOLD
 - a) No ORC shall be payable to contractor for the period of HOLD.
 - b) Subsequent to lifting of HOLD, Period of HOLD shall not be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.

2.12.3.8 In case Force Majeure is invoked:

- (i) No ORC shall be applicable during the period of Force Majeure.
- (ii) Subsequent to revocation of Force Majeure, period of Force Majeure shall be excluded in calculation of period for deciding applicable ORC rate as per clause 2.12.3.1.

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

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

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

10. Clause 2.14 of GCC (Quantity Variation)

- a) Existing Clause 2.14.1 of GCC stands revised as follows:

"The quantities given in the contract are tentative and may change to any extent (both in plus side and minus side). The quoted rates for individual items shall remain firm irrespective of any variations in the individual quantities No compensation becomes payable in case the variation of the final executed contract value is within the limit of Minus (-) 15% of awarded contract value"

- b) Existing Clause 2.14.2 ii). of GCC stands revised as follows:

"In case the finally executed contract value increases above the awarded Contract Value due to quantity variation, there will be no upward revision in the rates for the individual items and also contractor is not eligible for any compensation."

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11. Clause 2.17 of GCC (Price Variation Compensation) stands revised as follows:

2.17 PRICE VARIATION COMPENSATION

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

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

SL NO	CATEGORY	BASE INDEX	PERCENTAGE COMPONENT ('K')				
			CIVIL PACKAGES (See Note AB/C)			MECHANICAL PACKAGES	Electrical, C&I Material Management/Handling and other labour oriented packages
			A	B	C		
i)	LABOUR (ALL CATEGORIES)	'MONTHLY ALL-INDIA AVERAGE CONSUMER PRICE INDEX NUMBERS FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)	40	25	30	65	80
ii)	HIGH SPEED DIESEL OIL	Name of Commodity: HSD Commodity Code: 1202000005 (See Note E)	5	3	5	5	5
iii)	WELDING ROD	Name of Commodity: MANUFACTURE OF BASIC METALS Commodity Code: 1314000000 (See Note E)				15	
iv)	CEMENT	Name of Commodity: ORDINARY PORTLAND CEMENT Commodity Code: 1313050003 (See Note E)		20	30		
v)	STEEL (Structural and Reinforcement Steel)	Name of Commodity: MILD STEEL: LONG PRODUCTS Commodity Code: 1314040000 (See Note E)		25			
vi)	ALL OTHER MATERIALS (Other than Cement & Steel)	Name of Commodity: ALL COMMODITIES Commodity Code: 1000000000 (See Note E)	40	12	20		

Note: A) Cement & Steel: Free Issue (BHEL Scope)
 B) Cement & Steel : In Contractor Scope
 C) Cement in Contractor Scope, and Steel is Free Issue (BHEL Scope)
 D) For Composite packages (i.e. Civil+Mechanical+Electrical and/or CI or Civil+Mechanical or Mechanical+Electrical and/or CI), the COMPONENT ('K') for various categories shall be as per respective packages as above.
 E) As per the 'MONTHLY WHOLE SALE PRICE INDEX' for the respective Commodity and Type, published by Office of Economic Adviser, Ministry of Commerce and Industry, Government of India. (Website: <http://eaindustry.nic.in/home.asp>). Revisions in the index or commodity will be re adjusted accordingly.

2.17.3 #

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

$$P = K \times R \times \frac{(X_N - X_0)}{X_0}$$

Where

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

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

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

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

X₀ = Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials as on the Base date

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

2.17.6 PVC shall not be payable for the ORC amount, Supplementary/Additional Items, Extra works.

However, PVC will be payable for items executed under quantity variation of BOQ items under originally awarded contract.

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

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

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

However total quantum of Price Variation amount payable/recoverable shall be regulated as follows:

- i. For the portion of shortfall / backlog not attributable to contractor, PVC shall be worked out on the basis of indices applicable for the respective month in which work is done. Base index shall be applicable as defined in clause 2.17.5
- ii. In case of Force majeure, PVC shall be regulated as per (a) or (b) below:
 - a) Force majeure is invoked before "base date"/ "revised base date" (as explained below) OR immediately after "base date"/ "revised base date" in continuation (i.e. during the period when PVC is not applicable):
 1. Base date shall be revised: Revised base date =Previous base date+ duration of Force majeure.
No PVC will be applicable for the work done till revised base date.
 2. PVC will be applicable for the work done after "base date"/ "revised base date" as the case may be (during extended period when delay is not attributable to contractor). PVC shall be worked out on the basis of indices applicable for the respective month in which work is done with base index as on "base date"/"revised base date" as the case may be.
 - b) Force majeure is invoked after "base date"/ "revised base date" as the case may be (during extended period when delay is not attributable to contractor) -

1. PVC shall be applicable for the work done after revocation of force majeure.
 2. PVC for the work done after revocation of force majeure shall be worked out on the basis of indices applicable for the respective month in which work is done excluding the effect of change in indices during total period of Force majeure(s) invoked after "base date"/ "revised base date" as the case may be. Base index shall be taken as on "base date"/ "revised base date" as the case may be.
- iii. The total amount of PVC shall not exceed 15% of the cumulatively executed contract value. Executed contract value for this purpose is exclusive of PVC, ORC, Supplementary/Additional Items and Extra works except extra items due to quantity variation.

12. Clause 2.2 of GCC (Law governing the contract and court jurisdiction) stands revised as follows:

"The contract shall be governed by the Law for the time being in force in the Republic of India. Subject to Clause 2.21.1 or 2.21.2 of this Contract, the Civil Court having original Civil Jurisdiction at Delhi for PSNR, at Kolkata for PSER, at Nagpur for PSWR and at Chennai for PSSR, shall alone have exclusive jurisdiction in regard to all matters in respect of the Contract."

13. Existing Clause 2.21 "ARBITRATION" of GCC has been amended as follows:

2.21 ARBITRATION & CONCILIATION

2.21.1 ARBITRATION:

2.21.1.1 Except as provided elsewhere in this Contract, in case Parties are unable to reach amicable settlement (whether by Conciliation to be conducted as provided in Clause 2.21.2 herein below or otherwise) in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract (hereinafter referred to as the 'Dispute'), then, either Party may, commence arbitration in respect of such Dispute by issuance of a notice in terms of section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice'). The Notice shall contain the particulars of all claims to be referred to arbitration in sufficient detail and shall also indicate the monetary amount of such claim. The arbitration shall be conducted by a sole arbitrator to be appointed by the Head of the BHEL Power Sector Region issuing the Contract within 60 days of receipt of the complete Notice. The language of arbitration shall be English.

The Arbitrator shall pass a reasoned award.

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

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

In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations (excluding disputes concerning Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative Mechanism for Resolution

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of CPSEs Disputes) as mentioned in DPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22-05-2018 as amended from time to time.

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

2.21.1.4 Notwithstanding the existence of any dispute or differences and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and expedition in a professional manner unless the dispute inter-alia relates to cancellation, termination or short-closure of the Contract by BHEL.

2.21.2 CONCILIATION:

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

Notes:

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

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

The Contractor hereby agrees that BHEL may make any amendments or modifications to the provisions stipulated in the Procedure 2.3 to this GCC from time to time and confirms that it shall be bound by such amended or modified provisions of the Procedure 2.3 with effect from the date as intimated by BHEL to it.

2.21.3 No Interest payable to Contractor

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

14. Clause no. 2.7.2 and 2.7.3 of Volume-IB-GCC shall be revised as follows:

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

- i). Contractor's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution.
- ii). Withdrawal from or abandonment of the work by contractor before completion of the work as per contract.

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- iii). Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor.
- iv). Termination of Contract on account of any other reason (s) attributable to Contractor.
- v). Assignment, transfer, subletting of Contract without BHEL's written permission.
- vi). Non-compliance to any contractual condition or any other default attributable to Contractor.

Risk & Cost Amount against Balance Work:

Risk & Cost amount against balance work shall be calculated as follows: Risk & Cost Amount= [(A-B) + (A x H/100)]

Where,

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

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

H = Overhead Factor to be taken as 5

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

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

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

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

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

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

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

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

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

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

- i). Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1
- ii) Let the value of executed work till the time of termination of contract= X
- iii) Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y
- iv) Delay in executed work attributable to contractor i.e. T2=[1-(X/Y)] x T1
- v) LD shall be calculated in line with LD clause (clause 2.7.9) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

2.7.2.2 In case Contractor fails to deploy the resources as per requirement, BHEL can deploy own/hired/otherwise arranged resources at the risk and cost of the contractor and recover the

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expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.

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

Following sequence shall be applicable for recoveries from contractor:

- a) Dues available in the form of Bills payable to contractor, SD, BGs against the same contract.
- b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above.
- c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery:
 - i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery.
 - ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor.
 - iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

15. Clause 2.24 of GCC (Performance Guarantee for Workmanship)

Term "Special Conditions of Contract" appearing in 3rd line of the current clause 2.24.1, is replaced by "Technical Conditions of Contract"

16. Clause 4.2.1.7 of Special Condition of Contract (SCC)

At the end of Clause 4.2.1.7 (i.e. after the line "Decision of BHEL shall be final and binding on the contractor") following para is to be added

"It is not obligatory on the part of BHEL to provide any tools and tackles or other materials other than those specifically agreed to do so by BHEL. However, depending upon the availability, BHEL /BHEL's Customer handling equipment and other plants may be made available to the contractor on payment of hire charges as fixed, subject to the conditions laid down by BHEL/Customer from time to time. Unless paid in advance, such hire charges, if applicable, shall be recovered from contractor's bill / security deposit or any other due payment in one installment."

17. Clause 9.61 of SCC (NON-COMPLIANCE)

Under NON-COMPLIANCE, at the end of Clause 9.61 (i.e. after the line "Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.") following para is to be added:

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

18. Clause 9.1 & 9.2 to 9.62 of SCC (HSE & OHSAS Obligations)

Cl. no. 9.0	No change
Cl. no. 9.1	HSE (Health, safety & Environment): Contractor will comply with HSE (Health, safety & Environment) requirements of BHEL as per "HSE Plan for Site Operations by Sub-contractors" (Document no. HSEP:14, Rev.00) attached with this tender.
Cl. no. 9.2 to 9.62	Deleted

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

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Annexure -BTerms & Conditions of Reverse Auction

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

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
2. Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit "online sealed bid" in the Reverse Auction. Non-submission of "online sealed bid" by the bidder for any of the eligible items for which techno- commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.
3. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.
4. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained for participation in the reverse auction.
5. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.
6. Bidders have to fax the Compliance form (annexure III) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.
7. In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" which is inclusive of all cost elements in line with terms & conditions of the tender for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.
8. Reverse auction will be conducted on scheduled date & time.
9. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.
10. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure IV) as provided on case-to-case basis to Service provider within two working days of Auction without fail.
11. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL's standard practice.
12. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the "Business Rules of Reverse Auction", which will be communicated before the Reverse Auction.
13. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action as *per extant BHEL guidelines*, shall be initiated by BHEL and the results of the RA scrapped/ aborted.
14. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.
15. In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) will not be allowed to participate in further RA process provided minimum three bidders are left after removal of H1 bidder. In case of tie for H1 bid (identical online sealed bids), 15 minutes' additional time shall be provided and all the participating bidders shall be informed by mail/message on bidding screen to enable bidders submit revised online sealed bids so as to break the tie.

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Annexure -C**Certificate by Chartered Accountant on letter head**

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

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

1. **For Manufacturing Enterprises:** Investment in plant and machinery (i.e. original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No.S.O.1722(E) dated October 5, 2006 :
Rs.....Lacs
2. **For Service Enterprises:** Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:
Rs.....Lacs

(Strike off whichever is not applicable)

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

Or

The company has been graduated from its original category {Micro/ Small} (Strike off which is not applicable) and the date of graduation of such enterprise from its original category is (dd/mm/yyyy) which is within the period of 3 years from the date of graduation of such enterprise from its original category as notified vide S.O. No. 3322(E) dated 01.11.2013 published in the gazette notification dated 04.11.2013 by Ministry of MSME.

Date:

(Signature)

Name-

Membership number-

Seal of Chartered Accountant

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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Annexure –D**Specific Clause w.r.t. BOCW Act & Cess Act**

1. It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
2. It shall be sole responsibility of the contractor engaging Building Workers in connection with the building or other construction works in the capacity of employer to apply and obtain registration certificate specifying the scope of work under the relevant provisions of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 from the appropriate Authorities.
3. It shall be responsibility of the contractor to furnish a copy of such Registration Certificate within a period of one month from the date of commencement of Work.
4. It is responsibility of the contractor to register under the Building and other Construction Workers' Welfare Cess Act, 1996 and deposit the required Cess for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 at such rate as the Central Government may, by notification in the Official Gazette, from time to time specify. However, before registering and deposit of Cess under the Building and other Construction Workers' Welfare Cess Act, 1996, the contractor will seek written prior approval from the Construction Manager.
5. In case where the contractor has been accorded written approval by the Construction Manager and the contractor is required to furnish information in Form I and deposit the Cess under the Building and other Construction Workers' Welfare Cess Act, 1996, fails to do so, BHEL reserves right to impose penalty at the rate of 30% of Cess Amount.
6. It shall be sole responsibility of the contractor as employer to get registered every Building Worker, who is between the age of 18 to 60 years of age and who has been engaged in any building or other construction work for not less than ninety days during the preceding twelve months as Beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996.
7. It shall be sole responsibility of the contractor as employer to maintain all the registers, records, notices and submit returns under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
8. It shall be sole responsibility of the contractor as employer to provide notice of poisoning or occupation notifiable diseases, to report of accident and dangerous occurrences to the concerned authorities under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the rules made thereunder and to make payment of all statutory payments & compensation under the Employees' Compensation Act, 1923.
9. It shall be responsibility of the Contractor to furnish BHEL on monthly basis, Receipts/ Challans towards Deposit of the Cess under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder along with following statistics :
 - (i) Number of Building Workers employed during preceding one month.
 - (ii) Number of Building workers registered as Beneficiary during preceding one month.
 - (iii) Disbursement of Wages made to the Building Workers for preceding wage month.
 - (iv) Remittance of Contribution of Beneficiaries made during the preceding month
10. BHEL shall reimburse the contractor the Cess amount deposited for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder. However, BHEL shall not reimburse the Fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.
11. It shall be responsibility of the Building Worker engaged by the Contractor and registered as a beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service)

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091

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Act, 1996 to contribute to the Fund at such rate per mensem as may be specified by the State government by notification in the Official Gazette. Where such beneficiary authorizes the contractor being his employer to deduct his contribution from his monthly wages and to remit the same, the contractor shall remit such contribution to the Building and other construction Workers' Welfare Board in such manner as may be directed by the Board, within the fifteen days from such deduction.

12. If any point of time during the contract period, non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder is observed, BHEL reserves the right to withhold a reasonable amount from the payables to discharge any obligations on behalf of Contractors. The reasonable amount shall be decided by the Construction Manager in consultation with Resident Accounts Officer & Head HR and shall be final.
13. The contractor shall declare to undertake any liability or claim arising out of employment of building workers and shall indemnify BHEL from all consequences / liabilities / penalties in case of non compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.

ANNEXURE-E**Statewise GST Registration nos.**

Sl. No.	State / UT	GST Reg. No.
1	Andhra Pradesh	37AAACB4146P7Z8
2	Assam	18AAACB4146P1ZE
3	Bihar	10AAACB4146P1ZU
4	Chandigarh	04AAACB4146P1ZN
5	Chattishgarh	22AAACB4146P1ZP
6	Daman & Diu	25AAACB4146P1ZJ
7	Delhi	07AAACB4146P1ZH
8	Gujarat	24AAACB4146P1ZL
9	Haryana	06AAACB4146P1ZJ
10	HP	02AAACB4146P1ZR
11	Jharkhand	20AAACB4146P5ZP
12	Karnataka	29AAACB4146P1ZB
13	Kerala	32AAACB4146P1ZO
14	Maharashtra	27AAACB4146P1ZF
15	MP	23AAACB4146P1ZN
16	Punjab	03AAACB4146P2ZO
17	Rajasthan	08AAACB4146P1ZF
18	Tamil Nadu	33AAACB4146P2ZL
19	Telangana	36AAACB4146P1ZG
20	Tripura	16AAACB4146P1ZI
21	UP	09AAACB4146P2ZC
22	Uttarakhand	05AAACB4146P1ZL
23	West Bangal	19AAACB4146P1ZC
24	Mizoram	15AAACB4146P1ZK
25	Orissa	21AAACB4146P1ZR
26	Arunachal Pradesh	12AAACB4146P1ZQ

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Annexure- CPP-GST/II**Please arrange to submit this filled-up format along with Tender**

Name of the Company	
Address of Company*	
Company Registration Number*	
Name of Partners / Directors	
ALL THE STATES WHERE BIDDER HAS A PLACE OF BUSINESS*	
ALL ADDRESS OF VENDOR MENTIONING THEIR PIN AS PER THE LATEST GST REGISTRATION*	
GSTN OF ALL THE ABOVE NOTED PLACES OF VENDOR*	
Bidder Type: Indian/ Foreign*	
City*	
State*	
Country*	
Postal Code*	
PAN/TAN Number*	
Company's Establishment Year	
Company's Nature of Business*	
Company's Legal Status* {limited /undertaking/joint venture/partnership/other}	
Company Category* {micro unit as per MSME/small unit as per MSME/medium unit as per MSME/ UAN as per Udyog Aadhaar Memorandum/ Ancillary unit/project affected person of this company/ssi/ other}	
Relevant documents to be submitted as applicable.	
Enter Company's Contact Person Details	
Title(Mr. / Mrs. / Ms. / Dr. / Shri)*	
Contact Name*	
Date Of Birth*	
Correspondence Email*	
(Correspondence Email ID can be same as your Login ID. All the mail correspondence will be sent only to the Correspondence Email ID.)	
Designation	
Phone*	
Fax*	
Mobile*	

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)

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TENDER NO: PSER:SCT:BAR-C1962:19

VOLUME -IB

GENERAL CONDITIONS OF CONTRACT
(SERVICE)

FOR

**APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS
FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER
THERMAL POWER PROJECT, STAGE-I,**

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVT. OF INDIA UNDERTAKING)

POWER SECTOR – EASTERN REGION

PLOT NO. – 9 / 1, DJ – BLOCK,

SECTOR – II, KARUNAMOYEE,

SALT LAKE CITY,

KOLKATA – 700091.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 1 OF 30

TABLE OF CONTENTS

1. Chapter-1 : General Instructions to Tenderers

- 1.1. Despatch Instructions
- 1.2. Submission of Tenders
- 1.3. Language
- 1.4. Price Discrepancy
- 1.5. Qualification of Tenderers
- 1.6. Evaluation of Bids
- 1.7. Data to be enclosed
- 1.8. Authorisation and Attestation
- 1.9. Earnest Money Deposit
- 1.10. Security Deposit
- 1.11. Return of Security Deposit
- 1.12. Bank Guarantee
- 1.13. Validity of offer
- 1.14. Execution of Contract Agreement
- 1.15. Rejection of Tender and other Conditions

2. Chapter-2

- 2.1. Definitions
- 2.2. Law Governing Contract and Court Jurisdiction
- 2.3. Issue of Notice
- 2.4. Use of land
- 2.5. Commencement of Work

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 2 OF 30

- 2.6. Measurement of Work and Mode of Payment
- 2.7. Rights of BHEL
- 2.8. Responsibilities of Contractor in respect of Local Laws, Employment of Workers etc
- 2.9. Progress Monitoring, Monthly Review and Performance Evaluation
- 2.10. Time of Completion
- 2.11. Extension of Time for Completion
- 2.12. Over Run Compensation
- 2.13. Interest Bearing Recoverable Advances
- 2.14. Quantity Variation
- 2.15. Extra Works
- 2.16. Supplementary Items
- 2.17. Price Variation Clause
- 2.18. Insurance
- 2.19. Strikes & Lockout
- 2.20. Force Majeure
- 2.21. Arbitration and Reconciliation
- 2.22. Retention Amount
- 2.23. Payments
- 2.24. Performance Guarantee for Workmanship
- 2.25. Closing of Contracts
- 2.26. Reverse Auction
- 2.27. Suspension of Business Dealings
- 2.28. Other Issues

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 3 OF 30

CHAPTER -1

1. GENERAL INSTRUCTION TO TENDERERS

1.1. DESPATCH INSTRUCTION

- i) The General Conditions of Contract form part of the Tender specifications. All pages of the tender documents shall be duly signed, stamped and submitted along with the offer in token of complete acceptance thereof. The information furnished shall be complete by itself. The tenderer is required to furnish all the details and other documents as required in the following pages
- ii) Tenderers are advised to study all the tender documents carefully. Any submission of tender by the tenderer shall be deemed to have been done after careful study and examination of the tender documents and with the full understanding of the implications thereof. Should the tenderers have any doubt about the meaning of any portion of the Tender Specification or find discrepancies or omissions in the drawings or the tender documents issued are incomplete or shall require clarification on any of the technical aspect, the scope of work etc., he shall at once, contact the authority inviting the tender well in time (so as not to affect last date of submission) for clarification before the submission of the tender. Tenderer's request for clarifications shall be with reference to Sections and Clause numbers given in the tender documents. The specifications and terms and conditions shall be deemed to have been accepted by the tenderer in his offer. Non compliance with any of the requirements and instructions of the tender enquiry may result in the rejection of the tender.
- iii) Integrity pact (IP) shall be applicable for all tenders / contracts if indicated in NIT. This integrity pact shall be issued as part of the Tender documents and shall be returned by the bidder along with Techno-commercial bid duly filled, signed and stamped by the authorized signatory who signs the bid. Only those vendors / bidders who have entered into such an IP with BHEL shall be considered qualified to participate in the bidding. Entering into this pact shall be a preliminary qualification.

1.2. SUBMISSION OF TENDERS

- 1.2.1 The tenderers must submit their tenders to Officer inviting tender as per instructions in the NIT
- 1.2.2 Tenders submitted by post shall be sent by 'REGISTERED POST ACKNOWLEDGEMENT DUE / by COURIER' and shall be posted with due allowance for any postal/courier delays. BHEL takes no responsibility for delay, loss or non-receipt of tenders sent by post/courier. The tenders received after the specified time of their submission are treated as 'Late Tenders' and shall not be considered under any circumstances. Offers received by Fax/Email/Internet shall be considered as per terms of NIT.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 4 OF 30

1.2.3 Tenders shall be opened by authorised Officer of BHEL at his office at the time and date as specified in the NIT, in the presence of such of those tenderers or their authorised representatives who may be present

1.2.4 Tenderers whose bids are found techno commercially qualified shall be informed the date and time of opening of the Price Bids and such Tenderers may depute their representatives to witness the opening of the price bids. BHEL's decision in this regard shall be final and binding.

1.2.5 Before submission of Offer, the tenderers are advised to inspect the site of work and the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, position of material and labour, means of transport and access to Site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge of any of these conditions.

1.3. LANGUAGE

1.3.1 The tenderer shall quote the rates in English language and international numerals. These rates shall be entered in figures as well as in words. For the purpose of the tenders, the metric system of units shall be used.

1.3.2 All entries in the tender shall either be typed or written legibly in ink. Erasing and over-writing is not permitted and may render such tenders liable for rejection. All cancellations and insertions shall be duly attested by the tenderer.

1.4 PRICE DISCREPANCY:

1.4.1 **Conventional (Manual) Price Bid opening :** In the case of price bid opening without resorting to Reverse Auction, if there are differences between the rates given by the tenderer in words and figures or in amount worked out by him, the following procedure for evaluation and award shall be followed:

- i) When there is a difference between the rates in figures and in words, the rates which corresponds to the amounts worked out by the contractor, shall be taken as correct
- ii) When the amount of an item is not worked out by the contractor or it does not correspond with the rate written either in figure or in words, then the rate quoted by the contractor in words shall be taken as correct
- iii) When the rate quoted by the contractor in figures and words tallies but the amount is not worked out correctly, the rate quoted by the contractor shall be taken as correct and not the amount.
- iv) In case of lumpsum price, if there is any difference between the amount in figures and in words, the amount quoted by the bidder in words shall be taken as correct.
- v) In case of omission in quoting any rate for one or more items, the evaluation shall be done considering the highest quoted rate obtained against the respective items by other tenderers for the subject tender. If the tenderer becomes L-1, the notional rates for the omission items shall be the lowest rates quoted for the respective items by the other tenderers against the respective omission items for the subject job and the 'Total quoted price (loaded for omissions)' shall be arrived at. However the overall price remaining the same as quoted originally, the rates for all the items in the 'Total quoted price (loaded for omissions)' shall be reduced item wise in proportion to the ratio of 'Original' total price and the 'Total quoted price (loaded for omissions)'.
- vi) The 'Final Total Amount' shall be arrived at after considering the amounts worked out in line with 'i' to 'iv' above.

1.4.2 **Reverse Auction:** In case of Reverse Auction, the successful bidder shall undertake to execute

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 5 OF 30

the work as per overall price offered by him during the Reverse Auction process. In case of omission of rates, the procedure shall be as per 'Guidelines for Reverse Auction' enclosed.

1.5. QUALIFICATION OF TENDERERS

- i) Only tenderers who have previous experience in the work of the nature and description detailed in the Notice Inviting Tender and/or tender specification are expected to quote for this work duly detailing their experience along with offer.
- ii) Offers from tenderers who do not have proven and established experience in the field shall not be considered
- iii) .Offers from tenderers who are under suspension (banned) by any Unit/Region/Division of BHEL shall not be considered.
- iv) Offers from tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt of India shall not be considered.

1.6. EVALUATION OF BIDS

- i) Technical Bids submitted by the tenderer will be opened first and evaluated for fulfilling the Pre Qualification criteria and other conditions in NIT/Tender documents, based on documentary evidences submitted along with the offer
- ii) In case the same qualifying experience is claimed by more than one agency, then the agency who has executed the work as per documentary evidence submitted shall only be qualified. Scope of qualifying work should be totally with the agency who has executed and in case it is only labour+consumables without T&P, then the responsibility of execution is assigned to the first agency and not to the agency who has executed only as labour supply contractor. Further, BHEL reserves the right to ask for further proofs including submission of TDS certificates for the said job
- iii) In case the qualifying experience is claimed by private organizations based on Work Order and completion certificates from another private organization, BHEL reserves the right to ask for further proofs including submission of TDS certificates for the said job
- iv) Assessing Bidder Capacity for executing the current tender shall be as per Notice Inviting Tender
- v) Price Bids of shortlisted bidders shall only be opened either through the conventional price bid opening or through electronic Reverse Auction, at the discretion of BHEL
- vi) Price Bids of unqualified bidders shall not be opened. Reasons for rejection shall be intimated in due course after issue of LOI/LOA to successful bidder and receipt of unqualified acceptance from the successful bidder
- vii) Bidders are advised to also refer to clause no 2.9.4 regarding evaluation of their performance in ongoing projects for the current tender

1.7. DATA TO BE ENCLOSED

Full information shall be given by the tenderer in respect of the following. Non-submission of this information may lead to rejection of the offer.

- i) **INCOME TAX PERMANENT ACCOUNT NUMBER**
Certified copies of Permanent Account Numbers as allotted by Income Tax Department for the Company/Firm/Individual Partners, etc. shall be furnished along with tender.
- ii) **ORGANIZATION CHART**
The organization chart of the tenderer's organization, including the names, addresses and contact

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 6 OF 30

information of the Directors/Partners shall be furnished along with the offer.

- iii) An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor
- iv) IN CASE OF INDIVIDUAL TENDERER:
His / her full name, address and place & nature of business.
- v) 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 enclosed.
- vi) 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.

1.8 AUTHORISATION AND ATTESTATION

Tenders shall be signed by a person duly authorized/empowered to do so. An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor shall be submitted along with the tenders

1.9 EARNEST MONEY DEPOSIT

1.9.1 Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) in the manner described herein.

- i) EMD shall be furnished along with the offer in full as per the amount indicated in the Special Conditions of Contract / NIT
- ii) EMD is to be paid in cash (as permissible under Income Tax Act), Pay order or Demand Draft in favour of 'Bharat Heavy Electricals Limited' and payable at Regional HQ issuing the tender.
- iii) No other form of EMD remittance shall be acceptable to BHEL
- iv) Bidder may opt to deposit "One Time EMD" of Rs. 2.0 lakhs (Rupees Two lakhs only) with BHEL:Power Sector Region HQ issuing the tender, which will enable them to participate in all the future tender enquiries in respect of Erection and Commissioning services issued from the respective office. Interested bidders may clearly send their consent for converting the present EMD into a "One Time EMD" in their offer.
 - Note : The 'One Time EMD' cannot be withdrawn by the tenderers within 3 years from the date of deposit, under any circumstances. The Tenderer who wishes to withdraw after three years will not be allowed to submit 'One Time EMD' again.
- v) Bidders who have already deposited such "One Time EMD" of Rs. 2.00 lakh are exempted from submission of EMD for this tender. However a copy of 'One Time EMD' certificate issued by BHEL Regional HQ issuing the tender shall be enclosed along with the offer.

1.9.2 EMD by the bidder will be forfeited as per Tender Documents if

- i) After opening the tender, the bidder revokes his tender within the validity period or increases his

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 7 OF 30

earlier quoted rates.

- ii) The bidder does not commence the work within the period as per LOI/Contract. In case the LOI / contract is silent in this regard then within 15 days after award of contract.

1.9.3 EMD shall not carry any interest.

1.9.4 In the case of unsuccessful bidders, the Earnest Money will be refunded to them within a reasonable time after acceptance of award by successful tenderer.

1.10 SECURITY DEPOSIT

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

SN	Contract Value	Security Deposit Amount
1	Up to Rs. 10 lakhs	10% of Contract Value
2	Above Rs. 10 lakhs upto Rs.50 lakhs	1 lakh + 7.5% of the Contract Value exceeding Rs. 10 lakhs.
3	Above Rs. 50 lakhs	Rs 4 lakhs + 5% of the Contract Value exceeding Rs. 50 lakhs.

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

1.10.3 Security Deposit may be furnished in any one of the following forms

- i) Cash (as permissible under the Income Tax Act)
- ii) Pay Order / Demand Draft in favour of BHEL.
- iii) Local cheques of scheduled banks, subject to realization.
- iv) Securities available from Post Offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor furnishing the security and duly pledged in favour of BHEL and discharged on the back).
- v) Bank Guarantee from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats
- vi) Fixed Deposit Receipt issued by Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C BHEL, duly discharged on the back.
- vii) Security deposit can also be recovered at the rate of 10% from the running bills. However in such cases at least 50% of the Security Deposit should be deposited in any form as prescribed before start of the work and the balance 50% may be recovered from the running bills.
- viii) EMD of the successful bidder can be converted and adjusted against the cash portion of Security Deposit excepting for such bidders who have remitted One Time EMD.

NOTE: Acceptance of Security Deposit against Sl. No. (iv) and (vi) above will be subject to hypothecation or endorsement on the documents in favour of BHEL. However, BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith.

1.10.4 The Security Deposit shall not carry any interest.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 8 OF 30

1.10.5 In case the value of work exceeds / reduces from the awarded / accepted value, the Security Deposit shall be correspondingly enhanced / reduced as given below:

- i) The enhanced part of the Security Deposit shall be immediately deposited by the Contractor or adjusted against payments due to the Contractor.
- ii) There will be no reduction in Security Deposit value in case of variation in contract value upto the lower limit specified in Quantity variation clause. In case of reduction of contract value beyond the lower limit specified in Quantity Variation clause, then the Security Deposit shall be re adjusted in proportion.
- iii) In case of reduction, the reduced Contract value shall be certified by BHEL Construction Manager after ascertaining / freezing of BOQ / Drawings from the Design / Engineering Centre. The reduced Security Deposit value can only be considered after taking into account the adequacy of the securities held by BHEL to meet the liabilities of the contractor for the contract, and the performance of the contract in general. In such cases, the revised value of Security Deposit shall be worked out only after execution of not less than the lower limit of the revised scope of work/contract value as per quantity variation clause, and as certified by Construction Manager. This reduction in value of Security Deposit shall not entitle the contractor to any amendment of Contract and shall be operated at the discretion of BHEL
- iv) Contract value for the purpose of operating the reduced/increased value of Security Deposit due to Quantity Variation, shall be exclusive of Price Variation Clause, Over Run Compensation and Extra works done on manday rates.

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

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

1.11 RETURN OF SECURITY DEPOSIT

Security Deposit shall be refunded/Bank Guarantee(s) released to the Contractor along with the 'Final Bill' after deducting all expenses / other amounts due to BHEL under the contract / other contracts entered into with them by BHEL.

1.12 BANK GUARANTEES

Where ever Bank Guarantees are to be furnished/submitted by the contractor, the following shall be complied with

- i) Bank Guarantees shall be from Scheduled Banks / Public Financial Institutions as defined in the Companies Act.
- ii) The Bank Guarantees shall be as per prescribed formats.
- iii) It is the responsibility of the bidder to get the Bank Guarantees revalidated/extended for the required period (subject to a minimum period of six months), as per the advice of BHEL Site Engineer / Construction Manager. BHEL shall not be liable for issue of any reminders regarding expiry of the

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 9 OF 30

Bank Guarantees.

- iv) In case extension/further extensions of any Bank Guarantees are not required, the bidders shall ensure that the same is explicitly endorsed by the Construction Manager and submitted to the Regional HQ issuing the LOI/LOA.
- v) In case the Bank Guarantees are not extended before the expiry date, BHEL reserves the right to invoke the same by informing the concerned Bank in writing, without any advance notice/communication to the concerned bidder.
- vi) Bidders to note that any corrections to Bank Guarantees shall be done by the issuing Bank, only through an amendment in an appropriate non judicial stamp paper.
- vii) The Original Bank Guarantee shall be sent directly by the Bank to BHEL under Registered Post (Acknowledgement Due), addressed to the Subcontracting Department of the respective Region.

1.13 VALIDITY OF OFFER

The rates in the Tender shall be kept open for acceptance for a minimum period of SIX MONTHS from latest due date of offer submission (including extension, if any) . In case BHEL (Bharat Heavy Electricals Ltd) calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderers.

1.14 EXECUTION OF CONTRACT AGREEMENT

The successful tenderer's responsibility under this contract commences from the date of issue of the Letter of Intent by Bharat Heavy Electricals Limited. The Tenderer shall submit an unqualified acceptance to the Letter of Intent/Award within the period stipulated therein.

The successful tenderer shall be required to execute an agreement in the prescribed form, with BHEL, within a reasonable time after the acceptance of the Letter of Intent/Award, and in any case before releasing the first running bill. The contract agreement shall be signed by a person duly authorized/empowered by the tenderer. The expenses for preparation of agreement document shall be borne by BHEL

1.15 REJECTION OF TENDER AND OTHER CONDITIONS

1.15.1 The acceptance of tender will rest with BHEL which does not bind itself to accept the lowest tender or any tender and reserves to itself full rights for the following without assigning any reasons whatsoever:-

- a. To reject any or all of the tenders.
- b. To split up the work amongst two or more tenderers as per NIT
- c. To award the work in part if specified in NIT
- d. In case of either of the contingencies stated in (b) and (c) above, the time for completion as stipulated in the tender shall be applicable.

1.15.2 Conditional tenders, unsolicited tenders, tenders which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 10 OF 30

conditions, specifications etc., are liable to be rejected.

- 1.15.3 Tenders are liable to be rejected in case of unsatisfactory performance of the tenderer with BHEL, or tenderer under suspension (hold/banning /delisted) by any unit / region / division of BHEL or tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt of India. BHEL reserves the right to reject a bidder in case it is observed that they are overloaded and may not be in a position to execute this job as per the required schedule in line with clause no. 9.0 of the 'NIT'. The decision of BHEL will be final in this regard.
- 1.15.4 If a tenderer who is a proprietor expires after the submission of his tender or after the acceptance of his tender, BHEL may at their discretion, cancel such tender. If a partner of a firm expires after the submission of tender or after the acceptance of the tender, BHEL may then cancel such tender at their discretion, unless the firm retains its character.
- 1.15.5 BHEL will not be bound by any Power of Attorney granted by changes in the composition of the firm made subsequent to the execution of the contract. They may, however, recognise such power of Attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor concerned.
- 1.15.6 If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage or to cancel the contract if awarded and forfeit the Earnest Money/Security Deposit/any other money due.
- 1.15.7 Canvassing in any form in connection with the tenders submitted by the Tenderer shall make his offer liable to rejection.
- 1.15.8 In case the Proprietor, Partner or Director of the Company/Firm submitting the Tender, has any relative or relation employed in BHEL, the authority inviting the Tender shall be informed of the fact as per specified format, along with the Offer. Failing to do so, BHEL may, at its sole discretion, reject the tender or cancel the contract and forfeit the Earnest Money/Security Deposit.
- 1.15.9 The successful tenderer should not sub-contract part or complete work detailed in the tender specification undertaken by him without written permission of BHEL's Construction Manager/Site Incharge. The tenderer is solely responsible to BHEL for the work awarded to him.
- 1.15.10 The Tender submitted by a techno commercially qualified tenderer shall become the property of BHEL who shall be under no obligation to return the same to the bidder. However unopened price bids and late tenders shall be returned to the bidders
- 1.15.11 Unsolicited discount received after the due date and time of Bid Submission shall not be considered for evaluation. However, if the party who has submitted the unsolicited discount/rebate becomes the L-I party, then the awarded price i.e contract value shall be worked out after considering the discount so offered.
- 1.15.12 BHEL shall not be liable for any expenses incurred by the bidder in the preparation of the tender irrespective of whether the tender is accepted or not.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 11 OF 30

CHAPTER-2

2.1 **DEFINITION:** The following terms shall have the meaning hereby assigned to them except where the context otherwise requires

i)	BHEL shall mean Bharat Heavy Electricals Limited (of the respective Power Sector Region inviting the Tender), a company registered under Indian Companies Act 1956, with its Registered Office at BHEL HOUSE, SIRI FORT, NEW DELHI – 110 049, or its Power Sector Regional Offices or its Authorised Officers or its Site Engineers or other employees authorised to deal with any matters with which these persons are concerned on its behalf.
ii)	“EXECUTIVE DIRECTOR” or ‘GROUP GENERAL MANAGER’ or “GENERAL MANAGER (Incharge)” or “GENERAL MANAGER” shall mean the Officer in Administrative charge of the respective Power Sector Region.
iii)	“COMPETENT AUTHORITY” shall mean Executive Director or Group General Manager or General Manager (Incharge) or General Manager or BHEL Officers who are empowered to act on behalf of the Executive Director or General Manager (Incharge) or General Manager of BHEL.
iv)	“ENGINEER” or “ENGINEER IN CHARGE” shall mean an Officer of BHEL as may be duly appointed and authorized by BHEL to act as “Engineer” on his behalf for the purpose of the Contract, to perform the duty set forth in this General Conditions of Contract and other Contract documents. The term also includes ‘CONSTRUCTION MANAGER’ or ‘SITE INCHARGE’ as well as Officers at Site or at the Headquarters of the respective Power Sector Regions.
v)	“SITE” shall mean the places or place at which the plants/equipments are to be erected and services are to be performed as per the specification of this Tender.
vi)	“CLIENT OF BHEL” or “CUSTOMER” shall mean the project authorities with whom BHEL has entered into a contract for supply of equipments or provision of services.
vii)	“CONTRACTOR” shall mean the successful Bidder/Tenderer who is awarded the Contract and shall include the Contractor’s successors, heirs, executors, administrators and permitted assigns.
viii)	“CONTRACT” or “CONTRACT DOCUMENT” shall mean and include the Agreement of Work Order, the accepted appendices of Rates, Schedules, Quantities if any, General Conditions of Contract, Special Conditions of Contract, Instructions to the Tenderers, Drawings, Technical Specifications, the Special Specifications if any, the Tender documents, subsequent amendments mutually agreed upon and the Letter of Intent/Acceptance issued by BHEL. Any conditions or terms stipulated by the contractor in the tender documents or subsequent letters shall not form part of the contract unless, specifically accepted in writing by BHEL in the Letter of Intent/Award and incorporated in the agreement.
ix)	“GENERAL CONDITIONS OF CONTRACT” shall mean the ‘Instructions to Tenderers’ and ‘General Conditions of Contract’ pertaining to the work for which above tenders have been called for.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 12 OF 30

x)	“TENDER SPECIFICATION” or “TENDER” or “TENDER DOCUMENTS” shall mean General Conditions, Common Conditions, Special Conditions, Price Bid, Rate Schedule, Technical Specifications, Appendices, Annexures, Corrigendums, Amendments, Forms, procedures, Site information, etc and drawings/documents pertaining to the work for which the tenderers are required to submit their offers. Individual specification number will be assigned to each Tender Specification.
xi)	“LETTER OF INTENT” shall mean the intimation by a Letter/Fax/email to the tenderer that the tender has been accepted in accordance with provisions contained in the letter. The responsibility of the contractor commences from the date of issue of this letter and all terms and conditions of the contract are applicable from this date.
xii)	“COMPLETION TIME” shall mean the period by ‘date/month’ specified in the ‘Letter of Intent/Award’ or date mutually agreed upon for handing over of the intended scope of work, the erected equipment/plant which are found acceptable by the Engineer, being of required standard and conforming to the specifications of the Contract.
xiii)	“PLANT” shall mean and connote the entire assembly of the plant and equipments covered by the contract.
xiv)	“EQUIPMENT” shall mean equipment, machineries, materials, structural, electricals and other components of the plant covered by the contract.
xv)	“TESTS” shall mean and include such test or tests to be carried out on the part of the contractor as are prescribed in the contract or considered necessary by BHEL, in order to ascertain the quality, workmanship, performance and efficiency of the contractor or part thereof.
xvi)	“APPROVED”, “DIRECTED” or “INSTRUCTED” shall mean approved, directed or instructed by BHEL.
xvii)	“WORK or CONTRACT WORK” shall mean and include supply of all categories of labour, specified consumables, tools and tackles and Plants required for complete and satisfactory site transportation, handling, stacking, storing, erecting, testing and commissioning of the equipments to the entire satisfaction of BHEL.
xviii)	“SINGULAR AND PLURALS ETC” words carrying singular number shall also include plural and vice versa, where the context so requires. Words imparting the masculine Gender shall be taken to include the feminine Gender and words imparting persons shall include any Company or Associations or Body of Individuals, whether incorporated or not.
xix)	“HEADING” – The heading in these General Conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken as instructions thereof or of the contract.
xx)	“MONTH” shall mean calendar month unless otherwise specified in the Tender.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 13 OF 30

xxi)	Day' or 'Days' unless herein otherwise expressly defined shall mean calendar day or days of twenty four (24) hours each. A week shall mean continuous period of seven (7) days.
xxii)	"COMMISSIONING" shall mean the synchronisation testing and achieving functional operation of the Equipment with associated system after all initial adjustments, trials, cleaning, re-assembly required at site if any, have been completed and Equipment with associated system is ready for taking into service.
xxiii)	"WRITING" shall include any manuscript type written or hand written or printed statement or electronically transmitted messages, under the signature or seal or transmittal of BHEL.
xxiv)	"TEMPORARY WORK" shall mean all temporary works for every kind required in or for the execution, completion, maintenance of the work.
xxv)	'CONTRACT PRICE' or 'CONTRACT VALUE' shall mean the sum mentioned in the LOI/LOA/Contract Agreement subject to such additions thereto or deductions there from as may be made under provisions hereinafter contained
xxvi)	"COMMENCEMENT DATE" or "START DATE" shall mean the commencement/start of work at Site as per terms defined in the Tenderl
xxvii)	"SHORT CLOSING" or "FORE CLOSING" of Contract shall mean the premature closing of Contract, for reasons not attributable to the contractor and mutually agreed between BHEL and the contractor
xxviii)	"TERMINATION" of Contract shall mean the pre mature closing of contract due to reasons as mentioned in the contract
xxix)	"DE MOBILISATION" shall mean the temporary winding up of Site establishment by Contractor leading to suspension of works temporarily for reasons not attributable to the contractor
xxx)	"RE MOBILISATION" shall mean the resumption of work with all resources required for the work after demobilization.
2.2	LAW GOVERNING THE CONTRACT AND COURT JURISDICTION The contract shall be governed by the Law for the time being in force in the Republic of India. The Civil Court having original Civil Jurisdiction at Delhi for PSNR, at Kolkata for PSER, at Nagpur for PSWR and at Chennai for PSSR, shall alone have exclusive jurisdiction in regard to all claims in respect of the Contract. No other Civil Court shall have jurisdiction in case of any dispute, under this contract
2.3	ISSUE OF NOTICE 2.3.1 <u>Service of notice on contractor</u> Any notice to be given to the Contractor under the terms of the contract shall be served by sending the same by Registered Post / Speed Post to or leaving the same at the Contractor's last known address of the principal place of business (or in the event of the contractor being a company, to or at its Registered Office). In case of change of address, the notice shall be served at changed address as notified in writing by the Contractor to BHEL. Such posting or leaving of the notice shall be deemed to be good service of such notice and the time mentioned to the condition for doing any act after notice shall be reckoned from the date so mentioned in such notice.
2.3.2	<u>Service of notice on BHEL</u>

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 14 OF 30

Any notice to be given to BHEL in-charge/Region under the terms of the Contract shall be served by sending the same by post to or leaving the same at BHEL address or changed address as notified in writing by BHEL to the Contractor.		
2.4	USE OF LAND No land belonging to BHEL or their Customer under temporary possession of BHEL shall be occupied by the contractor without written permission of BHEL.	
2.5	COMMENCEMENT OF WORK	
2.5.1	The contractor shall commence the work as per the time indicated in the Letter of Intent from BHEL and shall proceed with the same with due expedition without delay.	
2.5.2	If the contractor fails to start the work within stipulated time as per LOI or as intimated by BHEL, then BHEL at its sole discretion will have the right to cancel the contract. The Earnest Money and/or Security Deposit with BHEL will stand forfeited without any further reference to him without prejudice to any and all of BHEL's other rights and remedies in this regard.	
2.5.3	All the work shall be carried out under the direction and to the satisfaction of BHEL.	
2.6	MEASUREMENT OF WORK AND MODE OF PAYMENT:	
2.6.1	All payments due to the contractors shall be made by e mode only, unless otherwise found operationally difficult for reasons to be recorded in writing	
2.6.2	For progress running bill payments: - The Contractor shall present detailed measurement sheets in triplicate, duly indicating all relevant details based on technical documents and connected drawings for work done during the month/period under various categories in line with terms of payment as per contract. The basis of arriving at the quantities, weights shall be relevant documents and drawings released by BHEL. These measurement sheets shall be prepared jointly with BHEL Engineers and signed by both the parties.	
2.6.3	These measurement sheets will be checked by BHEL Engineer and quantities and percentage eligible for payment under various groups shall be decided by BHEL Engineer. The abstract of quantities and percentage so arrived at based on the terms of payment shall be entered in Measurement Book and signed by both the parties.	
2.6.4	Based on the above quantities, contractor shall prepare the bills in prescribed format and work out the financial value. These will be entered in Measurement Book and signed by both the parties. Payment shall be made by BHEL after effecting the recoveries due from the contractor.	
2.6.5	All recoveries due from the contractor for the month/period shall be effected in full from the corresponding running bills unless specific approval from the competent authorities is obtained to the contrary.	
2.6.6	Measurement shall be restricted to that portion of work for which it is required to ascertain the financial liability of BHEL under this contract.	

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 15 OF 30

- 2.6.7 The measurement shall be taken jointly by persons duly authorized on the part of BHEL and by the Contractor.
- 2.6.8 The Contractor shall bear the expenditure involved if any, in making the measurements and testing of materials to be used/used in the work. The contractor shall, without extra charges, provide all the assistance with appliances and other things necessary for measurement.
- 2.6.9 If at any time due to any reason whatsoever, it becomes necessary to re-measure the work done in full or in part, the expenses towards such re measurements shall be borne by the contractor unless such re measurements are warranted solely for reasons not attributable to contractor.
- 2.6.10 Passing of bills covered by such measurements does not amount to acceptance of the completion of the work measured. Any left out work has to be completed, if pointed out at a later date by BHEL.
- 2.6.11 Final measurement bill shall be prepared in the final bill format prescribed for the purpose based on the certificate issued by BHEL Engineer that entire works as stipulated in tender specification has been completed in all respects to the entire satisfaction of BHEL. Contractor shall give unqualified "No Claim" Certificate. All the tools and tackles loaned to him should be returned in satisfactory condition to BHEL. The abstract of final quantities and financial values shall also be entered in the Measurement Books and signed by both parties to the contract. The Final Bill shall be prepared and paid within a reasonable time after completion of work.
- 2.7 **RIGHTS OF BHEL**
BHEL reserves the following rights in respect of this contract during the original contract period or its extensions if any, as per the provisions of the contract, without entitling the contractor for any compensation.
- 2.7.1 To withdraw any portion of work and/or to restrict/alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment to its customer or in case BHEL decides to advance the date of completion due to other emergent reasons/ BHEL's obligation to its customer.
- 2.7.2 To terminate the contract or get any part of the work done through other agency or deploy BHEL's own/hired/otherwise arranged resources , at the risk and cost of the contractor after due notice of a period of two weeks by BHEL, in the event of:-
- i) Contractor's continued poor progress
 - ii) Withdrawal from or abandonment of the work before completion of the work
 - iii) Contractor's inability to progress the work for completion as stipulated in the contract
 - iv) Poor quality of work
 - v) Corrupt act of Contractor
 - vi) Insolvency of the Contractor
 - vii) Persistent disregard to the instructions of BHEL
 - viii) Assignment, transfer, sub-letting of contract without BHEL's written permission
 - ix) Non fulfillment of any contractual obligations
 - x) In the opinion of BHEL, the contractor is overloaded and is not in a position to execute the job as per required schedule

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 16 OF 30

- 2.7.3 To meet the expenses including BHEL overheads on the differential cost at 5%, over and above the Liquidated damages/penalties arising out of "Risk & Cost" as explained above under Sl.No. 2.7.2. BHEL shall recover the amount from any money due from Contractor, or from any money due to the Contractor including Security Deposit, or by forfeiting any T&P or material of the contractor under this contract or any other contract of BHEL or by any other means or any combination thereof
- 2.7.4 To terminate the contract or to restrict the quantum of work and pay for the portion of work executed in case BHEL's contract with their customer are terminated for any reason, as per mutual agreement.
- 2.7.5 To effect recovery from any amounts due to the contractor under this or any other contract or in any other form, the moneys BHEL is statutorily forced to pay to anybody, due to contractor's failure to fulfill any of his obligations. BHEL shall levy overheads of 5% on all such payments along with interest as defined elsewhere in the GCC.
- 2.7.6 While every endeavour will be made by BHEL to this end, they cannot guarantee uninterrupted work due to conditions beyond their control. The Contractor will not be normally entitled for any compensation/extra payment on this account unless otherwise specified elsewhere in the contract.
- 2.7.7 In case the execution of works comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than two months, due to reasons not attributable to the contractor and other than Force Majeure conditions, BHEL may consider permitting the contractor to de mobilize forthwith and re mobilize at an agreed future date. Cost of such demobilization/remobilization shall be mutually agreed. ORC in such cases shall not be applicable for the period between the period of demobilization and re mobilisation. The duration of contract/time extension shall accordingly get modified suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.
- 2.7.8 In the unforeseen event of inordinate delay in receipt of materials, drawings, fronts, etc, due to which inordinate discontinuity of work is anticipated, BHEL at its discretion may consider contractor's request to short close the contract in following cases:
- The balance works (including but not limited to Trial Operation, PG Test, etc) are minor vis a vis the scope of work envisaged as per the contract.
 - There has been no significant work in past 6 months OR no significant work is expected in next 6 months (example in Hydro projects or in projects where work has stopped due to reasons beyond the control of BHEL)
 - The balance works cannot be done within a reasonable period of time as they are dependent on unit shutdown or on other facilities of customer or any other reasons not attributable to the contractor

At the point of requesting for short closure, contractor shall establish that he has completed all works possible of completion and he is not able to proceed with the balance works due to constraints beyond his control. In such a case, the estimated value of the unexecuted portion of work (or estimated value of services to be provided for carrying out milestone/stage payments like

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 17 OF 30

	Trial Operation/PG Test, etc) as mutually agreed, shall however be reduced from the final contract value. 2.7.9 LIQUIDATED DAMAGES/PENALTY If the contractor fails to maintain the required progress of work which results in delay in the completion of the work as per the contractual completion period, BHEL shall have the right to impose Liquidated Damage/Penalty at the rate of 0. 5% of the contract value, per week of delay or part thereof subject to a maximum of 10% of the contract value. For this purpose, the period of delay shall be the delay attributable to the Contractor for the completion of work as per contract. Contract Value for this purpose, shall be the final executed value exclusive of ORC, Extra Works executed on Manday rate basis, Supplementary/Additional Items and PVC.
2.8	RESPONSIBILITIES OF THE CONTRACTOR IN RESPECT OF LOCAL LAWS, EMPLOYMENT OF WORKERS ETC. The following are the responsibilities of the contractor in respect of observance of local laws, employment of personnel, payment of taxes etc. The subcontractor shall fully indemnify BHEL against any claims of whatsoever nature arising due to the failure of the contractor in discharging any of his responsibilities hereunder: 2.8.1 As far as possible, Unskilled Workers shall be engaged from the local areas in which the work is being executed. 2.8.2 The contractor at all times during the continuance of this contract shall, in all his dealings with local labour for the time being employed on or in connection with the work, have due regard to all local festivals and religious and other customs. 2.8.3 The contractor shall comply with all applicable State and Central Laws, Statutory Rules, Regulations etc. such as Payment of Wages Act, Minimum Wages Act, Workmen Compensation Act, Employer's Liability Act, Industrial Disputes Act, Employers Provident Act, Employees State Insurance Scheme, Contract Labour (Regulation and Abolition) Act 1970, Payment of Bonus & Gratuity Act and other Acts, Rules and Regulations for labour as may be enacted by the Government during the tenure of the Contract and having force or jurisdiction at Site. The Contractor shall also give to the local Governing Body, Police and other relevant Authorities all such notices as may be required by the Law. 2.8.4 The contractor shall obtain independent License under the Contract Labour (Regulations and Abolition Act, 1970)as required from the concerned Authorities based on the certificate (Form-V) issued by the Principal Employer/Customer 2.8.5 The contractor shall pay all taxes, fees, license charges, deposits, duties, tolls, royalties, commission or other charges which may be leviable on account of his operations in executing the contract. 2.8.6 While BHEL would pay the inspection fees and Registration fees of Boiler/Electrical Inspectorate,

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 18 OF 30

	all other arrangements for site visits periodically by the Inspectorate to site, Inspection certificate etc. will have to be made by contractor. However, BHEL will not make any payment to the Inspectorate in connection with contractor's Welders/Electricians qualification tests etc.
2.8.7	Contractor shall be responsible for provision of Health and Sanitary arrangements (more particularly described in Contract Labour Regulation & Abolition Act), Safety precautions etc. as may be required for safe and satisfactory execution of contract.
2.8.8	The contractor shall be responsible for proper accommodation including adequate medical facilities for personnel employed by him.
2.8.9	The contractor shall be responsible for the proper behavior and observance of all regulations by the staff employed by him.
2.8.10	The contractor shall ensure that no damage is caused to any person/property of other parties working at site. If any such damage is caused, it is responsibility of the contractor to make good the losses or compensate for the same.
2.8.11	All the properties/equipments/components of BHEL/their Client loaned with or without deposit to the contractor in connection with the contract shall remain properties of BHEL/their Client.
2.8.12	The contractor shall use such properties for the purpose of execution of this contract. All such properties/equipments/components shall be deemed to be in good condition when received by the contractor unless he notifies within 48 hours to the contrary. The contractor shall return them in good condition as and when required by BHEL/their Client. In case of non-return, loss, damage, repairs etc, the cost thereof as may be fixed by BHEL Engineer will be recovered from the contractor
2.8.13	In case the contractor is required to undertake any work outside the scope of this contract, the rates payable shall be those mutually agreed upon if the item rates are not mentioned in existing contract
2.8.14	Any delay in completion of works/or non achievement of periodical targets due to the reasons attributable to the contractor, the same may have to be compensated by the contractor either by increasing manpower and resources or by working extra hours and/or by working more than one shift. All these are to be carried out by the contractor at no extra cost.
2.8.15	The contractor shall arrange, coordinate his work in such a manner as to cause no hindrance to other agencies working in the same premises.
2.8.16	All safety rules and codes applied by the Client/BHEL at site shall be observed by the contractor without exception. The contractor shall be responsible for the safety of the equipment/material and works to be performed by him and shall maintain all light, fencing guards, slings etc. or other protection necessary for the purpose. Contractor shall also take such additional precautions as may be indicated from time to time by the Engineer with a view to prevent pilferage, accidents, fire hazards. Due precautions shall be taken against fire hazards and atmospheric conditions. Suitable number of Clerical staff, watch and ward, store keepers to take care of equipment/materials and construction tools and tackles shall be posted at site by the contractor till the completion of work

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 19 OF 30

under this contract.

The contractor shall arrange for such safety devices as are necessary for such type of work and carry out the requisite site tests of handling equipment, lifting tools, tackles etc. as per prescribed standards and practices.

Contractor has to ensure the implementation of Health, Safety and Environment (HSE) requirements as per directions given by BHEL/Customer. The contractor has to assist in HSE audit by BHEL/Customer and submit compliance Report. The contractor has to generate and submit record/reports as per HSE plan/activities as per instruction of BHEL/Customer

- 2.8.17 The contractor will be directly responsible for payment of wages to his workmen. A pay roll sheet giving all the payments given to the workers and duly signed by the contractor's representative should be furnished to BHEL site for record purpose, if so called for.
- 2.8.18 In case of any class of work for which there is no such specification as laid down in the contract, such work shall be carried out in accordance with the instructions and requirements of the Engineer.
- 2.8.19 Also, no idle charges will be admissible in the event of any stoppage caused in the work resulting in contractor's labour and Tools & Plants being rendered idle due to any reason at any time.
- 2.8.20 The contractor shall take all reasonable care to protect the materials and work till such time the plant/equipment has been taken over by BHEL or their Client whichever is earlier.
- 2.8.21 The contractor shall not stop the work or abandon the site for whatsoever reason of dispute, excepting force majeure conditions. All such problems/disputes shall be separately discussed and settled without affecting the progress of work. Such stoppage or abandonment shall be treated as breach of contract and dealt with accordingly
- 2.8.22 The contractor shall keep the area of work clean and shall remove the debris etc. while executing day-to-day work. Upon completion of work, the contractor shall remove from the vicinity of work, all scrap, packing materials, rubbish, unused and other materials and deposit them in places specified by the Engineer. The contractor will also demolish all the hutments, sheds, offices, etc. constructed and used by him and shall clean the debris. In the event of his failure to do so, the same will be arranged to be done by the Engineer and the expenses recovered from the contractor.
- 2.8.23 The contractor shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and timely execution shall be the essence of this contract. The contractor shall be responsible to ensure that the quality, assembly and workmanship conform to the dimensions and clearance given in the drawings and/ or as per the instructions of the Engineer.
- 2.8.24 The Contractor to note that some of BHEL's T&Ps/MMDs may not be insured. The Contractor will take necessary precautions and due care to protect the same while in his custody from any damage/ loss till the same is handed over back to BHEL. In case the damage / loss is due to carelessness/ negligence on the part of the contractor, the Contractor is liable to get them repair/

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 20 OF 30

replaced immediately and in case of his failure to do so within a reasonable time, BHEL will reserve the right to recover the loss from the contractor.	
2.9	PROGRESS MONITORING, MONTHLY REVIEW AND PERFORMANCE EVALUATION
2.9.1	A detailed plan/programme for completion of the contractual scope of work as per the time schedule given in the contract shall be jointly agreed between BHEL and Contractor, before commencement of work . The above programme shall be supported by monthwise deployment of resources viz Manpower, T&P, Consumables, etc. Progress will be reviewed periodically (Daily/Weekly/Monthly) vis a vis this jointly agreed programme. The Contractor shall submit periodical progress reports (Daily/Weekly/Monthly) and other reports/information including manpower, consumables, T&P mobilization etc as desired by BHEL.
2.9.2	Monthly progress review between BHEL and Contractor shall be based on the agreed programme as above, availability of inputs/fronts etc, and constraints if any, as per prescribed formats. Manpower, T&P and consumable reports as per prescribed formats shall be submitted by contractor every month. Release of RA Bills shall be contingent upon certification by BHEL Site Engineer of the availability of the above prescribed formats duly filled in and signed.
2.9.3	The burden of proof that the causes leading to any shortfall is not due to any reasons attributable to the contractor is on the contractor himself. The monthly progress review shall record shortfalls attributable to (i) Contractor, (ii) Force Majeure Conditions, and (iii) BHEL
2.9.4	Performance of the Contractor shall be assessed as per prescribed formats and shall form the basis for 'Annual/Overall Performance Evaluation' of the Contractor and also for 'Assessment of Capacity of Bidder' for Tenders where the Contractor is a bidder. BHEL reserves the right to revise the evaluation formats during the course of execution of the works
2.10	TIME OF COMPLETION
2.10.1	The time schedule shall be as prescribed in the Contract. The time for completion shall be reckoned from the date of commencement of work at Site as certified by BHEL Engineers
2.10.2	The entire work shall be completed by the contractor within the time schedule or within such extended periods of time as may be allowed by BHEL under clause 2.11
2.11	EXTENSION OF TIME FOR COMPLETION
2.11.1	If the completion of work as detailed in the scope of work gets delayed beyond the contract period, the contractor shall request for an extension of the contract and BHEL at its discretion may extend the Contract.
2.11.2	Based on the monthly reviews jointly signed, the works balance at the end of original contract period less the backlog attributable to the contractor shall be quantified, and the number of months of 'Time extension' required for completion of the same shall be jointly worked out. Within this period of 'Time extension', the contractor is bound to complete the portion of backlog attributable to the contractor. Any further 'Time extension' or 'Time extensions' at the end of the previous extension shall be worked out similarly.
2.11.3	However if any 'Time extension' is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/LD for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take at the risk and cost of contractor.
2.11.4	A joint programme shall be drawn for the balance amount of work to be completed during the period of 'Time Extension', along with matching resources (with weightages) to be deployed by the contractor as per specified format. Review of the programme and record of shortfall shall be done

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 21 OF 30

every month of the 'Time extension' period in the same manner as is done for the regular contract period.	
2.11.5	During the period of 'Time extension', contractor shall maintain their resources as per mutually agreed program
2.11.6	At the end of total work completion as certified by BHEL Engineer, and upon analysis of the total delay, the portion of time extensions attributable to (i) Contractor, (ii) Force majeure conditions, and (iii) BHEL, shall be worked out and shall be considered to be exhausted in the same order. The total period of time extensions shall be the sum of (i), (ii) and (iii) above and shall be equal to period between the scheduled date of completion and the actual date of completion of contract. LD shall be imposed/levied for the portion of time extensions attributable to contractor and recoverable from the dues payable to the contractor.
2.12	OVERRUN COMPENSATION
2.12.1	Over Run Compensation (ORC) is payable for works done during the extension period, by way of rate revisions for periods beyond original contract period subject to the following terms and conditions.
2.12.2	Rates shall be increased by 10% for the first twelve months of one or more extensions beyond original contract period. For the next twelve months of further extensions if any, rates shall be increased as above by 10% over the previous twelve months, and similarly for each subsequent twelve months extension.
2.12.3	The amount of increase payable per month due to rate revisions is subject to a minimum of Rs 1,00,000/- per month and a maximum of Rs 10,00,000/- per month.
2.12.4	Should there be any 'Time extension' for reasons attributable only to the contractor, then the work shall be executed by the contractor at the rates applicable for the period the work was planned
2.12.5	Payment of ORC shall be regulated as follows: i) Contractor is entitled to Over Run Compensation (ORC) only for the portion of backlog attributable to BHEL. ii) 50% of the compensation as per clause 2.12.3 is allocated for deployment of resources agreed as per the joint programme drawn vide 2.11.4. Payment shall however be based on the actual deployment of resources for the month as certified by BHEL, as per weightages assigned therein iii) 50% of the compensation as per clause 2.12.3, is allocated for achieving of planned progress agreed as per the joint programme drawn vide 2.11.4. Payment shall be on pro rata basis for actual achieved quantities iv) Total Over Run Compensation shall be limited to 10% of the executed contract value as certified in Final Bill. For this purpose executed contract value excludes PVC, ORC, Supplementary/Additional Items and Extra Works done on Manday rate basis
2.12.6	Contractor shall not be entitled for any Over Run Compensation (ORC) for the portion of backlog attributable to the contractor. Such works shall be executed at the rates applicable for the period the work was planned
2.13	INTEREST BEARING RECOVERABLE ADVANCES
2.13.1	Normally no advance is payable to the contractor. However, advance payment in exceptional circumstances shall be interest bearing and secured through a Bank Guarantee and shall be limited to a maximum of 5% of contract value. This 'Interest Bearing Recoverable Advance' shall be

Bharat Heavy Electricals Limited		
Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 22 OF 30

payable in not less than two installments with any of the installment not exceeding 60% of the total eligible advance.	
2.13.2	In exceptional circumstances, with due justification, Competent Authority of BHEL is empowered to approve proposals for payment of additional interim interest bearing advance against Bank Guarantee, for resource augmentation towards expediting work for project implementation.
2.13.3	Bank Guarantee towards 'Interest Bearing Recoverable Advance' shall be atleast 110% of the advance so as to enable recovery of not only principle amount but also the interest portion, if so required.
2.13.4	Contractor shall establish the utilization of advance drawn before the release of next installment.
2.13.5	Payment and recovery of Interest Bearing Recoverable advance shall be at the sole discretion of BHEL and shall not be a subject matter of arbitration.
2.13.6	The rate of interest applicable for the above advances shall be the prime lending rate of State Bank of India prevailing at the time of disbursement of the advance + 2%, and such rate will remain fixed till the total advance amount is recovered
2.13.7	Unadjusted amount of advances paid shall not exceed 5% of the total contract value at any point of time. Recovery of advances shall be made progressively from each Running Bill such that the advance amounts paid along with the interest is fully recovered by the time the contractor's billing reaches 80% of contract value.
2.13.8	Recovery rate per month shall be the sum of: a. Not less than 10% of Running Bill amount b. Simple interest up to the date of RA Bill on the outstanding Principle amount/amounts
2.13.9	Contractor to submit Bank Guarantee as per prescribed formats for each of the advance and shall be valid for at least one year or the recovery duration or the balance contract period which ever is later. In case the recovery of dues does not get completed within the aforesaid BG period, the contractor shall renew the BG or submit fresh BG for the outstanding amount and the remaining recovery period.
2.13.10	BHEL is entitled to make recovery of the entire outstanding amount in case the contractor fails to comply with the BG requirement
2.14	QUANTITY VARIATION
2.14.1	The quoted rates shall remain firm irrespective of any variations in the individual quantities. No compensation becomes payable in case the variation of the final executed contract value is within the limits of Plus (+) or Minus (-) 15% of awarded contract value
2.14.2	Compensation due to variation of final executed value in excess of the limits defined in clause above, shall be as follows: i) In case the finally executed contract value reduces below the lower limit of Contract Value due to quantity variation specified above, the contractor will be eligible for compensation @ 15% of the difference between the lower limit of the contract value and the actual executed value. ii) In case the finally executed contract value increases above the upper limit of Contract Value

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 23 OF 30

due to quantity variation specified above, there will be no revision in the rates within the contract period.

2.15 EXTRA WORKS

- 2.15.1 All rectifications/modifications, revamping, and reworks required for any reasons not due to the fault of the contractor, or needed due to any change in deviation from drawings and design of equipments, operation/maintenance requirements, mismatching, or due to damages in transit, storage and erection/commissioning, and other allied works which are not very specifically indicated in the drawings, but are found essential for satisfactory completion of the work, will be considered as extra works.
- 2.15.2 Extra works arising on account of the contractor's fault, irrespective of time consumed in rectification of the damage/loss, will have to be carried out by the contractor free of cost. Under such circumstances, any material and consumable required for this purpose will also have to be arranged by the contractor at his cost.
- 2.15.3 All the extra work should be carried out by a separately identifiable gang, without affecting routine activities. Daily log sheets in the pro-forma prescribed by BHEL should be maintained and shall be signed by the contractor's representative and BHEL engineer. No claim for extra work will be considered/entertained in the absence of the said supporting documents i.e. daily log sheets. Signing of log sheets by BHEL engineer does not necessarily mean the acceptance of such works as extra works.
- 2.15.4 BHEL retains the right to award or not to award any of the major repair/rework/modification/rectification/fabrication works to the contractor, at their discretion without assigning any reason for the same
- 2.15.5 After eligibility of extra works is established and finally accepted by BHEL engineer/designer, payment will be released on competent authority's approval at the following rate.
- MAN-HOUR RATE FOR ELIGIBLE EXTRA WORKS:** Single composite average labour man-hour rate, including overtime if any, supervision, use of tools and tackles and other site expenses and incidentals, consumables for carrying out any major rework/ repairs/ rectification/ modification/ fabrication as certified by site as may arise during the course of erection, testing, commissioning or extra works arising out of transit, storage and erection damages, payment, if found due will be at Rs 60/- per man hour.
- 2.15.6 The above composite labour man hour rate towards extra works shall remain firm and not subject to any variation during execution of the work. PVC will not be applicable for extra works. Rate revision, Over Run Charges/compensation etc will not be applicable due to extra works.
- 2.15.7 **Extra Works for Civil Packages** shall be regulated as follows
- i) Rates for Extra Works arising due to (1) non availability of BOQ (Rate Schedule), OR (2) change in Specifications of materials/works (3) rectification/modification/dismantling & re erecting etc due to no fault of Contractor, shall be in the order of the following:

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 24 OF 30

a) Item rates are to be derived from similar nature of items in the BOQ (Rate Schedule) with applicable escalation derived from All India Consumer Price Index for Whole Sale Commodities. b) As per CPWD-DSR-2007 (or latest edition) with applicable escalation derived from All India Consumer price Index for Whole Sale Commodities, OR, Notification issued by the office of CPWD for 'Cost Index' in that Region where the project is being executed, whichever is less c) Item rates are to be worked out on the basis of prevailing market rates mutually agreed between BHEL and Contractor, plus 15% towards Contractor's overheads and profit. ii) PVC and ORC will not applicable be for (i) above.

2.16 SUPPLEMENTARY ITEMS 2.16.1 For NON Civil Works Supplementary items are items/works required for completion of entire work but not specified in the scope of work. Subject to certification of such items/works as supplementary items by BHEL Engineer, rates shall be derived on the basis of any one of the following on mutual agreement: i) Based on percentage breakup/rates indicated for similar/nearby items ii) In case (i) above does not exist, then BHEL/site may derive the percentage breakup/rates to suit the type of work 2.16.2 For Civil Works i) <u>Rates for Supplementary Works/Additional Works arising out due to additions/alterations in the original scope of works as per contract subject to certification of BHEL Engineer shall be worked out as under:</u> a) Item rates which are available in existing BOQ (Rate Schedule) shall be operated with applicable escalation derived from All India Consumer Price Index for Whole Sale Commodities b) Items of works which are not available in existing BOQ shall be operated as an 'Extra Works' and rate shall be derived as per clause no 2.15.7 ii) Execution of Supplementary Works/Additional Works through the Contractor shall be at the sole discretion of BHEL, and shall be considered as part of executed contract value for the purpose of Quantity Variation as per clause 2.14 iii) BHEL Engineer's decision regarding fixing the rate as above is final and binding on the contractor. iv) PVC and ORC will not be applicable for (i) above.

2.17 **PRICE VARIATION COMPENSATION**

2.17.1 In order to take care of variation in cost of execution of work on either side, due to variation in the index of LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS, Price Variation Formula as described herein shall be applicable

2.17.2 85% component of Contract Value shall be permitted to be adjusted for variation in various relevant indices during execution of work. The remaining 15% shall be treated as fixed component

2.17.3 The basis for calculation of price variation in each category, their component, Base Index, shall be as under:

SL NO.	CATEGORY	BASE INDEX	COMPONENT ('K')		
			CIVIL PACKAGES (See Note A/B/C)	MECHANICAL PACKAGES	LABOUR ORIENTED

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 25 OF 30

			A	B**	C		PACKAGES (See Note D)
i)	LABOUR (ALL CATEGORIES)	'MONTHLY ALL-INDIA AVERAGE CONSUMER PRICE INDEX NUMBERS FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)	40	25	30	65	80
ii)	HIGH SPEED DIESEL OIL	Name of Commodity : HSD OIL. Type : INDIVIDUAL COMMODITY (See Note F)	5	3	5	5	5
iii)	WELDING ROD	Name of Commodity : WELDING ROD Type: INDIVIDUAL COMMODITY (See Note F)				15	
iv)	CEMENT	Name of Commodity : GREY CEMENT Type: INDIVIDUAL COMMODITY (See Note F)		20	30		
v)	STEEL (Structural and Reinforcement Steel)	Name of Commodity : a1. IRON & SEMIS Type: GROUP ITEM (See Note F)		25			
vi)	MATERIALS (Other than Cement & Steel)	Name of Commodity: ALL COMMODITIES Type: GROUP ITEM (See Note F)	40	12	20		

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

B) Cement & Steel : In Contractor Scope {**: unless otherwise specified in Special Conditions of Contract (SCC) }

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

D) Predominantly 'Labour Oriented' packages including Material Handling & Management, Insulation, Painting, Electrical and CI or a combination thereof, which are separately tendered and awarded

E) For Composite packages (i.e. Civil+Mechanical+Electrical/CI or Civil+Mechanical or Mechanical+Electrical/CI), the components for various categories shall be as per respective packages

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

2.17.4 Payment/recovery due to variation in index shall be determined on the basis of the following notional formula without any initial absorption, in respect of the identified components viz LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS

$$P = K \times R \times \frac{(X_N - X_0)}{X_0}$$

Where

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

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

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

XN = Revised Index No for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials for the billing month under consideration

Xo = Index no for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials as on the Base date.

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 26 OF 30

2.17.5 Base date shall be calendar month of the latest date of submission of Tender.

2.17.6 PVC shall not be payable for the ORC amount, Supplementary/Additional Items, Extra works.

2.17.7 The contractor shall furnish necessary monthly bulletins for the necessary indices from the relevant websites along with his Bills.

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

2.17.9 PVC shall be applicable for the entire original contract period plus the extended period. However the Total Quantum of Price Variation amount payable/recoverable shall be regulated as follows:

- i) For the portion of backlog attributable to the contractor, the PVC will be based on the average of the indices for the period of the original contract period.
- ii) For the period of Force Majeure, the PVC will be limited to the indices applicable at the beginning of the force majeure period.
- iii) For the portion of backlog attributable to BHEL, the PVC will be as per the indices applicable for the respective months
- iv) The total amount of PVC shall not exceed 20% of the cumulatively executed contract value. Executed contract value for this purpose is exclusive of PVC, ORC, Supplementary/Additional Items and Extra works.

2.18 INSURANCE

2.18.1 BHEL/their customer shall arrange for insuring the materials/properties of BHEL/customer covering the risks during transit, storage, erection and commissioning.

2.18.2 It is the sole responsibility of the contractor to insure his materials, equipments, workmen, etc. against accidents and injury while at work and to pay compensation, if any, to workmen as per Workmen's compensation Act. The work will be carried out in a protected area and all the rules and regulations of the client /BHEL in the area of project which are in force from time to time will have to be followed by the contractor.

2.18.3 If due to negligence and or non-observation of safety and other precautions by the contractors, any accident/injury occurs to the property / manpower belong to third party, the contractor shall have to pay necessary compensation and other expense, if so decided by the appropriate authorities.

2.18.4 The contractor will take necessary precautions and due care to protect the material, while in his custody from any damage/ loss due to theft or otherwise till the same is taken over by BHEL or customer. For lodging / processing of insurance claim the contractor will submit necessary documents. BHEL will recover the loss including the deductible franchise from the contractor, in case the damage / loss is due to carelessness / negligence on the part of the contractor. In case of any theft of material under contractor's custody, matter shall be reported to police by the contractor immediately and copy of FIR and subsequently police investigation report shall be submitted to BHEL for taking up with insurance. However this will not relieve the contractor of his

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 27 OF 30

contractual obligation for the material in his custody.	
2.19	STRIKES & LOCKOUT 2.19.1 The contractor will be fully responsible for all disputes and other issues connected with his labour. In the event of the contractor's labour resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of one month, BHEL shall have the right to get the work executed through any other agencies and the cost so incurred by BHEL shall be deducted from the Contractor's bills. 2.19.2 For all purposes whatsoever, the employees of the contractor shall not be deemed to be in the employment of BHEL
2.20	FORCE MAJEURE The following shall amount to Force Majeure:- 2.20.1 Acts of God, act of any Government, War, Sabotage, Riots, Civil commotion, Police action, Revolution, Flood, Fire, Cyclones, Earth quake and Epidemic and other similar causes over which the contractor has no control. 2.20.2 If the contractor suffers delay in the due execution of the contractual obligation due to delays caused by force majeure as defined above, the agreed time of completion of the job covered by this contract or the obligations of the contractor shall be extended by a period of time equal to period of delay, provided that on the occurrence of any such contingency, the contractor immediately reports to BHEL in writing the causes of delay and the contractor shall not be eligible for any compensation.
2.21	ARBITRATION & RECONCILIATION 2.21.1 In case amicable settlement is not reached in the event of any dispute or difference arising out of the execution of the Contract or the respective rights and liabilities of the parties or in relation to interpretation of any provision by the Contractor in any manner touching upon the Contract, such dispute or difference shall (except as to any matters, the decision of which is specifically provided for therein) be referred to the sole arbitration of the arbitrator appointed by BHEL/In charge(Region). The award of the Arbitrator shall be binding upon the parties to the dispute Subject as aforesaid, the provisions of Arbitration and Reconciliation Act 1996 (India) or statutory modifications or re enactments thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. The venue of the arbitration shall be the place from which the contract is issued or such other place as the Arbitrator at his discretion may determine 2.21.2 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable :

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 28 OF 30

In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred to by either party to the arbitration of one of the arbitrators in the department of public enterprises. The award of the arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the parties hereto finally and conclusively.

2.21.3 The cost of arbitration shall be borne equally by the parties.

2.21.4 Work under the contract shall be continued during the arbitration proceedings

2.22 RETENTION AMOUNT

2.22.1 Retention Amount shall be 5% of executed contract value and shall be recovered at the rate of 5% from each Running Bill admitted, including PVC Bills.

2.22.2 Refund of Retention Amount shall be as follows:

- i) 50% of retention amount along with 'Final Bill'
- ii) Balance 50% of retention amount shall be retained towards 'Performance Guarantee for Workmanship' and shall become refundable after expiry of Guarantee period, provided all the defects noticed during the guarantee period have been rectified to the satisfaction of BHEL Site Engineer/BHEL Construction Manager, and after deducting all expenses/other amounts due to BHEL under the contract/other contracts entered into by BHEL with them. This portion of the retention amount can be released on commencement of the Guarantee period, on submission of equivalent Bank Guarantee.

2.23 PAYMENTS

Payments to Contractors are made in any one of the following forms

2.23.1 Running Account Bills (RA Bills)

- i) These are for interim payments when the contracts are in progress. The bills for such interim payments are to be prepared by Contractor in prescribed formats (RA Bill forms).
- ii) Payments shall be made according to the extent of work done as per measurements taken up to the end of the calendar month and in line with the terms of payments described in the Tender documents
- iii) Recoveries on account of electricity, water, statutory deductions, etc are made as per terms of contract
- iv) Full rates for the work done shall be allowed only if the quantum of work has been done as per the specifications stipulated in the contract. If the work is not executed as per the stipulated specifications, BHEL may ask the contractor to re do the work according to the required specifications, without any extra cost. However, where this is not considered necessary 'OR' where the part work is done due to factors like non-availability of material to be supplied by BHEL 'OR' non availability of fronts 'OR' non availability of drawings, fraction payment against full rate, as is considered reasonable, may be allowed with due regard for the work remaining to be done. BHEL decision in this regard will be final and

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 29 OF 30

binding on the contractor. v) In order 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	
2.23.2	Final Bill Final Bill' is used for final payment on closing of Running Account for works or for single payment after completion of works. 'Final Bill' shall be submitted as per prescribed format after completion of works as per scope and upon material reconciliation, along with the following. i) 'No Claim Certificate' by contractor ii) Clearance certificates where ever applicable viz Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department, etc iii) Indemnity bond as per prescribed format BHEL shall settle the final bills after deducting all liabilities of Contractor to BHEL
2.24	PERFORMANCE GUARANTEE FOR WORKMANSHIP
2.24.1	Even though the work will be carried out under the supervision of BHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of twelve months from the date of commencement of guarantee period as defined in Special Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works at the Contractor's risk and cost, without prejudice to any other rights and recover the same from the Guarantee money.
2.24.2	BHEL shall release the guarantee money subject to the following i) Contractor has submitted 'Final Bill' ii) Guarantee period as per contract has expired iii) Contractor has furnished 'No Claim Certificate' in specified format iv) BHEL Site Engineer/Construction Manager has furnished the 'No Demand Certificate' in specified format v) Contractor has carried out the works required to be carried out by him during the period of Guarantee and all expenses incurred by BHEL on carrying out such works is included for adjustment from the Guarantee money refundable.
2.25	CLOSING OF CONTRACTS The Contract shall be considered completed and closed upon completion of all contractual obligations and settlement of Final Bill or completion of Guarantee period whichever is later. Upon closing of Contract, BHEL shall issue a completion certificate as per standard format, based on specific request of Contractor.
2.26	REVERSE AUCTION: BHEL reserves the right to go for Reverse Auction for Price Bid Opening by BHEL appointed service provider, instead of opening the submitted sealed price bid in the conventional way. The Business Rules for Reverse Auction shall be as per BHEL guidelines issued from time to time.
2.27	SUSPENSION OF BUSINESS DEALINGS BHEL reserves the right to take action against Contractors who either fail to perform or Tenderers/Contractor who indulge in malpractices, by suspending business dealings with them in

Bharat Heavy Electricals Limited Power Sector - Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-IB	GENERAL CONDITIONS OF CONTRACT (SERVICE)	PAGE 30 OF 30

line with BHEL guidelines issued from time to time.	
2.28	OTHER ISSUES
2.28.1	Value of Non judicial Stamp Paper for Bank Guarantees and for Contract Agreement shall be not less than Rs 100/- unless otherwise required under relevant statutes.
2.28.2	In case of any conflict between the General Conditions of Contract and Special Conditions of Contract, provisions contained in the Special Conditions of Contract shall prevail.
2.28.3	Unless otherwise specified in NIT, offers from consortium/JVs shall not be considered.
2.28.4	BHEL may not insist for signing of Contract Agreements in respect of low value and short time period contracts like providing services for Hot water flushing, Chemical Cleaning, Transportation, etc

TENDER NO: PSER:SCT:BAR-C1962:19

VOLUME -ID

SPECIAL CONDITIONS OF CONTRACT

FOR

**APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE
CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL
POWER PROJECT, STAGE-I,**

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVT. OF INDIA UNDERTAKING)

POWER SECTOR – EASTERN REGION

PLOT NO. – 9 / 1, DJ – BLOCK,

SECTOR – II, KARUNAMOYEE,

SALT LAKE CITY,

KOLKATA – 700091.

Bharat Heavy Electricals Limited Power Sector – Eastern Region, Kolkata		
TENDER NO. PSER:SCT:BAR-C1962:19		
VOLUME-ID	SPECIAL CONDITIONS OF CONTRACT (SERVICE)	PAGE1OF47

CONTENTS

SN	DESCRIPTION	Chapter	No. OF PAGES
1	General Intent of the Specifications	Chapter-I	
2	General Services to be rendered by the Bidder	Chapter-II	
3	General Technical Requirements (Codes and Standards)	Chapter-III	
4	Obligations of Contractor (In respect of Tools, Tackles, Consumables, etc employment of supervisory staff and workmen)	Chapter-IV	
5	Responsibilities of Contractor (In respect of employment of Labour, Supervisory staff, etc)	Chapter-V	
6	Material Handling, Storage, Preservation, etc	Chapter-VI	
7	Drawings and Documents	Chapter-VII	
8	Inspection and Quality	Chapter-VIII	
9	HSE & OHSAS Obligations	Chapter-IX	
10	RA Bill Payment	Chapter-X	
11	Performance Monitoring	Chapter-XI	
12	Suspension of Business Dealings	Chapter-XII	

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - I : General Intent of Specifications

1.0	INTENT OF THE SPECIFICATION
1.1	The intent of this erection specification is to provide services for execution of the 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 / price shall deem to be inclusive of all such contingencies.
1.2	The work shall conform to dimensions and tolerances given in various drawings and documents that will be provided during erection. If any portion of works is found to be defective in workmanship and not conforming to drawings / documents or other stipulations, the contractor shall dismantle and re-do the work duly replacing the defective materials at their own cost, failing which recoveries, as determined by BHEL, shall be effected from contractor's bills.
1.3	It is not the intent of this specification to specify herein all the details of erection and commissioning. However, the system shall conform in all respects to high standards of quality and workmanship for performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgments is not in full accordance herewith.
1.4	The omission of specific reference to any fabrication / erection or other method, equipment or material necessary for proper and efficient working of the plant shall not relieve the tenderer of the responsibility of providing such facilities to complete the work at quoted rates. Any mismatch/ defect found due to mistake in fabrication / erection shall have to be rectified by the vendor free of cost. Inspection by BHEL/Customer does not relieve vendor of his responsibility of executing quality erection.
1.5	The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful and timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, modern / latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.

Bharat Heavy Electricals Limited Power Sector – Eastern Region, Kolkata		
VOLUME-ID	TENDER NO. PSER:SCT:BAR-C1962:19	PAGE2OF47

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - I : General Intent of Specifications

1.6	Contractor shall erect and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the contractor. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods / sequence adopted in erection of similar sets elsewhere.
1.7	Following shall be the minimum responsibility of contractor and have to be provided within finally accepted rates / prices:
1.7.1	Provision as required of all types of labour, supervisors, engineers, watch and ward, tools & tackles, calibrated MMEs (Monitoring and Measuring Equipment) as specified and otherwise required for the work, consumables for erection, testing and commissioning including material handling
1.7.2	Achieving Proper out-turn / Turn-over as per BHEL plan and commitment.
1.7.3	Completion of work as per BHEL Schedule
1.7.4	Good quality and accurate workmanship for proper performance of the equipment
1.7.5	Repair and rectification
1.7.6	Preservation / Re-conservation of all components during storage / erection / commissioning till handing over.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - II : General Services to be rendered by the Bidder

2.0	GENERAL SERVICES TO BE RENDERED BY THE BIDDER
2.1	Services for construction, fabrication, equipment erection testing as well as trial run & commissioning of various equipment and accessories under the contract shall include but not be limited to the following:
2.2	Issuing materials from store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant/equipment is officially taken over by the owner / BHEL after complete erection any successful trial run & commissioning.
2.3	Transport of material to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.
2.4	Trial run and commissioning of individual equipment / sub-systems to the satisfaction of Owner/BHEL.
2.5	Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to be rendered under this specification.
2.6	Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under scope of this specification except otherwise specified.
2.7	Supply of all consumables, eg welding electrodes, cleaning agents, diesel oil, lubricant etc as well as materials required for temporary supports, scaffolding etc as necessary for such erection work, unless specified other wise.
2.8	Providing support services for the contractor's erection staff eg construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, watch and ward for security and safety of the materials under the Contractor's custody etc. as required.
2.9	Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with BHEL, Submission of monthly progress reports and any such document as and when desired by BHEL/owner, taking approval of all statutory authorities i.e Boiler Inspector, Factory Inspector, Inspector of Explosives etc , as applicable for respective portions of work fall under the jurisdiction of such statutes of laws.
2.10	Any other service, although not specifically called for but required for a contract of the size and nature indicated in the specification.

SPECIAL CONDITIONS OF CONTRACT (SCC)
Chapter - III : General Technical Requirements (Codes and Standards)

3.0	GENERAL TECHNICAL REQUIREMENTS (CODES AND STANDARDS)
3.1	Except where otherwise specified, the plant/equipment shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as mentioned elsewhere in contract specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary, to enable BHEL to identify all of the plant/equipment in the same detail as would be possible had there been a Standard Specification.
3.2	Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.
3.3	In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements which are more stringent shall govern.
3.4	Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

4.0	OBLIGATIONS OF CONTRACTOR
4.1	CONSUMABLES & OTHER ITEMS
4.1.1	The contractor shall provide within finally accepted price / rates, all consumables (excepting those indicated in BHEL scope) like welding electrodes (including alloy steel and stainless steel), filler wires, TIG filler wires (over & above as supplied by the unit along with the plant materials, which will be given free of cost to bidder), gases (inert, welding, cutting), soldering material, dye penetrants, radiography films, etc. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, packers, shims, wooden planks, scaffolding materials hardware items etc required for temporary works such as supports, scaffoldings are to be arranged by the contractor. Sealing compounds, gaskets, gland packing, wooden/concrete sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by the contractor.
4.1.2	All the shims, gaskets and packing, which go finally as part of plant equipment, shall be supplied by BHEL free of cost.
4.1.3	It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of consumables. Non-availability of any consumable materials or equivalent suggested by BHEL cannot be considered as reason for not attaining the required progress or for additional claim.
4.1.4	<u>TIG Filler wire for Boiler and Filler wires for Electrodes for P91/T91 piping:</u> These shall be supplied by BHEL free of cost as supplied by BHEL Manufacturing Units as part of regular supply. Required quantity as arrived at by calculation / standards will only be supplied. It would be the contractors' responsibility to account for the consumption of these filler wires. Additional consumption beyond standard / calculated quantity will be at cost recovery basis only unless and otherwise accounted for. Surplus quantity of TIG filler wire, if any, shall be properly stored and returned to BHEL stores.
4.1.5	It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of electrodes etc before procurement of welding electrodes. On receipt of electrodes at site these shall be subjected to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number, date of expiry etc and produce test certificate for each lot / batch with correlation of batch / lot number with respective test certificate. No

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

	electrode without a valid test certificate will to be used.
4.1.6	BHEL reserves the right to reject the use of any consumable including electrodes, gases, lubricants / special consumables if it is not found to be of the required standard / make / purity or when shelf life has expired. Contractor shall ensure display of shelf life on consumable wherever required and records maintained.
4.1.7	Storage of all consumables including welding electrodes shall be done as per requirement / instruction of the Engineer by the contractor at his cost.
4.1.8	In case of improper arrangement for procurement of any consumable, BHEL reserves the right to procure the same from any source and recover the cost from the Contractor's first subsequent bill at market value plus the departmental charges of BHEL from time to time. Postponement of such recovery is normally not permitted. The decision of Engineer in this regard shall be final and binding on the Contractor.
4.1.9	All lubricants and chemicals required for pre-commissioning, commissioning, testing, preservation and lubricants for trial runs of the equipment shall be supplied by BHEL / BHEL's client. All services including labour and T&P will be provided by the contractor for handling, filling, emptying, refilling etc. The consumption of lubricants / chemicals shall be properly accounted for. Surplus material if any shall be properly stacked/tagged and returned to BHEL/ CUSTOMER stores at no extra cost to BHEL. BHEL reserves the right to recover costs for wastage by the contractor.
4.1.10	Transportation of oil drums, from stores, filling of oil for flushing, first filling, subsequent changeover if any, topping/making up till the unit is fully commissioned and handed over to customer is included in scope of this contract. The contractor shall have to return all the empty drums to BHEL / BHEL's client store at no extra cost. Any loss / damage to above drums shall be to contractor's account.
4.1.11	All charges on account of Octroi, terminal or sales tax and other duties on materials obtained from any source for carrying out the works in the scope of the contractor shall be borne by the contractor.
4.2	TOOLS AND PLANTS / MONITORING AND MEASURING EQUIPMENT (MMEs)
4.2.1	T&Ps and MMEs to be provided by Contractor
4.2.1.1	All T&Ps and MMEs excepting those specifically indicated in BHEL scope are to be provided by the Contractor. Contractor has to make his own arrangement at his cost for completing the formalities (including arrangement of Road permits, if any) if required with Sales Tax/VAT authorities, for bringing their materials, plants and

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

	equipments at site for the execution of work under this contract.
4.2.1.2	All suitable cranes, lifting and transport equipments for material handling at stores/yard/siding of BHEL/Customer are included in scope. BHEL's cranes will not be available for this purpose unless otherwise specifically permitted as per contract conditions
4.2.1.3	All T&Ps to be deployed by the contractor shall have the approval of BHEL Engineer with regard to brand, quality and specification.
4.2.1.4	Indicative list of Major T&Ps in the scope of Contractor are given in the Technical Conditions of Contract. Bidders to note that these are only indicative and as such all other T&P necessary for timely and satisfactory completion of work in scope shall be mobilized by Contractor
4.2.1.5	Timely deployment of adequate T&Ps is the responsibility of the contractor. The contractor shall be prepared to augment the T&P at short notice to match the planned programme and to achieve the milestones.
4.2.1.6	Contractor shall maintain and operate his tools and plants in such a way that major breakdowns are avoided. In the event of major breakdown, contractor shall make alternative arrangements expeditiously so that the progress of work is not hampered.
4.2.1.7	In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, BHEL will make alternative arrangement at the risk and cost of the contractor. Decision of BHEL shall be final and binding on the contractor
4.2.1.8	The T&P to be arranged by the contractor shall be in proper working condition and their operation shall not lead to unsafe condition. The movements of cranes, and other equipment should be such that no damage / breakage occurs to foundations, other equipments, material, property and men. All arrangements for the movement of the T&P etc shall be the contractor's responsibility.
4.2.1.9	Use of welding generators/ rectifiers only shall be permitted for welding. Use of welding transformers will be subject to specific approval of BHEL engineer.
4.2.1.10	The contractor at his cost shall carry out periodical testing of his construction equipments. Test certificates shall be furnished to BHEL.
4.2.1.11	Contractor shall ensure deployment of serviced and healthy T&Ps including cranes, lifting tackles, wire ropes, manila ropes, winches and slings etc. History card and maintenance records for major T&Ps will be maintained by the contractor and will be made available to BHEL Engineer for inspection as and when required.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

	Fitness certificate / Test Certificates of T&P shall have to be submitted before it is put in use. Identification for such T&Ps will be done as per BHEL Engineer's advice. BHEL reserves the right to permit only new slings up to 20 mm and lifting tackles up to 3 MT capacities.
4.2.1.12	Contractor shall ensure deployment of reliable and calibrated MMEs (Inspection measuring and Monitoring equipment). The MMEs shall have test / calibration certificates from authorized / Government approved / accredited agencies traceable to National / International standards. Each MME shall have a label indicating calibration status i.e. date of calibration, calibration agency and due date for calibration. A list of such instruments deployed by contractor at site with its calibration status is to be submitted to BHEL Engineer for control.
4.2.1.13	Re-testing / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such MME so that work does not suffer when the particular instrument is sent for calibration. If any MMEs not found fit for use, BHEL shall have the right to stop the use of such item. It will be necessary for the contractor to deploy proper item. Any readings taken by the defective instrument will be recalled and repeat the readings taken by that instrument with a proper one. In case he fails to do so, BHEL may deploy MMEs and retake the readings at contractor's cost.
4.2.1.14	BHEL shall have lien on all T&P, MMEs and other equipment of the contractor brought to the site for the purpose of erection, testing and commissioning. BHEL shall continue to hold the lien on all such items throughout the period of contract / extended period. The contractor and / or his sub-contractors, without the prior written approval of the Engineer, shall remove no material brought to the site.
4.2.1.15	The month wise T&P deployment plan to execute the work is to be submitted as per relevant format as per the instruction of BHEL. It shall be the contractor's responsibility to deploy the required T&P, for timely and successful completion of the job, to any extent.
4.2.2	Obligations in respect of T&Ps and MMEs provided by BHEL
4.2.2.1	T&P / MMEs being provided by BHEL to sub-contractor free of hire charges shall be shared by other subcontractors working for BHEL at site and the allotment done by BHEL Engineer shall be final and binding.
4.2.2.2	BHEL T&P will be issued in basic assembled condition. Additional loose components / sub-assemblies / attachments as and when necessary, will be

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

	issued by BHEL. Assembly of such additional loose components/sub-assemblies/ attachments is in contractor's scope.
4.2.2.3	In case of non-availability of the T&Ps to be provided by BHEL due to breakdown, major overhauls, distribution pattern or any other reason, the contractor shall plan / amend / alter his activities to meet erection / commissioning targets in consultation with BHEL.
4.2.2.4	void
4.2.2.5	The contractor shall engage trained and experienced operators for the operation of BHEL's T&Ps. Their skill / performance will be checked by BHEL Engineer before they are allowed to operate the same. However checking of skills by BHEL does not absolve the contractor of his responsibilities for proper and safe handling of equipment, consistent good performance of operators and regular performance evaluation of operators.
4.2.2.6	The day to day operation and maintenance of BHEL's T&Ps (Other than cranes) shall be carried out by contractor as per manufacturer's / BHEL's maintenance schedule at his cost. The contractor shall arrange, at his own cost, trained operators, fuel and other consumables for their operation. BHEL shall arrange all spares needed for upkeep of major T&Ps provided like Huck Bolting Machine*, DG Set, Induction Machine and Hydraulic Test pumps. The contractor has to arrange for fixing of the spares; supervision in specialized cases will be provided by BHEL. For upkeep of all other T&Ps supplied by BHEL, spares shall be arranged by the Contractor. BHEL supplied T&Ps shall be maintained in good working condition during the entire period of use. T&Ps in defective / damaged condition shall be rectified promptly to the full satisfaction of BHEL engineer. Contractor shall maintain records for maintenance of major T&Ps. These shall be made available for Inspection whenever required. In case of any lapses on the part of the contractor, BHEL at its own discretion shall get the servicing / repair of equipment done at the risk and cost of the contractor along with BHEL overheads. Further, if there are breakdowns / damages due to negligence of the contractor, the complete service / repair charges and cost of all the spares damaged with BHEL overheads shall be recovered from contractor's RA bills. *: for operation and maintenance of ESP Huck bolting machine, BHEL shall provide the basic power rig and hose. Balance toolingsie Guns, chuck jaws etc are to be arranged by contractor.
4.2.2.7	void

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

4.2.2.8	Increasing / shortening of the crane boom to suit work requirements shall have to be arranged by the indenting contractor at his cost including restoration to a state as directed by BHEL. All necessary manpower tools, support, consumables, illumination etc. will have to be arranged by contractor at his cost. If required, contractor has to return the crane with original boom.
4.2.2.9	The area and infrastructure development of the area to be carried out by the customer. However in construction projects of this magnitude it is possible that all the areas / approaches may not be ready. In such cases backfilling of approaches where ever necessary, consolidation of ground and arrangement of sleepers / sand bag filling etc for safe operation / movement of equipment including cranes / trailers etc shall be the responsibility of the contractor at his cost. No compensation on this account shall be payable.
4.2.2.10	In the event of contractor not using and maintaining BHEL T&Ps according to BHEL's instructions. BHEL will have the right to withdraw such item without any notice and no claim in this regard shall be entertained and contractor shall be responsible for delay in execution on this account.
4.2.2.11	The contractor shall furnish regular utilization report of the BHEL T&Ps, as per requirement of BHEL.
4.2.2.12	Any loss / damage to any part of BHEL T&Ps and MMEs shall be to the contractor's account and any expenditure on these accounts by BHEL will be recovered from the contractor's bill in case the contractor fails to make good the loss.
4.2.2.13	It shall be responsibility of the contractor to take delivery of T&Ps and MMEs from stores or place of use by other contractor at project site, transport the same to site and return the same to BHEL store / place as intimated by Engineer in project site in good working conditions after use.
4.2.2.14	The contractor shall return BHEL T&Ps and MMEs issued to him in good working condition as and when desired by BHEL (on completion or reduction of workload). If contractor delays return of T&P and MME, hire charges as applicable shall be levied by BHEL from time, it was requisitioned till the time of actual return. T&Ps and MMEs returned in damaged / unserviceable condition shall be got repaired by BHEL at its own discretion and entire cost of repair with BHEL overheads shall be recovered from the contractor.
4.2.2.15	Replacement cost including BHEL overheads in respect of irreparable / completely damaged / non return of T&Ps and MMEs shall be recovered from the

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

	contractor's running / final bills
4.2.2.16	Obligations in respect of Cranes provided by BHEL
a)	BHEL will make available the cranes (as per Technical Conditions of Contract) free of charge to the contractor on sharing basis mainly for the purposes enumerated/indicated therein. BHEL cranes have to be shared with other agencies / contractors of BHEL. The allocation of cranes shall be the discretion of BHEL engineer, which shall be binding on the contractor.
b)	BHEL Cranes may be initially issued in basic assembled condition. Any alteration/addition like boom reduction / extension, assembly of components/sub-assemblies needed for modulating the capacity/reach/other features of cranes and restoration to the state as directed by BHEL shall be the contractor's responsibility.
c)	In case the BHEL cranes are not covered under AMC of BHEL, then the day-to-day upkeep and running maintenance like filling / topping up of lubricants, changing filters, etc including repair of self starter and dynamo of these cranes shall be the responsibility of the contractor. If on checking it is found that the same is not followed, BHEL will exercise its right to get the job/works done at the risk and cost of contractor. In case BHEL cranes are covered under AMC awarded by BHEL, then the day-to-day upkeep and running maintenance as described above are excluded from scope. However any additional helpers if any required during Preventive/Breakdown Maintenance, Assembly/disassembly shall be provided by contractor at no extra cost. 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.
d)	Minor consumables like cotton cloth, cotton waste, etc is to be supplied by Contractor. All spares and lubricants/grease is excluded from scope. Contractor to give the requirements of these items well in advance in case the cranes provided by BHEL are BHEL owned cranes.
e)	Unless otherwise specified, trained operators for BHEL owned cranes shall be provided by the contractor. These operators should possess valid license for heavy vehicle.
f)	BHEL cranes will be withdrawn for regular and capital maintenance as per the respective schedule of maintenance. As far as possible such schedules will be intimated to the contractor in advance and may be adjusted depending on the work

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IV : Obligations of Contractor

	requirements at site. However no claim whatsoever will be entertained on account of non-availability of cranes.
g)	Where the services of the cranes provided by BHEL are to be shared by other agencies/ contractors of BHEL, the contractor's responsibilities defined above will also be apportioned accordingly to the beneficiary agency. Working arrangements in this regard will be done at site by BHEL engineer and in any case his decision shall be final and binding.
h)	Major breakdowns will be attended to by BHEL. However, in case of breakdowns or damages due to negligence of the contractor, the complete service/repair charges including cost of spares shall be to the account of the contractor, along with BHEL overheads.
4.2.2.17	Obligations in respect of Construction Lift/Elevators provided by BHEL
a)	The total erection including commissioning, maintenance, statutory clearances shall be included in scope of work. Supervision by the original equipment supplier or their authorized agency shall be arranged for by BHEL, in case found necessary.
b)	All day to day and routine maintenance and checking is to be carried out by the contractor as per the recommendations of the supplier. He should periodically check the brakes and carry out the all works to ensure the safety of all those using the lift/elevator. BHEL shall arrange spares required for upkeep of Construction lift/elevator
c)	The construction lift/elevator should never be overloaded as this can lead to serious accidents. Ensuring all safety aspects in operation of the lift shall be the responsibility of the contractor. Erection of all the required number of landing platforms is included in scope. Landing platforms are to be provided with proper barricades and hand railings.
d)	After completion of contractual scope of work or as per BHEL advice, the temporary elevator/lift shall be dismantled and handed over to BHEL neatly identified/tagged. Temporary structures/platforms etc erected for the elevators/lifts are also to be dismantled and materials to be returned to stores as applicable. The construction and dismantling of the foundations required for the construction/elevator lifts is included in the scope of the contractor.

SPECIAL CONDITIONS OF CONTRACT (SCC)
**Chapter – V : Responsibilities of Contractor in respect of Labour,
Supervisory Staff, etc.**

5.0	RESPONSIBILITIES OF CONTRACTOR IN RESPECT OF LABOUR, SUPERVISORY STAFF, ETC.
5.1	Refer relevant clauses of General Conditions of Contract (GCC) also in this regard
5.2	The contractor shall deploy all the necessary skilled/semiskilled/ unskilled labour including highly skilled workmen etc. These workmen should have previous experience on similar job. They shall hold valid certificates wherever necessary. BHEL reserves the right to insist on removal of any employee of the contractor at any time if he is found to be unsuitable and the contractor shall forthwith remove him.
5.3	Contractor shall also comply with the requirements of local authorities/ project authorities calling for police verification of antecedents of the workmen, staff etc.
5.4	It is the responsibility of the contractor to engage his workmen in shifts and or on overtime basis for achieving the targets set by BHEL. This target may be set to suit BHEL's commitments to its customer or to advance date of completion of events or due to other reasons. The decision of BHEL in regard to setting the erection and commissioning targets will be final and binding on the contractor.
5.5	Contractor shall provide at different elevation suitable arrangement for urinal and drinking water facility with necessary plumbing & disposal arrangement including construction of septic tank. These installations shall be maintained in hygienic condition at all times.
5.6	The Contractor in the event of engaging 20 or more workmen, shall obtain Independent license under the Contract labour (Regulation and Abolition) Act 1970 from the concerned authorities based on Form-V issued by the Principal Employer/Customer. In order to issue Form-V by Customer, Contractor shall fulfill all Statutory requirements like Insurance Policy, PF Code/PF Account number etc as per the requirement of BHEL/Customer
5.7	Contractor shall deduct the necessary amount towards Provident Fund and contribute equal amount as per Government of India laws. This amount will be deposited regularly to the provident Fund Commissioner. BHEL/Customer may insist for submission of the account code duly certified by PF Commissioner
5.8	Contractor may also be required to comply with provisions of ESI Act in vogue if applicable and submit evidence to BHEL.
5.9	BHEL / customer may insist for witnessing the regular payment to the labour. They may also like to verify the relevant records for compliance with statutory

SPECIAL CONDITIONS OF CONTRACT (SCC)
**Chapter – V : Responsibilities of Contractor in respect of Labour,
Supervisory Staff, etc.**

	requirements. Contractor shall enable such facilities to BHEL / Customer.
5.10	Contractor shall deploy only qualified and experienced engineers/ supervisors. They shall have professional approach in executing the work.
5.11	The contractor's supervisory staff shall execute the work in the most professional manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. They shall be responsible to ensure that the assembly and workmanship conform to dimensions and tolerances given in the drawings/instructions given by BHEL engineer from time to time.
5.12	The supervisory staff employed by the contractor shall ensure proper outturn of work and discipline on the part of the labour put on the job by the contractor. Also in general they should see that the works are carried out in a safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other contractors of BHEL or BHEL's client.
5.13	It is the responsibility of the contractor to arrange gate pass for all his employees, T&P etc for entering the project premises. Necessary coordination with customer officials is the responsibility of the contractor. Contractor to follow all the procedures laid down by the customer for making gate passes. Where permitted, by customer / BHEL, to work beyond normal working hours, the contractor shall arrange necessary work permits for working beyond normal working hours.
5.14	The actual deployment will of Labour and Engineer/supervision staff shall be so as to satisfy the erection and commissioning targets set by BHEL. If at any time, it is found that the contractor is not in a position to deploy the required engineers/supervisors/workmen due to any reason, BHEL shall have the option to make alternate arrangements at the contractor's risk and cost. The expenditure incurred along with BHEL overheads thereon shall be recovered from the contractor
5.15	Contractor shall not deploy women labour at night.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VI: Material Handling, Storage & preservation

6.0	MATERIAL HANDLING, STORAGE AND PRESERVATION ETC
6.1	MATERIAL HANDLING AND STORAGE
6.1.1	All the equipments/materials furnished under this contract shall be received from the project stores, sheds / storage yards and transported to pre assembly area / erection site and stored in the storage spaces in a manner so that they are easily retrievable till the contractor erects them. While drawing/lifting material from BHEL / customer stores, the contractor shall ensure that the balance / other materials are stacked back immediately. No claim is admissible on this account
6.1.2	While BHEL will endeavor to store / stack / identify materials properly in their open / close / semi closed / tarpaulins covered storage yard / shed, it shall be contractor's responsibility to assist BHEL in identifying materials well in time for erection. They should take the delivery of the same, following the procedure indicated by BHEL, and transport the material safely to pre-assembly yard / erection site in time, according to program.
6.1.3	The contractor shall take delivery of components, equipment / consumables from storage area after getting the approval of BHEL Engineer on standard indent forms.
6.1.4	The contractor shall identify and deploy necessary Engineers / supervisors / workmen for the above work in sufficient number as may be needed by BHEL, for areas covering their scope.
6.1.5	All the equipment shall be handled very carefully to prevent any damage or loss. No untested wire ropes / slings etc. shall be used for unloading / handling. The equipment shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the stores shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site.
6.1.6	Contractor shall ensure that while lifting slings shall be put over the points indicated on the equipment or as indicated in the manufacturer's drawings. Slings / shackles of proper size shall be used for all lifting and rigging purposes. All care shall be taken to safe guard the equipment against any damage. Dragging of piping / valves should be avoided. In case of any damage the cost shall be covered from the contractor.
6.1.7	Approach road conditions from the stores / yards to the erection site may not

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VI: Material Handling, Storage & preservation

	be equipped and ideal for smooth transportation of the equipment. Contractor may have to be adequately prepared to transport the materials under the above circumstances without any extra cost. . The contractor may familiar himself with soil conditions at site.
6.1.8	Contractor shall be responsible for examining all the plant and materials issued to him and notify the Engineer immediately of any damage, shortage, discrepancy etc before they are moved out of the stores / storage area. The contractor shall be solely responsible for any shortages or damages in transit, handling, storage and erection of the equipment once received by him. As the erection work will be spread in different areas / locations of the project, contractor has to arrange sufficient number of watch / ward personal to avoid any pilferage of material
6.1.9	The contractor shall maintain an accurate and exhaustive record-detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the engineer at any time.
6.1.10	All the material in the custody of contractor and stored in the open or dusty locations must be covered with suitable weather proof / fire retardant covering material wherever applicable and shall be blocked up on raised level above ground. All covering materials including blocks and sleeper shall be arranged by the contractor at his cost.
6.1.11	If the material belonging to the contractor are stored in area other than those earmarked for his operation the engineer will have the right to get it moved to the area earmarked for the contractor at the contractors risk and cost.
6.1.12	The contractor shall be responsible for making suitable indoor storage facilities to store all equipment (drawn by the contractor from BHEL / customer stores), which require indoor storage till the time of their installation. The Engineer will direct the contractor in this regard, which item in his opinion will require indoor storage, and the contractor shall comply with Engineer's decision.
6.1.13	The contractor shall ensure that all surplus / damaged / scrap / unused material, packing wood / containers/ special transporting frames etc are returned to BHEL at a place in project area identified by the Engineer. The contractor will maintain an account for all items received and returned to BHEL. Any shortage in returning such items shall be chargeable to the contractor except allowable wastage for packing wood only.
6.1.14	The contractor shall hand over all parts / materials remaining extra over the normal requirement with proper identification tags to the stores as directed by

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VI: Material Handling, Storage & preservation

	the concerned BHEL engineer.
6.1.15	The contractor shall ensure that all the packing materials and protective devices installed on equipment during transit and storage are removed before installation.
6.1.16	It shall be the responsibility of the contractor to keep the work / storage areas in neat, tidy and working conditions. All surplus/unusable packing and other materials shall be removed and deposited at location(s) specified by BHEL within the project premises. If required weighing of the same within the project premises will have to be carried out.
6.2	PRESERVATION OF COMPONENTS
6.2.1	After taking delivery from BHEL / customer's stores, plant materials storage shall be subjected to the following protection besides other provisions indicated in these specifications elsewhere.
6.2.1.1	Items stored outdoors shall be stacked up at least six inches (6") off the ground. Items should not be stored in a low lying area where water logging is a possibility. Contractor should have sufficient numbers of wooden / concrete / steel sleepers for the job.
6.2.1.2	Motors, valves, electrical equipment, control equipment and instruments, and special or precision items requiring special care, etc shall be stored indoors. Motor windings shall be kept dry by use of external heat or space heaters.
6.2.1.3	Bearings and other wearing surfaces of plant materials shall be protected against corrosion and kept clean and should be regularly monitored.
6.2.1.4	Insulation materials shall be stored indoors or otherwise protected against getting wet/ damaged, using suitable measures and should be protected from direct rain.
6.2.2	It shall be the responsibility of the contractor to apply preservatives / touch up paints (primer) on equipment handled and erected by him till such time of final painting. It shall be contractor's responsibility to arrange for required paints (primer), thinners, labour, scaffolding materials, cleaning materials like wire brush, emery sheets, etc, cleaning of surface and provide one coat of preservatives / paints (primer) from time to time as decided by BHEL engineer. The accepted rate shall include this work also. It is to be noted that such painting may have to be done as and when required till such time the final painting is carried out.
6.2.3	The contractor shall effectively protect the finished work from action of weather

SPECIAL CONDITIONS OF CONTRACT (SCC)
Chapter – VI: Material Handling, Storage & preservation

	and from damage or defacement and shall cover the finished parts then and there for their protection.
6.2.4	Any failure on the part of contractor to carry out works according to above clauses will entail BHEL to carry out the job from any other party and recover the cost from contractor.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VII: Drawings and documents

7.0	DRAWINGS AND DOCUMENTS
7.1	The detailed drawings, specifications available with BHEL engineers will be made available to the contractor during execution of work at site. The contractor will also ensure availability of all drawings / documents at work place.
7.2	Necessary drawings to carry out the erection work will be furnished to the contractor by BHEL on loan, which shall be returned to BHEL Engineer at site after completion of work. Contractor shall ensure safe storage and quick retrieval of these documents.
7.3	The contractor shall maintain a record of all drawings and documents available with him in a register as per format given by BHEL Engineer. Contractor shall ensure use of pertinent drawings / data / documents and removal of obsolete ones from work place and returning to BHEL.
7.4	The data furnished in various annexure enclosed with this tender specification are only approximate and for guidance. However, the change in the design and in the quantity may occur as is usual in any such large scale of work. The contractors quoted rates shall be inclusive of the above factor
7.5	Should any error or ambiguity be discovered in the specification or information the contractor shall forthwith bring the same to the notice of BHEL before commencement of work. BHEL's interpretation in such cases shall be final and binding on the contractor.
7.6	Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimension / details, without specific approval of BHEL.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VIII: Inspection and Quality

8.0	INSPECTION AND QUALITY
8.1	Inspection, Quality Assurance, Quality Control
8.1.1	Preparation of quality assurance log sheets and protocols with customer/ consultants/statutory authority, welding logs, NDE records, testing & calibration records and other quality control and quality assurance documentation as per BHEL engineer's instructions, is within the scope of work/specification. These records shall be submitted to BHEL/customer for approval from time to time.
8.1.2	The protocols between contractor and customer/ BHEL shall be made prior to installation for correctness of foundations, materials, procedures, at each stage of installation, generally as per the requirement of customer/ BHEL. This is necessary to ensure elimination of errors or keeping them within tolerable limits and to avoid accumulation and multiplication of errors.
8.1.3	A daily log book should be maintained by every supervisor/engineer of contractor on the job in duplicate (one for BHEL and one for contractor) for detailing and incorporating alignment/clearance / centering / leveling readings and inspection details of various equipments etc. High pressure welding details like serial number of weld joints, welders name, date of welding, details of repair, heat treatment etc. will be documented in welding log as per BHEL Engineer's instructions. Record of radiography containing details like serial number of weld joints, date of radiography, repairs, if any, re-shots etc shall also be maintained as per BHEL Engineer's instructions. Record of heat treatments performed shall be maintained as prescribed by BHEL
8.1.4	The performance of welders will be reviewed from time to time as per the BHEL standards. Welders' performance record shall be furnished periodically furnished for scrutiny of BHEL's Engineer. Corrective action as informed by BHEL shall be taken in respect of those welders not conforming to these standards. This may include removal/ discontinuance of concerned welder(s). Contractor shall arrange for the alternate welders immediately
8.1.5	All the welders shall carry identity cards as per the proforma prescribed by BHEL/Customer/Consultant. Only welders duly authorized by

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VIII: Inspection and Quality

	BHEL/customer/consultant shall be engaged on the work.
8.1.6	Contractor shall provide all the Measuring Monitoring Equipments (MMEs) required for completion of the work satisfactorily. These MMEs shall be of brand, quality and accuracy specified by BHEL Engineer and should have necessary calibration and other certificates as per the requirement of BHEL Engineer. Decision of BHEL Engineer regarding acceptance or otherwise of the measuring instruments/gauges/tools for the work under this specification, is final and binding on the contractor. BHEL may give an indicative list of MMEs required for this work and to be made available by the contractor. The list will be reviewed by BHEL and the contractor shall meet any augmentation needed wherever required.
8.1.7	It is the responsibility of the contractor to prove the accuracy of the testing/measuring/calibrating equipments brought by him based on the periodicity of calibration as called for in the BHEL's quality assurance standards/BHEL Engineer's instructions.
8.1.8	Any re-laying or re-termination of cables/re-erection of instruments/recalibration of instruments etc. required due to contractor's mistake or design requirement and found at any stage inspection, shall be carried out by the contractor at no extra cost.
8.1.9	BHEL, Power Sector Regions (PSNR/PSER/PSWR/PSSR) have already been accredited with ISO 9001 certification and as such this work is subject to various audits to meet ISO 9001 requirements. One particular aspect which needs special mention is about arrangement of calibration of instruments by the contractor. Contractor shall ensure deployment of reliable and calibrated MMEs (Measuring and Monitoring Equipments). The MMEs shall have test / calibration certificates from authorised / Government approved / Accredited agencies traceable to National / International Standards. Re-testing / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such MMEs so that work does not suffer when the particular equipment / instrument is sent for calibration. Also if any MMEs not found fit for use, BHEL shall have the right to stop the use of such item and instruct the contractor to deploy proper item and recall ie repeat the readings taken by that instrument, failing which BHEL may deploy MME and retake the readings at Contractor's cost.
8.1.10	Re-work necessitated on account of use of invalid MMEs shall be entirely to the

Bharat Heavy Electricals Limited

Power Sector – Eastern Region, Kolkata

VOLUME-ID

TENDER NO. PSER:SCT:BAR-C1962:19

PAGE 22 OF 47

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VIII: Inspection and Quality

	contractor's account. He shall be responsible to take all corrective actions, including resource augmentation if any, as specified by BHEL to make-up for the loss of time.
8.1.11	In the courses of erection, it may become necessary to carry repeated checks of the work with instruments recently calibrated, re-calibrated. BHEL may counter/ finally check the measurements with their own MMEs. Contractor shall render all assistance in conduct of such counter/final measurements.
8.1.12	Total Quality is the watchword of the work and Contractor shall strive to achieve the Quality Standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and Quality Standards.
8.2	Stage Inspection By FES/QA Engineers
8.2.1	Apart from day-to-day inspection by BHEL Engineers stationed at Site and Customer's Engineers, stage inspection of equipments under erection and commissioning at various stages shall also be conducted by teams of Engineers from Field Engineering Services of BHEL's Manufacturing Units, Quality Assurance teams from Field Quality Assurance, Unit/Factory Quality Assurance and Commissioning Engineers from Technical Services etc. Contractor shall arrange all labour, tools and tackles etc along with proper access for such stage inspections free of cost.
8.2.2	Any modifications suggested by BHEL FES and QA Engineers' team shall be carried out. Claims of contractor, if any, shall be dealt as per Section 13, and provided such modifications have not arisen for reasons attributable to the contractor.
8.3	Statutory Inspection of Work
8.3.1	The work to be executed under these specifications has to be offered for inspection, at appropriate stages of work completion, to various statutory authorities for compliance with applicable regulations. The work related statutory inspections, though not limited to, are as under: 1) Inspectorate of Steam Boilers and Smoke Nuisance 2) Electrical Inspector 3) Factory Inspector, Labour Commissioner, PF Commissioner and other authority connected to this project work

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VIII: Inspection and Quality

	The scope includes getting the approvals from the statutory authorities, which includes arranging for inspection visits of statutory authority periodically as per BHEL Engineer's instructions, arranging materials for ground inspection, taking rub outs for the pressure parts to be offered for inspection, submitting co-related inspection reports, documents, radiographs etc and following up the matter with them. Contractor shall also make all arrangements for offering the Products / Systems for inspection at location, as applicable, to the concerned authority.
8.3.2	Contractor should be qualified to execute pressure parts & piping work coming under the purview of IBR, for which he should register himself with CIB of state concerned. contractor also should be aware of the latest IBR regulations and Electricity Act, including the amendments thereof.
8.3.3	Contractor shall comply with 'Qualification Tests for welders engaged in welding of Boilers and Steam Pipes under Construction, Erection and Fabrication at Site in India and in repairing Boilers and steam pipes by welding' in line with Chapter XIII of Indian Boiler Regulations-1950, for testing his welders / men / workers, including all associated fees, procedures, required instruments and equipments and their calibration there of. It shall be contractor's responsibility to obtain approval of Statutory Authorities, wherever applicable, for the conducting of any work which comes under the purview of these authorities, at his cost.
8.3.4	The following fees shall be excluded from scope of Contractor: 1. Registration Fee as per Regulation 385 of Chapter IX of Indian Boiler Regulations-1950 2. Fees for inspection of Boiler at the site of Construction as per Regulation 395 A, sl no 4 of Chapter IX of Indian Boiler Regulations-1950 However all other fees like visit fees charged by the Boiler Inspector and other arrangements for his visit or visits till satisfactory completion of work, shall be included in scope of Contractor
8.4	The Quality Management System of BHEL, Power Sector Regions (PSNR/PSER/PSWR/PSSR) have already been certified and accredited under ISO 9002 standards in this regard. The basic philosophy of the Quality Management System is to define the organizational responsibility, work as per

Bharat Heavy Electricals Limited

Power Sector – Eastern Region, Kolkata

VOLUME-ID

TENDER NO. PSER:SCT:BAR-C1962:19

PAGE24OF47

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter – VIII: Inspection and Quality

	documented procedures, verify the output with respect to acceptance norms, identify the non-conforming product/ procedure and take corrective action for removal of non-conformance specifying the steps for avoiding recurrence of such non-conformities, & maintain the relevant quality records. The nonconformities are to be identified through the conduct of periodical audit of implementation of quality systems at various locations/stages of work. Suppliers/vendors of various products/services contributing in the work are also considered as part of the quality management system. .as such the contractor is expected not only to conform to the quality management system of BHEL but also it is desirable that they themselves are accredited under any quality management system standard.
8.5	Field Quality Assurance
8.5.1	Contractor shall carry out all activities conforming to the approved Field Quality Plan (FQP) as revised from time to time. Total quality shall be the watchword of the work and contractor shall strive to achieve the quality standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards. Contractor shall provide the services of quality assurance engineer as per the relevant clauses.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

9.0	OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME: BHEL, Power Sector Regions (PSNR/ER/WR/SR) are each certified for ISO 9001. Quality of work to customer's satisfaction and fulfillment of system requirements are the essence of ISO 9001 certification. BHEL, PS Regions have HSE certification (ISO 14001 & OHSAS 18001) and therefore Contractor also shall organise/ plan/ perform all their activities to meet with the applicable requirements of these standards.
9.1	HSE (Health, safety & Environment): Contractor will comply with HSE (Health, safety & Environment) requirements of BHEL. HSE requirements in brief, are given below :-
9.1.1	Contractor will nominate one of their qualified and experienced employees as Safety Officer, who will be responsible for all HSE related issues of contractors work area. Safety Officer will have authority to stop any activity, in case he observes that the activity is not being carried out in safe manner. He will conduct surprise inspection as well as periodic inspection/drill (at least once in a month) and submit such reports to BHEL. He will conduct periodic meetings with supervisors of different working groups and explain HSE issues and use of PPEs to them. Reports of such meetings will be submitted to BHEL. Contractor will develop suitable work procedures based upon HSE guidelines and OCPs and implement it. Such work procedures will consist of Area of work, T&P Details, Work Procedure, PPE requirements etc. Please refer Schedule VIII of BOCW Rules for number of safety officers, qualification, duties etc. Contractor should highlight the requirement of safety to staff and labour through daily tool box meeting before start of the days job. Contractor to also submit monthly safety reports as per the format/procedure of BHEL.
9.1.2	The contractor shall arrange induction and regular health check of their employees as per schedule VII of BOCW rules by aregistered medical practitioner. The contractor shall take special care of the employees affected with occupational diseases under rule 230 and schedule II of BOCW Rules. The employees not meeting the fitness requirement should not be engaged for such job
9.1.3	Following personnel protective equipments (PPEs), in adequate numbers, will

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	be made available at site & their regular use by all concerned will be ensured :-
	- HELMET
	- SAFETY GOGGLES & WELDING FACE SHIELDS
	- SAFETY BELTS AND PROTECTIVE NET FOR WORKING AT HEIGHT
	- SAFETY SHOES
	- EAR PLUG
	- ANY OTHER SAFETY EQUIPMENT REQUIRED FOR SAFE COMPLETION OF THE WORK
	Contractor to also submit monthly reports on above as per the format/procedure of BHEL.
9.1.4	Providing appropriate First Aid facilities for prompt treatment of injuries and illness at work place. Arranging training to contractor workmen/ employees for giving first aid.
9.1.5	Arranging ambulance in case of any emergency situation .
9.1.6	Identification of nearest hospital and health check-up of workmen/employees
9.1.7	Providing filtered drinking water at work place in cool container.
9.1.8	Providing Canteen, Rest Room, Washing facilities to the contracted employees as per provisions of Contract Labour Regulation Act 1970 (Chapter V).
9.1.9	Providing appropriate fire fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
9.1.10	Identification of nearest fire station and display contact telephone nos. / person's name around work places for cases of emergencies .
9.1.11	Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts.
9.1.12	Fulfilling safety requirements at all power tapping points.
9.1.13	Red & White caution tape of proper width(1.5 to 2 inch) to be used for cordoning unsafe area such as open trench, excavation area etc.
9.1.14	Providing contractors company logo on cloths /uniform/ proper identity cards with photographs, for correct identification of people working at project site .
9.1.15	High/ Low pressure welders to be identified with separate colourclothings. No welders will be deployed without passing appropriate tests and holding valid welding certificates. Approved welding procedure should be displayed at work place.
9.1.16	Displaying safe handling procedures for all chemicals such as lube oil, acid, alkali, sealing compounds etc , at work place .

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

9.1.17	All scaffolding/ platforms should be made from materials of appropriate quality/grade so that these are safe for use. It should be certified/declared safe for use by an experienced contractor person, before any scaffolding/platform is used. Please refer IS:3696 part 1&2 and 4014 part 1 & 2
9.1.18	All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test/calibration certificates bearing endorsement from competent authority of BHEL.. Contractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.
9.1.19	Ensure that the regulatory requirement of excessive weight limit (to carry/lift/ move weights beyond prescribed limits) for male and female workers are complied with.
9.1.20	Safety slogan, Safety/ Caution boards , wherever required to be displayed in consultation with BHEL.
9.1.21	Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained. Ensure proper cleanliness of work place, housekeeping and waste management (including proper waste disposal) on daily basis.
9.1.22	It is imperative on the part of the contractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, keeping good relation with local populace etc.
9.1.23	The contractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.
9.1.24	The Contractor is required to provide proper safety net systems (IS-11057) where ever the hazard of fall from height is present as per instruction of BHEL Engineer. The safety nets shall be fire resistant, duly tested and shall be of ISI Mark and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.
9.1.25	All applicable OCPs (Operational control procedures) will be followed by contractor as per BHEL instructions. This will be done as part of normal scope of work. List of such OCPs is given below . In case any other OCP is found to

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	be applicable during the execution of work at site, then contractor will follow this as well, within quoted rate. These OCPs (applicable ones) will be made available to contractor during work execution at site. However for reference purpose, these are kept with Safety Officer of BHEL at the Power Sector Regional HQ, or available in downloadable format in the website, which may be refereed by contractor, if they so desire.
■	OCP for safe handling of chemicals
■	OCP for Electrical safety
■	OCP for energy conservation
■	OCP for safe welding and gas cutting operation
■	OCP for fire safety
■	OCP for safety in use of hand tools
■	OCP for first aid
■	OCP for food safety at canteen
■	OCP for safety in use of cranes
■	OCP for storage and handing of gas cylinders
■	OCP for manual arc welding
■	OCP for safe use of helmets
■	OCP for good house keeping
■	OCP for working at height
■	OCP for safe excavation
■	OCP for safe filling of Hydrogen in cylinder
■	OCP for illumination
■	OCP for handling and erection of heavy metals
■	OCP for safe acid cleaning
■	OCP for safe alkali boil out
■	OCP for safe oil flushing
■	OCP for steam blowing
■	OCP for safe working in confined area
■	OCP for safe operation of passenger lift, material hoists & cages
■	OCP for Vehicle maintenance
■	OCP for safe radiography
■	OCP for waste disposal
■	OCP for working at night
■	OCP for blasting
■	OCP for DG Set
■	OCP for handling & storage of mineral wool

Bharat Heavy Electricals Limited Power Sector – Eastern Region, Kolkata		
VOLUME-ID	TENDER NO. PSER:SCT:BAR-C1962:19	PAGE29OF47

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	■ OCP for drilling, reaming and grinding(machining) etc.
	■ OCP for hydraulic test
	■ OCP for spray insulation
	■ OCP for trial run of rotary equipment
	■ OCP for stress relieving
	■ OCP for material preservation
	■ OCP for cable laying/tray work
	■ OCP for electrical maintenance
	■ OCP for transformer charging
	■ OCP for safe handling of battery system
	■ OCP for computer operation
	■ OCP for storage in open yard
	■ OCP for sanitary maintenance
	■ OCP for batching
	■ OCP for piling rig operation
	■ OCP for gas distribution test
	■ OCP for cleaning of hotwell / deaerator
	■ OCP for electro-resistance heating
	■ OCP for compressor operation
	■ OCP for O&M of control of AC plant & system
	■ OCP for air compressor
	■ OCP for passivation
	■ OCP for Safe EDTA Cleaning
	■ OCP for Safe Chemical cleaning of Pre boiler system
	■ OCP for Safe Boiler Light up
	■ OCP for Safe Rolling and Synchronisation
	■ OCP for Safe Loading of Unit
9.2	SAFETY AND CLEANLINESS : The contractor shall take all necessary safety precautions and arrange for appropriate appliances as per discretion of BHEL or its authorised officials (Site Construction Manager) to prevent loss of human lives, injuries, to personnel engaged and damage to property. Before commencing the work, the contractor shall submit a "Safety Plan" to the above authorised BHEL official and obtain approval on the same. The safety plan shall indicate in detail the measures that would be taken by the contractor to ensure safety of men, equipment, materials and environment during execution of the work. This will also include an organization structure, role and responsibilities of the concerned key

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	personnel, the safety practices that will be followed, PPEs deployed, plan for handling critical activities and emergencies.
9.3	If the contractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions issued by the authorised BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the contractor.
9.4	During the course of construction, alternation or repairs, scrap with protruding nail, sharp edge etc and all other debris shall be kept clean from working areas, passage, ways and stairs in and around site.
9.5	Combustible scrap and debris shall be removed at regular intervals during the course of execution. Safe means shall be provided to facilitate such removal. The combustible scrap should be stored in safe place away from the plant materials to avoid fire accidents. The area shall be chosen in consultation with the Engineer and to be cordoned off.
9.6	Rigging equipment for materials handling shall be inspected prior to use in each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment will be removed from service.
9.7	Rigging equipment shall not be loaded in excess of its recommended safe working load. Rigging equipment, when not in use, shall be removed from the original work area so as not to present a hazard to employees.
9.8	Contractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the contractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.
9.9	Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the contractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The contractor shall be responsible for obtaining

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	the same.
9.10	Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.
9.11	When cylinders are transported by powered vehicle they shall be secured in a vertical position.
9.12	All workmen of the contractor working on construction area shall wear safety shoes, hand gloves, safety helmets and safety belt as applicable. The contractor shall provide to its workforce and ensure the use of following personnel protective equipment as found necessary and as directed by BHEL.
9.12.1	Safety Helmets conforming to IS-2925 : 1984
9.12.2	Safety Belts conforming to IS-3521:1983
9.12.3	Safety Shoes conforming to IS-1989 : 1978
9.12.4	Eye and face protection devices conforming to IS – 1179:1967, IS 5983:1980, IS 8521 Part 1:1977, IS 8521 Part 2: 1994.
9.12.5	Hand and body protection devices conforming to IS 4770:1991 and IS- 6994 : Part 1: 1973, IS – 8619 : 1977
9.12.6	Ear protection IS-9167:1979
9.12.7	Respiratory Protective Devices as per IS-9473:2002, i4746:1999 and 14166:1994
9.13	The contractor shall insure his workmen against all accidents and the policy shall be presented to BHEL Engineer on demand. Other wise, BHEL will arrange the same and the expenditure towards this will be debited to the contractor. In case of a fatal or disabling injury accident to any person at construction site due to lapses by the contractor, the victim and/or his/her dependants shall be compensated by the contractor as per statutory requirements. However, if considered necessary BHEL shall have the right to impose appropriate financial penalty on contractor and recover the same from payments due to the contractor for suitably compensating the victim and/or his/her dependence before imposing any such penalty. Appropriate enquiry shall be held by BHEL giving opportunity to the contractor for presenting his case. Above safety conditions are not exhaustive but gives an idea for the contractor and contractor shall adhere to all safety precaution given by the

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	Engineer at site.
9.14	The contractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations during night hours at the work spot as well as at the pre-assembly area.
9.15	The contractor shall be responsible for provision of all the safety notices and safety equipment as enjoined on him by the application of relevant statutory regulation / provisions and/or as called upon by BHEL from time to time. He shall be held responsible for any violation of statutory regulations (local, state or central) and BHEL instruction that may endanger safety of men, equipment and material.
9.16	The contractor shall provide temporary fencing wherever required as a safety measure against accident and damage to properties. Suitable caution notices shall be displayed where access to any part is found to be unsafe and hazardous.
9.17	Contractor shall ensure safety of all the workmen, material and equipment either belonging to him or to others working at site. He shall observe safety rules and codes applied by BHEL without exception.
9.18	It will be the responsibility of the contractor to ensure safe lifting of the equipment, taking due precaution to avoid any accident and damage to other equipment and personnel. All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the contractor by engaging only the COMPETENT PERSONS as per law. Defective equipment or uncertified shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.
9.19	The contractor shall provide necessary first aid facilities as per schedule III. In addition, ambulance facilities, OHC and CMO as per schedule IV, V, X and XI of BOCW Rules as applicable for all his employees, representatives and workmen at site and BHEL shall have no obligation in this regard. The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time. The contractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.
9.20	Training

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

9.20.1	The contractor shall arrange induction safety training for all employees before assigning work. In addition, awareness programme, mock drill at regular intervals and daily tool box meetings shall be arranged. Monthly report of the above to be given to BHEL safety Officer as per prescribed BHEL formats
9.20.2	All the contractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Contractor should nominate his supervisor to coordinate and implement the safety measures.
9.21	Contractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labour colony etc. Such fire protection equipment shall be easy and kept open at all times. The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders. All other fire safety measures as laid down in the "codes for fire safety at construction site" issued by safety coordinator of BHEL shall be followed. Non-compliance of the above requirement under fire protection shall in no way relieve the contractor of any of his responsibility and liabilities to fire accident occurring either to his materials or equipment or those of others. Emergency contacts nos must be displayed at prominent locations
9.22	The contractor shall at his cost, remove from vicinity of work at least once each day all combustible waste, scrap, painting materials, rubbish, unused or other materials and deposit them in places specified by BHEL to keep the work site clear and tidy. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.
9.23	The contractor shall not use any hand lamp energized by Electric power with supply voltage of more than 24 volts in confined spaces like inside water boxes, turbine casings, condensers etc.
9.24	All portable electric tools used by the contractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the contractor to carry out all types of electrical works. Details of earth resource and their test date to be given to BHEL safety officer as per the prescribed formats of BHEL
9.25	In case of any delay in completion of a job due to mishaps attributable to lapses by the contractor, BHEL shall have the right to recover cost of such delay from

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	the payments due to the contractor, after notifying the contractor suitably.
9.26	Valve protection caps shall be kept in place and secured.
9.27	The contractor shall be responsible for the safe storage and handling of his radio-active sources as per BARC rules and regulations.
9.28	Tarpaulin being inflammable should not be used (instead, only non infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.
9.29	If the contractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the contractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the contractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
9.30	If the contractor succeeds in carrying out its job in time with out any fatal or disabling injury accident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the contractor suitably for the performance.
9.31	The contractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.
9.32	The contractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site. BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the contractor. All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations. Area wise Electrical safety inspection is to be carried out on monthly basis as per "Electrical Safety Inspection checklist" and the report is to be submitted to BHEL safety officer
9.33	The contractor shall arrange adequate number of persons specifically for clearing any debris and for house keeping of the erection area including restacking of components in the erection areas. Housekeeping to be carried out

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	as per BHEL's checklist and report is to be submitted to BHEL safety officer
9.34	In case of any damage to property due to lapses by the contractor, BHEL shall have the right to recover the cost of such damages from the contractor after holding an appropriate enquiry.
9.35	The contractor shall submit report of all accidents, fires and property damage etc to the Engineer immediately after such occurrence, but in any case not later than 24 hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. In addition periodic reports on safety shall also be submitted by the contractor to BHEL from time to time as prescribed by the Engineer. Compiled monthly reports of all kinds of accidents, fires and property damage to be submitted to BHEL safety officer as per prescribed formats
9.36	Before commencing the work, the contractor shall appoint/nominate a responsible person to supervise implementation of all safety measures and liaison with his counterpart of BHEL.
9.37	Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders. When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ horizontal and 1 vertical.
9.38	Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the out side and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from savor, from swaying, from the building or structure.
9.39	Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

9.40	Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.
9.41	Wherever there are open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.
9.42	Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least $\frac{1}{4}$ " for each additional foot of length.
9.43	A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to Construction.
9.44	All personnel of the Contactor working within the plant site shall be provided with safety helmets. All welders shall wear welding goggles while doing welding work and all metal worker shall be provided with safety gloves. Persons employed on metal cutting and grinding shall wear safety glasses.
9.45	Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.
9.46	All trenches, four feet or more in depth, shall at all times be supplied with at least one ladder for each 30 m in length or fraction thereof. The ladder shall be extended from bottom of the trench to at least 90 cm above the surface of the ground. Sides of the trenches which are 1.50 m or more in depth shall be stepped back to give suitable slope or securely held by timer bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.
9.47.1	The contractor shall take permission of BHEL prior to risky jobs such as working at height, hot work, liftig activities, etc through permits. No job should be started without permits.
9.47.2	The Contactor shall take all measures at the sites of the work to protect all persons from accidents and shall be bound to bear the expenses of defense of

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	every suit, action or other proceeding at law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the Contractor be paid to compromise any claim by any such person should such claim proceeding be filed against BHEL, the Contractor hereby agrees to indemnify BHEL against the same.
9.48	Before any demolition work is commenced and also during the process of the work the following shall be ensured:
9.48.1	All roads and open areas adjacent to the work site shall either be closed or suitably protected.
9.48.2	No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.
9.48.3	All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.
9.49	All necessary personnel safety equipment as considered adequate by the Engineer should be kept available for the use of the persons employed in the Site and maintained in a condition suitable for immediate use and the Contractor should take adequate steps to ensure proper use of equipment by those concerned.
9.49.1	Workers employed on mixing asphalted materials, cement and lime mortars shall be provided with protective foot wear and protective goggles.
9.49.2	Those engaged in white washing and mixing or stacking of cement bags or any materials which is injurious to the eyes shall be provided with protective goggles.
9.49.3	Those engaged in welding works shall be provided with welder's protective eyesight lids.
9.49.4	Stone breakers shall be provided with protective goggles and protective clothing and seated sufficient to safe intervals.
9.49.5	Where workers are employed in sewers and manholes, which are in use, the Contractor shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into manhole, and the manholes so opened shall be cordoned off with suitable railing and provided

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	with warning signals or boards to prevent accident to the public.
9.49.6	The Contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precautions should be taken.
9.49.6.1	No paint containing lead or lead products shall be used except in the form of paste or ready made paint.
9.49.6.2	Suitably face masks should be supplied for use by the workers where paints are applied in the form of spray or a surface having lead paint dry rubbed and scrapped.
9.49.6.3	Overalls shall be supplied by the Contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
9.50	When the work is being done near any place where there is risk of drowning all necessary equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.
9.51	Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safe guards. Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers employed on electrical installations which are already energized, insulting mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.
9.52	All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near the places of work.
9.53	The contractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc as applicable, to enable inspection Agency for performing Inspection. If any test equipment is found not complying with proper safety

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.
9.54	The Contractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard. BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the contractor shall adhere to such instructions. BHEL may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.
9.55	All safety precautions shall be taken for welding and cutting operations as per IS-818. All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.
9.56	.All gas cylinders shall be stored in upright position. Suitable trolley shall be used. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced. No of cylinders shall not exceed the specified quantity as per OCP
9.57	These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent, place at work spot. The persons responsible for compliance of the safety code shall be named therein by the Contractor
9.58	To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangement made by the contract shall be open to inspection by the Engineer of the Engineer's Representative.
9.59	Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the contractor. Such cleanings has to be done by contractor within quoted rate, on daily basis by an identified group. If such activity is not carried out by contractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost alongwith BHEL overheads will be deducted from contractor's bill. Such decisions of BHEL shall be binding on the contractor.
9.60	Notwithstanding the above clauses there is nothing to exit the Contractor from the operations of any other Act or Rule in force in area of work in this respect. Provided always that all safety measures apart from those specifically provided in this agreement which are brought to the notice of the Contractor from time to time by the Engineer shall be complied by the Contractor. Provided further that

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	all consequences, damages, or losses arising by reason of any safety code shall be met with by the Contractor.																																																																
9.61	<u>NON COMPLIANCE:-</u> NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE CONTRACTOR AS UNDER <u>for every instance of violation noticed:</u> <table border="1"> <thead> <tr> <th>SN</th><th>Violation of Safety Norms</th><th>Fine (in Rs)</th></tr> </thead> <tbody> <tr><td>01</td><td>Not Wearing Safety Helmet</td><td>50/- *</td></tr> <tr><td>02.</td><td>Not wearing Safety Belt or not anchoring life line</td><td>100/-*</td></tr> <tr><td>03</td><td>Not wearing safety shoe</td><td>100/-*</td></tr> <tr><td>04</td><td>Not keeping gas cylinders vertically</td><td>100/-</td></tr> <tr><td>05</td><td>Not using flash back arrestors</td><td>50/-</td></tr> <tr><td>06</td><td>Not wearing gloves</td><td>50/- *</td></tr> <tr><td>07.</td><td>Grinding Without Goggles</td><td>50/- *</td></tr> <tr><td>08.</td><td>Not using 24 V Supply For Internal Work</td><td>500/-</td></tr> <tr><td>09.</td><td>Electrical Plugs Not used for hand Machine</td><td>100/-</td></tr> <tr><td>10.</td><td>Not Sliding property</td><td>200/-</td></tr> <tr><td>11.</td><td>Using Damaged Sling</td><td>200/-</td></tr> <tr><td>12.</td><td>Lifting Cylinders Without Cage</td><td>500/-</td></tr> <tr><td>13.</td><td>Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.</td><td>200/-</td></tr> <tr><td>14.</td><td>Not Removing Small Scrap From Platforms</td><td>200/-</td></tr> <tr><td>15.</td><td>Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting</td><td>200/-</td></tr> <tr><td>16.</td><td>Not Maintaining Electric Winches Which are Operated Dangerously</td><td>500/-</td></tr> <tr><td>17.</td><td>Improper Earthing Of Electrical T&P</td><td>500/-</td></tr> <tr><td>18</td><td>No or improper barricading</td><td>500/-</td></tr> <tr><td>19.</td><td>Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)</td><td>1000/-</td></tr> <tr><td>20.</td><td>Accident Resulting in Partial Loss in Earning Capacity</td><td>25,000/- per victim</td></tr> </tbody> </table>		SN	Violation of Safety Norms	Fine (in Rs)	01	Not Wearing Safety Helmet	50/- *	02.	Not wearing Safety Belt or not anchoring life line	100/-*	03	Not wearing safety shoe	100/-*	04	Not keeping gas cylinders vertically	100/-	05	Not using flash back arrestors	50/-	06	Not wearing gloves	50/- *	07.	Grinding Without Goggles	50/- *	08.	Not using 24 V Supply For Internal Work	500/-	09.	Electrical Plugs Not used for hand Machine	100/-	10.	Not Sliding property	200/-	11.	Using Damaged Sling	200/-	12.	Lifting Cylinders Without Cage	500/-	13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-	14.	Not Removing Small Scrap From Platforms	200/-	15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	200/-	16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-	17.	Improper Earthing Of Electrical T&P	500/-	18	No or improper barricading	500/-	19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-	20.	Accident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
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SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter - IX: HSE & OHSAS

	21.	Fatal Accident/Accidents Resulting in total loss in Earning Capacity	1,00,000/- per victim #
	Legend:-*: per head, #: or as deducted by Customer whichever is higher Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the contractor. The amount collected above will be utilized for giving award to the employees who could avoid accident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.		
9.61	CITATION:-If safety record of the contractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the contractor may be considered by BHEL after completion of the job		
9.62	MEMORANDUM OF UNDERSTANDING After Award Of Work, Contractors Are Required To Enter Into A Memorandum Of Understanding As Given Below: <u>Memorandum of Understanding</u> ➤ BHEL, Power Sector _____ Region is committed to Health, Safety and Environment Policy (EHS Policy). ➤ M/s _____ do hereby also commit to the same EHS Policy while executing the Contract Number _____ ➤ M/s _____ shall ensure that safe work practices not limited to the above are followed by all construction workers and supervisors. Spirit and content therein shall be reached to all workers and supervisors for compliance. ➤ BHEL will be carrying out EHS audits twice a year and M/s _____ shall ensure to close any non-conformity observed/reported within fifteen days. Signed by authorized representative of M/s -----		

SPECIAL CONDITIONS OF CONTRACT (SCC)
Chapter - IX: HSE & OHSAS

	Name : Place & Date:

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter-X: RA Bill Payments

10.0	RA Bill Payments
10.1	The contractor shall submit his monthly RA bills with all the details required by BHEL on specified date every month covering progress of work in all respects and areas for the previous calendar month.
10.2	Mode of payment and measurement of work completed shall be as per relevant clauses of General Conditions of Contract
10.3	Release of payment in each running bill including PVC Bills where ever applicable will be restricted to 95% of the value of work admitted as per stages of progressive pro rata payments.
10.4	The 5% thus remaining shall be treated as 'Retention Amount' and shall be released as per terms specified in the General Conditions of Contract.
10.5	The payment for running bills will normally be released within 30 days of submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc and other dues in the meanwhile. In case of Civil works, 60% of RA Bills complete and correct in all respects and certified by BHEL Engineer, shall be paid within 15 days of receipt. Balance payment shall be within 30 days.
10.6	BHEL shall release payment through Electronic Fund Transfer (EFT)/RTGS. In order to implement this system, Contractor to furnish details pertaining to his Bank Accounts where proceeds will be transferred through BHEL's banker, as per prescribed formats: Note: BHEL may also choose to release payment by other alternative modes as applicable
10.7	Paying Authority shall be the Construction Manager of the Site. Any change in the paying Authority shall be intimated to the Contactor accordingly.

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter-XI : Performance Monitoring

11.0	Performance Monitoring
11.1	Performance of the contractor is monitored through various reports/reviews and shall be jointly evaluated every month for unit wise identified packages as per prescribed formats. Based on the net weighted scores obtained, Contractors shall be rated 'Good' or 'Satisfactory' or 'Unsatisfactory'
11.2	In case of any dispute on performance rating and the contractor refuses to sign on the performance rating given by BHEL package Incharge, the same shall be reviewed by BHEL site Incharge/Construction Manager and his decision shall be final.
11.3	Release of RA Bills will be contingent upon joint evaluation of performance
11.4	Performance of the contractor will be taken into consideration for assessing the capacity of the bidder to execute future jobs under tender, as detailed in the Notice Inviting Tender. Risk of non evaluation or non availability of the Monthly performance evaluation reports is to be borne by the Bidder.
11.5	In case of 'Unsatisfactory performance' for a continuous period of three or more months for a package or packages, BHEL has the right to get the balance works executed at the risk and cost of the contractor.
11.6	In case of 'Unsatisfactory performance' in a financial year, BHEL reserves the right to put on hold such Contractors for a period of six months for similar package or similar packages

SPECIAL CONDITIONS OF CONTRACT (SCC)

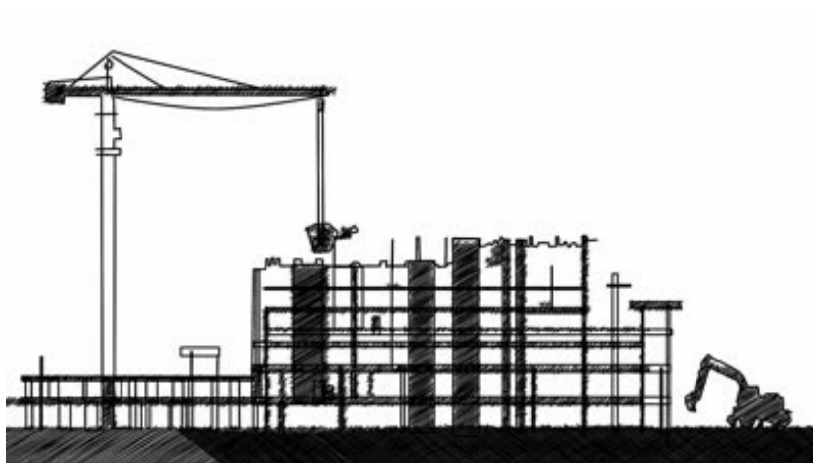
Chapter-XII: Suspension of Business Dealings

12.0	Suspension of Business dealings
12.1	BHEL reserves the right to take action against contractors who fail to perform or indulge in malpractices, by suspending business dealings with them.
12.2	Suspension could be in the form of 'Hold', 'De-listing' or 'Banning' a contractor.
12.3	A bidder may be put on HOLD for a period of 6 months, for future tenders for specific works on the basis of one or more of the following reasons: a) Bidder does not honour his own offer or any of its conditions within the validity period. b) Bidder fails to respond against three consecutive enquires of BHEL. c) After placement of order, Bidder fails to execute a contract. d) Bidder fails to settle sundry debt account, for which he is legitimately liable, within one year of its occurrence. e) Bidder's performance rating falls below 60% in specific category (more fully described in chapter 'Performance Monitoring') f) Bidder works are under strike/ lockout for a long period.
12.4	A Bidder may be de-listed from the list of registered Bidders of the region for a period of 1 year on the basis of one or more of the following reasons:- a) Bidder tampers with tendering procedure affecting ordering process or commits any misconduct which is contrary to business ethics. b) Bidder has substituted, damaged, failed to return, short returned or unauthorizedly disposed off materials/ documents/ drawings/ tools etc of BHEL. c) Bidder no longer has the technical staff, equipment, financial resources etc. required to execute the orders/ contracts.
12.5	A Bidder can be banned from doing any business with all Units of BHEL for a period of 3 years on the basis of one or more of the following reasons: a) Bidder is found to be responsible for submitting fake/ false/ forged documents, certificates, or information prejudicial to BHEL's interest. b) In spite of warnings, the Bidder persistently violates or circumvents the provisions of labour laws/ regulations/ rules and other statutory requirements. c) Bidder is found to be involved in cartel formation

SPECIAL CONDITIONS OF CONTRACT (SCC)

Chapter-XII: Suspension of Business Dealings

	d) The Bidder has indulged in malpractices or misconduct such as bribery, corruption and fraud, pilferage etc which are contrary to business ethics. e) The Bidder is found guilty by any court of law for criminal activity/ offences involving moral turpitude in relation to business dealings. f) The Bidder is declared bankrupt, insolvent, has wound up or been dissolved; i.e ceases to exist for all practical purposes. g) Bidder is found to have obtained Official Company information/ documentation by questionable means. h) Communication is received from the administrative Ministry of BHEL to ban the Bidder from business dealings.
12.6	Contracts already entered with a contractor before the date of issue of order of 'HOLD' or 'DE-LISTING' shall not be affected.
12.7	All existing contracts with a 'BANNED' contractor shall normally be short closed
12.8	Once the order for suspension is passed, existing offers/new offers of the contractor shall not be entertained
12.9	The above guidelines are not exhaustive but enunciate broad principles governing action against contractors



HEALTH, SAFETY and ENVIRONMENT PLAN

for

**SITE
OPERATIONS**

by

**SUB-
CONTRACTORS**

POWER SECTOR

HSE PLAN FOR SITE OPERATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

BEFORE START	SIGNING OF MOU	
	Agree to comply to HSE requirement- Statutory and BHEL's	
PLAN	HSE ORGANISATION	
	Manpower 1 (one) safety officer for every 500 workers or part thereof 1(one) safety-steward/ supervisor for every 100 workers Qualification As per Cl. 7.1	HSE Roles and responsibilities - Site In-charge- As per clause 7.2.1 - Safety officer- As per clause 7.2.2
PROVIDE	HSE Planning	
	for Man , Machinery/Equipment/Tools & Tackles	
TRAIN	HSE INFRASTRUCTURE	
	- PPEs - Drinking Water - Washing Facilities - Latrines and Urinals - Provision of shelter for rest - Medical facilities	- Canteen facilities - Labour Colony - Emergency Vehicle - Pest Control - Scrapyard - Illumination
COMMUNICATE	HSE TRAINING , AWARENESS & PROMOTION	
	Training - Induction training - Height work and other critical areas - Tool Box talk & Pep Talk	Awareness & Promotion - Signage - Poster - Banner - Competition - Awards
	HSE COMMUNICATION	
	Incident Reporting - Accident- Fatal & Major - Property damage - Near Miss	Event Reporting - Celebrations - Training - Medical camp

EXECUTE SAFELY**OPERATIONAL CONTROL PROCEDURES****PERMIT TO WORK**

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

SAFETY DURING WORK EXECUTION

• Welding • Rigging • Cylinder- storage & Movement • Demolition work • T&Ps • Chemical Handling • Electrical works	• Fire • Scaffolding • Height work • Working Platform • Excavation • Ladder • Lifting • Hoisting appliance

HOUSE KEEPING**WASTE MANGEMENT****TRAFFIC MANAGEMENT****ENVIRONMENTAL CONTROL****EMERGENCY PREPAREDNESS AND RESPONSE PLAN****CHECKS****HSE AUDITS & INSPECTION**

• Daily Checks • Inspection of PPEs • Inspection of T& Ps • Inspection of Cranes & Winches	• Inspection of Height work • Inspection of Welding and Gas cutting • Inspection of elevators etc

HSE PERFORMANCE EVALUATION PARAMETERS**NON CONFORMANCE****PENALTY for NON CONFORMANCE****Refer Clause 16****Incremental penalty**

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

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



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS**

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 1 of 43

Sr. No.	Description	Page No.
1.0	PURPOSE	4
2.0	SCOPE	4
3.0	OBJECTIVES AND TARGETS	4
4.0	HEALTH, SAFETY & ENVIRONMENT POLICY	5
5.0	MEMORANDUM OF UNDERSTANDING	6
6.0	TERMS & DEFINITIONS	7
7.0	HSE ORGANIZATION	8
7.1	QUALIFICATION FOR HSE PERSONNEL	8
7.2	RESPONSIBILITIES	9
8.0	PLANNING BY SUBCONTRACTOR	11
8.1	MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS	11
8.2	MOBILISATION OF MANPOWER BY SUBCONTRACTOR	11
8.3	PROVISION OF PPES	12
8.4	ARRANGEMENT OF INFRASTRUCTURE	13
9.0	HSE TRAINING & AWARENESS	16
9.1	HSE INDUCTION TRAINING	16
9.2	HSE TOOLBOX TALK	17
9.3	TRAINING ON HEIGHT WORK	17
9.4	HSE TRAINING DURING PROJECT EXECUTION	17



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 2 of 43

9.5	HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC	18
10.0	HSE COMMUNICATION	18
10.1	INCIDENT REPORTING	18
10.2	HSE EVENT REPORTING	18
11.0	OPERATIONAL CONTROL	19
11.1	HSE ACTIVITIES	19
11.2	WORK PERMIT SYSTEM	20
11.3	SAFETY DURING WORK EXECUTION	20
11.4	ENVIRONMENTAL CONTROL	24
11.5	HOUSEKEEPING	24
11.6	WASTE MANAGEMENT	25
11.7	TRAFFIC MANAGEMENT SYSTEM	26
11.8	EMERGENCY PREPAREDNESS AND RESPONSE	28
12.0	HSE INSPECTION	29
12.1	DAILY HSE CHECKS	29
12.2	INSPECTION OF PPE	29
12.3	INSPECTION OF T&Ps	30
12.4	INSPECTION OF CRANES AND WINCHES	30
12.5	INSPECTION ON HEIGHT WORKING	30
12.6	INSPECTION ON WELDING AND GAS CUTTING OPERATION	30



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS**

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 3 of 43

12.7	INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES	31
12.8	INSPECTION OF ELEVATOR	31
13.0	HSE PERFORMANCE	31
14.0	HSE PENALTIES	32
15.0	OTHER REQUIREMENTS	32
16.0	NON COMPLIANCE	33
17.0	HSE AUDIT/INSPECTION	34
18.0	MONTHLY HSE REVIEW MEETING	34
19.0	FORMATS USED	34
20.0	Annexures	36

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 4 of 43

1.0 PURPOSE

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

2.0 SCOPE

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

3.0 OBJECTIVES AND TARGETS

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

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



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 5 of 43

POWER SECTOR

HSE TARGETS

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

4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY

Power Sector HSE Policy

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

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

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

Sd/-

Date: 01.05.2013

Director (Power)

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 6 of 43

5.0 MEMORANDUM OF UNDERSTANDING:

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

Memorandum of Understanding

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

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

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

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

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

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

Name :

Place & Date:

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 7 of 43

6.0 TERMS AND DEFINITIONS

6.1 DEFINITIONS

6.1.1 INCIDENT

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

6.1.2 NEAR MISS

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

6.1.3 MAN-HOUR WORKED

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

6.1.4 FIRST AID CASES

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

6.1.5 LOST TIME INJURY

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

6.1.6 MEDICAL CASES

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

6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

Non-Reportable Cases:

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 8 of 43

Reportable Cases:

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

Injury Cases:

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

6.1.8 TOTAL REPORTABLE FREQUENCY RATE

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

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

6.1.9 SEVERITY RATE

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

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

6.1.10 INCIDENCE RATE

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

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

7.0 HSE ORGANISATION**Number of safety officers:**

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

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

7.1 QUALIFICATION FOR HSE PERSONNEL

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS		Doc no.: HSEP: 14
	POWER SECTOR		REV: 00
			Date: 12.08.2014
			Page: 9 of 43

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

7.2 RESPONSIBILITIES

7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 10 of 43

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

7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 11 of 43

8.0 PLANNING BY SUBCONTRACTOR

8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

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

8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 12 of 43

8.3 PROVISION OF PPEs

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

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

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

Relevant is-codes for personal protection

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 13 of 43

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

Colour scheme for Helmets:

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

8.4 ARRANGEMENT OF INFRASTRUCTURE

8.4.1 DRINKING WATER

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

8.4.2 WASHING FACILITIES

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

8.4.3 LATRINES AND URINALS

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 14 of 43

8.4.4 PROVISION OF SHELTER DURING REST

Proper Shed & Shelter shall be provided for rest during break

8.4.5 MEDICAL FACILITIES

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

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

8.4.5.2 FIRST AIDER

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

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

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

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

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 15 of 43

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

8.4.6 PROVISION OF CANTEEN FACILITY

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

8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY

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

8.4.8 PROVISION OF EMERGENCY VEHICLE

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

8.4.9 PEST CONTROL

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

8.4.10 SCRAPYARD

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

8.4.11 ILLUMINATION

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 16 of 43

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

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

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

9.0 HSE TRAINING& AWARENESS

9.1 HSE INDUCTION TRAINING

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

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 17 of 43

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

9.2 HSE TOOLBOX TALK

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

9.3 TRAINING ON HEIGHT WORK

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

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

9.4 HSE TRAINING DURING PROJECT EXECUTION

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 18 of 43

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

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

9.5.1 Display of HSE posters and banners

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

9.5.2 Display of HSE signage

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

9.5.3 Competition on HSE and award

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

9.5.4 HSE awareness programme

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

10.0 HSE COMMUNICATION

10.1 INCIDENT REPORTING

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

10.2 HSE EVENT REPORTING

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 19 of 43

11.0 OPERATIONAL CONTROL

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

LIST OF OCPs

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

11.1 HSE ACTIVITIES

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

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 20 of 43

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

11.2 WORK PERMIT SYSTEM

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

11.3 SAFETY DURING WORK EXECUTION

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

11.3.1 WELDING SAFETY

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

11.3.2 RIGGING

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

11.3.3 CYLINDERS STORAGE AND MOVEMENT

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 21 of 43

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

11.3.4 DEMOLITION WORK

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

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

11.3.5 T&Ps

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

11.3.6 CHEMICAL HANDLING

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

11.3.7 ELECTRICAL SAFETY

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 22 of 43

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

11.3.8 FIRE SAFETY

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

11.3.9 SCAFFOLDING

- Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders.
- When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ horizontal and 1 vertical.
- Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the out side and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from savor, from swaying, from the building or structure.

11.3.10 WORK AT HEIGHT:

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 23 of 43

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

11.3.11 WORKING PLATFORM

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

11.3.12 EXCAVATION

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

11.3.13 LADDER SAFETY

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

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

11.3.14 LIFTING SAFETY

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 24 of 43

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

11.3.15 HOISTING APPLIANCE

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

11.4 ENVIRONMENTAL CONTROL

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

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

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

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

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

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

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

11.5 HOUSEKEEPING

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 25 of 43

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

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

11.6 WASTE MANAGEMENT

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

11.6.1 BINS AT WORK PLACE

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

11.6.2 STORAGE AND COLLECTION

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 26 of 43

11.6.3 SEGREGATION

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

11.6.4 DISPOSAL

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

11.6.5 WARNING AND SIGNS

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

11.7 TRAFFIC MANAGEMENT SYSTEM

11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 27 of 43

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

11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

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

11.7.3 WORK VEHICLE

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

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 28 of 43

11.7.4 DAILY CHECK BY DRIVER

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

11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

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

11.7.6 MAINTENANCE

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

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

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

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 29 of 43

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

12.0 HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSEMS requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test etc as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

12.1 DAILY HSE CHECKS

Both the Site Supervisors and safety officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

- Personal Safety wears & gear compliance.
- Complying with site safety rules and permit-to-work (PTW).
- Positions and postures of workers.
- Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

12.2 INSPECTION OF PPE

- PPEs shall be inspected by HSE officer at random once in a week as per format no. HSEP:13-F06 for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 30 of 43

12.3 INSPECTION OF T&Ps

- A master list of T&Ps shall be maintained by each subcontractor.
- All T&Ps being used at site shall be inspected by HSE officer once in a month as per format no. HSEP:13-F07 for its healthiness and maintenance.
- The T&Ps which require third party inspection shall be checked for its validity during inspection. The third party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.
- The validity of T&P shall be monitored as per "Status of T&Ps" format no. HSEP:13-F08

12.4 INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by HSE officer once in a month as per format no. HSEP:13-F09 for healthiness, maintenance and validity of third party inspection.
- The date of third party inspection and next due date shall be painted on cranes and winches.
- The operators/drivers shall be authorized by sub-contractor based on their competency and experience and shall carry the I-card.
- The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

12.5 INSPECTION ON HEIGHT WORKING

- Inspection on height working shall be conducted daily by supervisors before start of work to ensure safe working condition including provision of
 - o Fall arrestor
 - o Lifelines
 - o Safety nets
 - o Fencing and barricading
 - o Warning signage
 - o Covering of opening
 - o Proper scaffolding with access and egress.
 - o Illumination
- Inspection on height working shall be conducted once in a week by HSE officer as per format no. HSEP:14-F10.
- Medical fitness of height worker shall be ensured.
- Height working shall not be allowed during adverse weather.

12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

- Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
- Gas cylinders shall be kept upright.
- Use of Flash back arrestor shall be ensured at both ends.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 31 of 43

- Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per format no. HSEP:14-F11.
- Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
- Availability of fire extinguisher at vicinity shall be ensured.

12.7 INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no. HSEP:14-F12.

12.8 INSPECTION OF ELEVATOR

- Elevators shall be inspected by concerned supervisors once in a week as per format no. HSEP:14-F13.
- All elevators shall be inspected by competent person and validity shall be ensured.
- The date of third party inspection and next due date shall be painted on elevator.

13.0 HSE PERFORMANCE

HSE performance of the subcontractor shall be monitored as per the following parameters:

Sl. No.	Parameters of measurement
1	Timely deployment of qualified safety officer and cumulative number of days in a month the required no. of qualified safety officer is available
2	Shortfall in number of meetings in the month conducted or attended by the safety officer
3	Level of compliance wrt decisions taken in previous meetings/audit/inspection/as reported.
4	Delay in submission of monthly report on safety in the prescribed format
5	Delay in reporting any incident including near-miss to BHEL /Customer/statutory authority(if required)
6	Degree of PPE non-compliance
7	Non- conducting of health check-up as per BOCW equirements
8	Non availability of proper first-aid facility , ambulance, adequate labour welfare initiatives
9	Non conductance of induction training and tool box meeting
10	Total number of instances in the month, House keeping NOT attended inspite of instructions by BHEL i.e. removal/disposal of surplus earth/ debris/scrap/unused/surplus cable drums/other electrical items/surplus steel items/packing material

- Suitable HSE reward system shall be developed at site level to promote HSE compliance amongst workmen.
- To decide HSE reward performance towards HSE shall be evaluated for workmen and it shall be awarded regularly in public gathering.
- If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 32 of 43

14.0 HSE PENALTIES

- As per contractual provision HSE penalties shall be imposed on subcontractors for non-compliance on HSE requirement as per format no. HSEP:14-F14. The list in the format is only indicative. For any other violation, not listed in the format, the minimum penalty amount is to be decided as per BOCW act.
- If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.
- The penalty amount shall be recovered by Site Finance department from subcontractors from the RA/Final bill.

15.0 OTHER REQUIREMENTS

- In case of any delay in completion of a job due to mishaps attributable to lapses by the subcontractor, BHEL shall have the right to recover cost of such delay from the payments due to the subcontractor, after notifying the subcontractor suitably.
- If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps at the risk and cost of the subcontractor after giving a notice of not less than 7 days indicating the steps that would be taken by BHEL.
- If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.
- In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.
- The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.
- The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.
- The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.
- BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 33 of 43

- BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

16. NON COMPLIANCE

NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND BHEL HAS RIGHT TO IMPOSE FINES ON THE SUBCONTRACTOR AS UNDER FOR EVERY INSTANCE OF VIOLATION NOTICED:

SN	Violation of Safety Norms	Fine (in Rs)
01.	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03.	Not wearing safety shoe	200/-*
04.	Not keeping gas cylinders vertically	200/-
05.	Not using flash back arrestors	100/-
06.	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Sliding properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18.	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

- Legend:-

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the subcontractor. The amount collected above will be utilized for giving award to the employees who could avoid incident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 34 of 43

17.0 HSE AUDIT/INSPECTION

- Regular HSE Audit/inspection shall be carried out by Subcontractor as per Site HSE audit calendar.
- HSE checklist(**Annexure 02**) shall be used for carrying out audit/inspection and report shall be submitted to BHEL site management
- All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed off by site in a time bound manner and reported back the implementation status
- Corrective action and Preventive action on HSE issues raised by certification body issued by Regional HQs shall be implemented by site and reported to Site management.

18.0 MONTHLY HSE REVIEW MEETING

- Site shall hold HSE review meeting every month to discuss and resolve HSE issues of site and improve HSE performance. It will also discuss the incidents occurred since previous meeting, its root cause and Corrective action and Preventive action. The agenda is given below:
 - Implementation of earlier MOM
 - HSE performance
 - HSE inspection
 - HSE audit and CAPA
 - HSE training
 - Health check-up camp
 - HSE planning for the erection and commissioning and installation activities in the coming month
 - HSE reward and promotional activities
- The meeting shall be chaired by Construction Manager, convened by HSE coordinator and attended by all HOS, Site Incharge of Subcontractors and HSE officer of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

19.0 FORMATS USED (Details available in Annexure-04)

SL. No.	Format Name	Format No.	Rev No.
01	Inspection of First Aid Box	HSEP:13-F01	00
02	Health Check Up	HSEP:13-F02	00
03	HSE Induction Training	HSEP:13-F03	00
04	Tool Box Talk	HSEP:13-F04	00
05	Monthly Site HSE Report	HSEP:13-F05	00
06	Inspection of PPE	HSEP:13-F06	00



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS**

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: **35 of 43**

07	Inspection of T&Ps	HSEP:13-F07	00
08	Status of T&Ps	HSEP:13-F08	00
09	Inspection of Cranes and Winches	HSEP:13-F09	00
10	Inspection on Height Working	HSEP:13-F10	00
11	Inspection on Welding & Gas Cutting	HSEP:13-F11	00
12	Inspection on Electrical Installation	HSEP:13-F12	00
13	Inspection on Elevator	HSEP:13-F13	00
14	HSE Penalty	HSEP:13-F14	00
15	Accident /incident / property damage /fire incident report	HSEP:13-F15	00

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 36 of 43

20.0 ANNEXURES

ANNEXURE 01

As per Contract Labour (Regulation & Abolition Act), Central Rules, 1971,

- (1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

(a) For establishments in which the number of contract labour employed does not exceed fifty, each first aid box shall contain the following equipment:

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labour Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

(b) For establishment in which the number of contract labour exceeds fifty each first-aid box shall contain the following equipment:

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS**

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 37 of 43

(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recoupment of the equipment when necessary.

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14 REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 38 of 43

ANNEXURE 02**HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT**

PROJECT: _____

SUBCONTRACTOR: _____

DATE : _____

OWNER : _____

INSPECTION BY: _____

Note : write 'NA' wherever the items is not applicable

Item	Y e s	N o	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Passageways and walkways clear				
General neatness of working area				
Other				
PERSONNEL PROTECTIVE EQUIPMENTS				
Goggles; shields				
Face protection				
Hearing protection				
Respiratory masks etc.				
Safety belts				
Other				
EXCAVATIONS / OPENINGS				
Openings properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				
WELDING, CUTTING				
Gas cylinders chained upright				
Cable and hoses not obstructing				
Fire extinguisher (s) accessible				
Others				
SCAFFOLDING				
Fully decked platforms				
Guard and intermediate rails in place				
Toe boards in place				
Adequate shoring				
Adequate access				
Others				
LADDER				
Extension side rails 1 m above				
Top of landing				
Properly secured				



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 39 of 43

POWER SECTOR

Angle + 70° from horizontal				
Other				
HOISTS, CRANES AND DERRICKS				
Condition of cables and sheaf OK				
Condition of slings, chains, hooks OK				
Inspection & maintenance log maintained				
Outriggers used				
Signals observed and understood				
Qualified operators				
Others				
MACHINERY, TOOLS & EQUIPMENT				
Proper instruction				
Safety devices				
Proper cords				
Inspection and maintenance				
Other				
VEHICLE AND TRAFFIC				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Other				
TEMPORARY FACILITIES				
Emergency instructions posted				
Fire extinguishers provided				
Fire-aid equipment available				
General neatness				
Others				
FIRE PREVENTION				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas.				
Hydrants				
Clearance				
Others				
ELECTRICAL				
Proper wiring				
ELCB's provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Other				
HANDLING & STORAGE OF MATERIALS				
Properly stored or stacked				
Passageways clear				
Other				
FLAMMABLE GASES AND LIQUIDS				
Containers clearly identified				
Proper storage				
Fire extinguisher nearby				



**HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS**

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: **40 of 43**

Other				
WORKING AT HEIGHT				
Safety nets				
Safety belts				
Safety helmets				
Anchoring of safety belt to the life line rope				
ENVIRONMENT				
Lubricant waste/engine oils properly dispose.				
Waste from Canteen, offices, sanitation etc. disposed properly.				
Disposal of surplus earth, stripping materials, expired batteries, oily rags and combustible materials done properly.				
HEALTH CHECKS				
Hygienic conditions at labor camps O.K.				
Availability of first-aid facilities				
Proper sanitation at site, office & labor camps.				
Arrangement of medical facilities.				
Measures for dealing with illness.				
Availability of potable drinking water for workmen & staff.				
Provision of crèches for children.				

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 41 of 43

ANNEXURE 03**REFERENCES**

- Contract documents
- Relevant legislations
- HSEMSM
- Relevant Indian standards as listed below (illustrative only):

SL NO	CODE NAME	TITLE
(1)	IS : 818-1888 (Reaffirmed 2003)	Code of Practice for safety and health requirements in Electric and Gas Welding and Cutting operations.
(2)	IS: 1179-1967 (Reaffirmed 2003)	Specification for Equipment for Eye & Face protection during welding.
(3)	IS : 1989 (Part 2):1986 (Reaffirmed 1997)	Specification for Leather Safety Boots & Shoes
(4)	IS:2925 – 1984 (Reaffirmed 2010)	Specification for Industrial Safety Helmets
(5)	IS:3521 : 1999 (Reaffirmed 2002)	Industrial Safety Belts & Harnesses-Specification
(6)	IS:3646(Part II) – 1966 (Reaffirmed 2003)	Code of Practice for Interior Illumination
(7)	IS:3696 (Part I) – 1987 (Reaffirmed 2002)	Safety Code for Scaffolds and Ladders
(8)	IS: 3696(Part 2) : 1991 (Reaffirmed 2002)	Scaffolds and Ladders-Code of Safety
(9)	IS:3786 – 1983 (Reaffirmed 2002)	Method for Computation of Frequency and Severity Rates for Industrial Injuries and Classification of Industrial Incidents
(10)	IS:4770 : 1991 (Reaffirmed 2006)	Rubber Gloves – Electricals purposes-Specification
(11)	IS:4912 : 1978 (Reaffirmed 2002)	Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
(12)	IS: 5983 – 1980 (Reaffirmed 2002)	Specification for Eye-Protectors
(13)	IS:6519 – 1971 (Reaffirmed 1997)	Code of Practice for Selection, Care and Repair of Safety Footwear
(14)	IS:9167:1979	Specification for Ear-Protectors
(15)	IS:6994(Part I)-1973 (Re affirmed 1996)	Specification for Industrial Safety Gloves Leather and Cotton Gloves
(16)	IS:8519 – 1977 (Reaffirmed 1983)	Guide for Selection of Industrial Safety Equipment for Body Protection.
(17)	IS 11006 : 2011	Flash Back(Flame Arrestor) Specification

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 42 of 43

(18)	IS:8520 – 1977 (Reaffirmed 2002)	Guide for Selection of Industrial Safety Equipment for Eye, Face and Ear Protection.
(19)	IS:9473:2002	Respiratory Protective Devices-Filtering Half Masks to protect against Particles-Specification.
(20)	IS:9944:1992 (Reaffirmed 2003)	Natural and Man-made Fiber Rope Slings-Recommendations on Safe working loads.
(21)	IS:11057 – 1884 (Reaffirmed 2001)	Specification for Industrial Safety Nets
(22)	IS:12254:1993 (Reaffirmed 2002)	Polyvinyl Chloride (PVC) Industrial Boots-Specification
(23)	IS:13367(Part 1):1992 (Reaffirmed 2003)	Safe Use of Cranes-Code of Practice
(24)	IS:14166:1994 (Reaffirmed 2002)	Respiratory Protective Devices-Full Face Masks Specification
(25)	IS:14746 : 1999 (Reaffirmed 2003)	Respiratory Protective Devices-Half Masks and Quarter Masks - Specification
(26)	IS : 15397 :2003 (Reaffirmed 2008)	Portable Extinguisher Mechanical Foam Type(Stored Pressure)-Specification
(27)	IS: 19011:2002	Guidelines for Quality and/or Environmental Management Systems Auditing

	HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS	Doc no.: HSEP: 14
		REV: 00
	POWER SECTOR	Date: 12.08.2014
		Page: 43 of 43

ANNEXURE 04 : SAFETY FORMATS
&
ANNEXURE 05 : WORK PERMIT FORMATS

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:13-F01

REV NO.: 00

PAGE NO. 01 OF 02

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Number of employees on the site:- _____

Sl.No.	Item	No. Available	Remarks
1	No. of small sterilized dressings		
2	No of medium sized sterilized dressings		
3	No of large sized sterilized dressings.		
4	No of large sized sterilized burn dressings		
5	No of (15 grams) packets sterilized cotton wool		
6	No of pieces of sterilized eye pads in separate sealed packets.		
7	No of roller bandages 10 cm wide.		
8	No of roller bandages 5 cm wide.		
9	Whether tourniquet available		
10	Whether supply of suitable splints available.		
11	No of packets of safety pins.		
12	Whether kidney tray available		
13	Whether sufficient number of eye wash bottles, filled with distilled water or suitable liquid, clearly indicated by a distinctive sign which shall be visible at all times, available.		
14	Whether 4%-xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops available.		
15	Whether (60ml) bottle containing a two percent alcoholic solution of iodine available		
16	Whether (two hundred ml) bottle of mercurochrome (2 per cent) solution in water available.		

**POWER SECTOR****INSPECTION OF FIRST AID BOX**

FORMAT NO: HSEP:13-F01

REV NO.: 00

PAGE NO. 02 OF 02

Sl.No.	Item	No. Available	Remarks
17	Whether 120ml bottle containing Sal volatile having the dose and mode of administration indicated on the label, available.		
18	Whether roll of adhesive plaster (6 cmX1 meter) available		
19	No of rolls of adhesive plaster (2 cmX1 meter)		
20	Whether snake bite lancet available.		
21	Whether (30 grams) bottle of potassium permanganate crystals available.		
22	Whether a pair scissors available		
23	Whether copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labour Institutes, Government of India available.		
24	Whether bottle containing 100 tablets (each of 5 grains) of aspirin available		
25	Whether Ointment for burns available		
26	Whether bottle of a suitable surgical anti septic solution available		

Signature of Subcontractor's Site I/C::

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:13-F02

REV NO.: 00

PAGE NO. 01 OF 02

Name of Site :	
Name of Sub-Contractor :	
Name of Employee :	

NAME:

History Of Past Illness	H/O Epilepsy	
	H/O Drug Allergy	
	H/O Diabetics/ Hypertension	
	H/O Unconsciousness	
Personal History		
EXAMINATION		OBSERVATION
<u>General Physical Examination</u>		
Height	:	
Weight	:	
BMI	:	
Built And nourishment	:	
Pallor	:	
Temperature	:	
Chest Expansion	:	Inspiration Expansion
Lymph Node Enlargement	:	
<u>Ear, Nose, Throat</u>	:	
Ear	:	
Nose	:	
Throat	:	

**POWER SECTOR****HEALTH CHECK UP**

FORMAT NO: HSEP:13-F02

REV NO.: 00

PAGE NO. 02 OF 02

EXAMINATION	OBSERVATION
<u>Cardiovascular System Examination :</u>	
Inspection :	
Palpation :	Pulse BP
Auscultation (Heart Sounds) :	
<u>Respiratory System :</u>	
Inspection :	Respiratory Rate
Palpation:	
Percussion :	
Auscultation (Breath Sounds) :	
<u>Examination of Abdomen :</u>	
Inspection :	
Palpation :	
Auscultation (Bowel Sounds) :	
Any Other :	
Clinical Impression	

Signature of the examining doctor

	POWER SECTOR	FORMAT NO: HSEP:13-F03 REV NO.: 00 PAGE NO. 01 OF 01
	HSE INDUCTION TRAINING	

Name of Site :	
Name of Sub-Contractor :	
Date :	
Name of Training Co-ordinator	

Sl No.	Name	Designation	Organisation	Signature

Signature of Training co-ordinator :

	POWER SECTOR	FORMAT NO: HSEP:13-F04 REV NO.: 00 PAGE NO. 01 OF 01
	TOOL-BOX TALK	

Name of Site :	
Sub-Contractors Name :	
Date :	

Topic	Name of person delivered Tool Box Talk	No. of Participants attended	Remarks

Signature of Site I/C of Subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:13-F06 REV NO.: 00 PAGE NO. 01 OF 01
	PERSONAL PROTECTIVE EQUIPMENTS	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection :	

Item	Issued this Month	Nos. Issued up to the Month	Percentage of usage at site
Safety Helmet			
Safety Shoes			
Full Body Harness			
Fall Arrestor			
Safety Nets			
Other PPEs.			

Signature of Site I/C of Subcontractor :

**POWER SECTOR****INSPECTION OF T&Ps**

FORMAT NO: HSEP:13-F07

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site :	
Name of Sub-Contractor :	
Date of Inspection :	

Sl.No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs / overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Site Safety Officer (BHEL)

Signature-Subcontractor/ Subcontractor's
Safety Officer

	POWER SECTOR	FORMAT NO: HSEP:13-F08 REV NO.: 00 PAGE NO. 01 OF 01
	STATUS OF T&Ps	

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

Item	Nos. Deployed	Identification No.	Nos. Tested by competent person	Validity of Test Certificate
Winches				
Chain Blocks				
Wire Rope Slings				
Man Cages				
D-Shackles				
Air Compressors				
Crawler Cranes				
Mobile Cranes				
Hydra Cranes				
Others				

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:13-F09 REV NO.: 00 PAGE NO. 01 OF 03
	INSPECTION OF CRANES AND WINCHES	
Name of Site :		
Name of Sub-Contractor :		
Inspected by :		
Date of Inspection:		

Crane Reg. No (Make/Model) _____

Name of Driver/Operator _____

Sl.no.	Description	Observation	Measures
1	Valid Driving license		
2	Hook & Hook Latch		
3	Over Hoist limit switch		
4	Boom limit switch		
5	Boom Angle Indicator		
6	Boom limit cutoff switch		
7	Condition of Boom		
8	Condition of ropes		
9	Number of load lines		
10	Size and condition of the slings		
11	Stability of the cranes		
12	Soil Condition		
13	Swing Break And Lock		
14	Proper Break And Lock		
15	Hoist Break And Lock		
16	Boom Break And Lock		
17	Main Clutch		
18	Leakage in Hydraulic Cylinders		
19	Out riggers fully extendable		
20	Tyre pressure		
21	Condition of Battery And Lamps		

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 02 OF 03

Sl.no.	Description	Observation	Measures
22	Guards of moving and rotating parts		
23	Load chart provided		
24	Number and position of pedant ropes		
25	Reverse Horn		
26	Load Test Details		
27	Operator's fitness		
28	Pollution under control certificate		
29	Fire extinguisher of appropriate type.		
30	Training of the operator		

WINCH

Sl. No.	Description	YES	NO	NA	Remarks
1	Has the copy of Third Party Inspection certificate been provided in winch machine shed?				
2	Is winch machine operator experienced enough to operate the winch machine?				
3	Is the winch machine operated by someone other than the winch machine operator?				
4	Is there guard provided in all moving parts like wheel and motor's shaft?				
5	Will it protect against unforeseen operational contingencies?				
6	Are brakes, clutch and locking arrangement working properly?				
7	Has it been ensured that the guard does not constitute a hazard by itself?				
8	Are the cranks and the connecting rods protected by guardrails?				
9	Is there provision for fully covered shed with wooden plank roof?				

**POWER SECTOR****INSPECTION OF CRANES AND WINCHES**

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 03 OF 03

Sl. No.	Description	YES	NO	NA	Remarks
10	Is wire rope free from any kind of damage or wear and tear?				
11	Is split pin provided for the protection of clutch and brake locking arrangement?				
12	Is pulley inspected by competent person and certified before use?				
13	Is pulley free from any wear and tear visually?				
14	Is winch rope barricaded with clipsheet for the protection of rope and person?				
15	Is the wire rope lubricated by cardium oil?				
16	Is there any friction in wire rope which may damage the wire rope rather than the rolling parts?				
17	Is there any oil leakage in the hydraulic system of the winch machine?				
18	Has it been ensured that the guard will not cause discomfort or inconvenience to operator?				
	Total Number of NO:				
	Total Number of NA:				
	% Compliance :				

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:13-F10 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF HEIGHT WORKING	

Name of Site :	
Name of Sub-Contractor :	
Inspected by :	
Date of Inspection:	

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
1	All the workers have been explained safe work method?		
2	An established communication system has been established and explained to the workers.		
3	Adequate illumination has been ensured.		
4	Work area inspected prior to the start of the work.		
5	Area below the work place barricaded, particularly below hot work.		
6	Workers provided with bags /box to carry bolts, nuts and hand tools		
7	Arrangement for fastening hand tools made.		
8	All work platforms ensured to be of adequate strength and ergonomically suitable.		
9	Fabricated makeshift arrangements are checked for quality and type of material welding, anchoring etc.		
10.	Work at more than one elevation at the same segment is restricted.		
	ACCESS/EGRESS		
1	Walkways provided with handrail, mid-rail and toe guard?		
2	All checkered plates, gratings properly welded/ bolted?		
3	Are ladders inspected and they are in good condition?		
4	Are ladders spliced?		
5	Are ladders properly secured to prevent slipping, sliding or falling?		
6	Do side rails extend 36" above top landing?		
7	Are built up ladders constructed of sound materials?		

	POWER SECTOR	FORMAT NO: HSEP:13-F10 REV NO.: 00 PAGE NO. 02 OF 02
	INSPECTION OF HEIGHT WORKING	

Sl. No.	Descriptions	Observation (Yes/No)	Remarks
8	Are rugs and cleats not over 12" on center?		
9	Metal ladders not used around electrical hazards.		
10	Proper maintenance and storage.		
11	Ladders placed at right slope.		
12	Ladders / staircases welded/ bolted properly.		
13	Any obstruction in the stairs.		
14	Are landing provided with handrails, knee rails, toe boards etc.?		
15	Whether ramp is provided with proper slope.		
16	Proper hand rails / guards provided in ramps.		
	Housekeeping		
1	Walkways, aisles & all overhead workplaces cleared of loose material.		
2	Flammable materials, if any, are cleared.		
3	All the de shuttering materials are removed after de shuttering is done.		
4	Platforms and walkways free from oil/grease or other slippery material.		
5	Collected scrap are brought down or lowered down and not dropped from height.		
	PPE And Safety Devices		
1	Use of safety helmet, safety belts ensured for all workers		
2	Anchoring points provided at all places of work.		
3	Common lifeline provided wherever linear movement at height is required.		
4	Safety nets are use wherever required.		
5	Proper fall arrest system is deployed at critical workplaces.		
6	Crawler boards/Safety system or works on fragile roof are used.		

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:13-F11 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF WELDING AND GAS CUTTING	

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Welding				
Sl.no.	Description	Y e s	N o	Remarks
1	Is electric connection given through 30 mA ELCB/RCCB to welding m/c?			
2	Is electric cable fitted properly in junction box on m/c?			
3	Is electrical cable free from joints?			
4	Are the joints attached firmly & insulated with tape?			
5	Is double earthing given to body of m/c?			
6	Is the physical condition of the m/c good?			
7	Is ON/OFF switch connected to the m/c is working and in good condition?			
8	Are indication lamps on m/c working?			
9	Is the electrode holder in good condition?			
10	Are the cables of the welding m/c lugged & tight properly?			
11	Are return lead connected properly (Rod, Angle, Channels shall not be used)			
	Total No of NO			
	Total No of YES			

	POWER SECTOR	FORMAT NO: HSEP:13-F11 REV NO.: 00 PAGE NO. 02 OF 02
	INSPECTION OF WELDING AND GAS CUTTING	

Gas Cutting				
Sl. no	Description	Yes	No	Remarks
1	Are Cylinders kept on trolleys?			
2	Physical condition of Gas cylinders Good?			
3	Is there Oil/Grease on valve of the cylinder?			
4	Are pressure regulators in good condition?			
5	Condition of hose pipe OK?			
6	Are hose pipe clamped with hose clip?			
7	Is flash back arrestor & NRV fitted on torch both for O2 and LPG cylinder?			
8	Is nozzle of the torch cleaned?			
	Total Number of NO			
	Total No of YES			
	% Compliance			

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:13-F12 REV NO.: 00 PAGE NO. 01 OF 02
	INSPECTION OF ELECTRICAL INSTALLATION	

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection:	

Sr. No.	Contents	Yes/No	Remarks
A	Cable		
1.	Whether the condition of cable is checked?		
2.	Are cables received from other sites checked for insulation resistance before putting them into use?		
3.	Are all main cables taken either underground / overhead?		
4.	Are welding cables routed properly above the ground?		
5.	Are welding and electrical cables overlapping?		
6.	Is any improper joining of cables/wires prevailing at site?		
B	DBs/SDBs		
1.	Is earth conductor continued upto DB / SDB?		
2.	Whether DBs and extension boards are protected from rain / water?		
3.	Is there any overloading of DBs / SDBs?		
4.	Are correct / proper fuses & CBs provided at main boards and sub-boards?		
5.	Is energized wiring in junction boxes, CB panels & similar places covered all times?		
C	ELCB		
1.	Whether the connections are routed through ELCB?		
2.	Is ELCB sensitivity maintained at 30 mA?		

	POWER SECTOR	FORMAT NO: HSEP:13-F12 REV NO.: 00 PAGE NO. 02 OF 02
	INSPECTION OF ELECTRICAL INSTALLATION	

Sr. No.	Contents	Yes/No	Remarks
3.	Are the ELCB numbered and tested periodically & test results recorded in a logbook countersigned by a competent person?		
D	Grounding		
1.	Is natural earthing ensured at the source of power (main DB at Generator or Transformer)?		
2.	Whether the continuity and tightness of the earth conductor are checked?		
3.	Mention the gauge of the earth conductor used at the site.		
4.	Mention the value of Earth Resistance.		
E	Electrically operated Machines or Accessories.		
1.	Whether the plug top is provided everywhere.		
2.	Are all metal parts of electrical equipment and light fittings / accessories grounded?		
3.	Is there any shed or cover for welding machines?		
4.	Are halogen lamps fixed at proper places?		
5.	Are portable power tools maintained as per norms?		
6.	Any other information:		

Signature of Site I/C of subcontractor :

	POWER SECTOR	FORMAT NO: HSEP:13-F13 REV NO.: 00 PAGE NO. 01 OF 01
	INSPECTION OF ELEVATOR	

Name of Site	
Name of Sub-Contractor	
Inspected by	
Date of Inspection	

Sr. No.	Description	Remarks
1.0	Name of equipment	
2.0	Basic Information of equipment	
2.1	Specification	
2.2	Sr. No. of equipment	
2.3	Make	
2.4	Year of manufacture	
3.0	Major repairs/overhauls(Furnish details of work carried out)	Date(s) of major repair/overhaul
3.1		
3.2		
3.3	Repairs carried out at site	
4.0	Any performance test conducted	Yes/No
5.0	Document Submitted	Yes/No
6.0	Manufacturer's test / guarantee certificate	Available/ Not available
7.0	Performance test	Done/ Not Done
8.0	Acceptance Norms	
9.0	Committee Observations	
10.0	Date of next review (if accepted)	

Signature-Subcontractor/ Subcontractor's Safety Officer	Signature-Site Safety Officer (BHEL)

**POWER SECTOR****HSE PENALTY**

FORMAT NO: HSEP:13-F14

REV NO.: 00

PAGE NO. 01 OF 02

Sub: MEMO for Penalty for non compliances in Safety

Following lapse (tick marked) was observed and penalty is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

Safety Area

SN	Violation of Safety Norms	Fine (in Rs)
01.	Not Wearing Safety Helmet	200/- *
02.	Not wearing Safety Belt or not anchoring life line	500/-*
03.	Not wearing safety shoe	200/-*
04.	Not keeping gas cylinders vertically	200/-
05.	Not using flash back arrestors	100/-
06.	Not wearing gloves	50/- *
07.	Grinding Without Goggles	50/- *
08.	Not using 24 V Supply For Internal Work	500/-
09.	Electrical Plugs Not used for hand Machine	100/-
10.	Not Slings properly	200/-
11.	Using Damaged Sling	200/-
12.	Lifting Cylinders Without Cage	500/-
13.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
14.	Not Removing Small Scrap From Platforms	500/-
15.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	500/-
16.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
17.	Improper Earthing Of Electrical T&P	500/-
18.	No or improper barricading	500/-
19.	Activity carried out without Safety work permit (Height work, Lifting activity, Hot work-each person/case)	1000/-
20.	Incident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
21.	Fatal Incident Resulting in total loss in Earning Capacity	1,00,000/- per victim for first instance #

Legend:-

*: per head. For repeated violation by the same person, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

#: or as deducted by customer, whichever is higher. For repeated fatal incident in the same Unit incremental penalty to be imposed. The subcontractor will pay 2 times the penalty compared to previously paid in case there are repeated cases of fatal incidents under the same subcontractor for the same package in the same unit.

**POWER SECTOR****HSE PENALTY**

FORMAT NO: HSEP:13-F14

REV NO.: 00

PAGE NO. 02 OF 02

Details (if any) related to non- compliance (Name of persons, Nature of deficiency, etc.)

Penalty imposed:

1, Rate as per above chart _____

2. No. of Persons/ machine/ event/ labour _____

3. Total Penalty= 1. X 2. = _____

Signature :

Witnessed by: (Sub- Contractor representative) (BHEL Personnel)

Name _____

Name _____

Distribution: 1 Copy: to Sub- contractor,
1 Copy to Site Construction Manager(BHEL)

	POWER SECTOR- HQ	FORMAT NO: HSEP:13-F15 REV NO.: 00 PAGE NO. 01 OF 01
	Incident Report (To be submitted within 24 hours of time of incident)	

Type of incident: Fatal/Major/ Minor/Fire/Property Damage/Near-miss

1	NAME OF SITE		3	ACTIVITY AREA	
2	SCOPE OF WORK		4	NAME OF CONTRACTOR	
			5	NAME & DESIGNATION OF BHEL ACTIVITY I/C	
6	DATE & TIME OF ACCIDENT		7	DATE RESUMED	
8	NO. OF WORK-DAYS LOST BY VICTIM (If duty not resumed, give estimated figure)				
9	NO. OF MANHOURS LOST BY OTHERS				
10	PERSONAL DETAILS OF INJURED AND / OR DETAILS OF MATERIALS / EQUIPMENT / PROPERTY DAMAGED				
NAME			NAME OF MATERIAL / EQUIPMENT / PROPERTY		
PERIOD OF EMPLOYMENT					
AGE	YRS	SEX	MALE/ FEMALE	ESTIMATED COST	ACTUAL COST
MARITAL STATUS		SINGLE / MARRIED			
OCCUPATION		NATURE OF DAMAGE			
PART OF BODY INJURED					
NATURE OF INJURY					
AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) MOST RESPONSIBLE FOR CAUSING ACCIDENT / INJURY / DAMAGE					
12	PERSON (NAME & DESIGNATION) WITH MOST CONTROL OVER AGENCY (OBJECT / EQUIPMENT / SUBSTANCE) CAUSING ACCIDENT INJURY / DAMAGE				
13	DESCRIBE CLEARLY HOW THE ACCIDENT OCCURRED (USE ADDITIONAL SHEET, IF REQUIRED)				
ANALYSIS					
14	WHAT ACTS AND / OR CONDITIONS CONTRIBUTED MOST DIRECTLY TO THIS ACCIDENT				
15	WHAT ARE THE BASIC REASON FOR THE EXISTENCE OF THESE ACTS AND / OR CONDITION ?				
16	WHAT CORRECTIVE ACTIONS HAVE BEEN TAKEN TO PREVENT ACCIDENT RECURRENCE ?				
	DATE :		SIGNATURE OF SITE HSE COORDINATOR		
17	COMMENTS OF HEAD / SOX				
	DATE:		SIGNATURE OF HEAD/SOX		



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

BURNING/WELDING /HOT WORK PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____

Name of Work Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Proper Access/Exit available		
2.	Proper ventilation and /or lighting provided.		
3.	Proper and safe scaffolding, platform, ladder provided.		
4.	Welding machine located in a clean and dry area.		
5.	Welding machine grounded at the equipment and proper leakage current protection device (ELCB) provided for welding machine.		
6.	Emergency STOP buttons are in working condition. Welder /Helper knows how to operate it.		
7.	Welding machine input/output cables, welding holder and weld return clamp (Holder) are insulated and in good condition.		
8.	Welder & Fitter trained to connect ground/work return clamps (Holder) to work place prior to energization of welding machine.		
9.	Gas cylinders are stacked vertically and not below the welding / cutting area. Regulator key is available with cylinder.		
10.	Pressure gauges/Flash back arrestor provided and in working condition.		
11.	Personal Protective equipment Minimum applicable: safety helmet, safety goggles, welding helmet, safety shoes, leather gloves, long sleeve and nose mask -provided		
12.	In case of pits, water removed from the pit and wood/rubber insulation provided.		
13.	Safety signboards are in place.		
14.	Adequate and Suitable nos. of fire fighting extinguisher provided.		
15.	Nearby combustible material removed. Housekeeping done.		
16.	Other		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ Sign: _____ Date: _____ Time: _____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor

Bharat Heavy Electricals Limited
Power Sector - Eastern Region, Kolkata



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

LIFTING ACTIVITY PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____

Name of Work Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	Crane used for lifting activity tested, certified and approved for rated lifting		
2.	All lifting tackles, gears/appliances are tested and certified for lifting works.		
3.	Crane operator is trained and competent for lifting operation.		
4.	Lifting sling/ belt is protected against sharp edge of the jobs to be lifted.		
5.	Access and exit marked and without obstruction.		
6.	Lifting arrangement adequate.		
7.	Unwanted rubbish material removed from work platform.		
8.	Minimum 2 guidelines have been provided for balancing and guiding jobs to be lifted.		
9.	Periphery area of crane booms as well as lifting job is barricaded and unauthorised/no-entry sign board posted.		
10.	Rigger and signal man is trained and competent for lifting work.		
11.	No lifting activity to be carried out during lightening, heavy wind/rain.		
12.	If scaffolding to be used during lift, scaffolding with valid tag available for use.		
13.	Double lanyards safety harness/belt checked and in working condition.		
14.	Safety shoes (non-slip), helmet with chin strap available with employees.		
15.	Others.		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ Sign: _____ Date: _____ Time: _____

Permit Cancellation:

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor

Bharat Heavy Electricals Limited

Power Sector - Eastern Region, Kolkata



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

WORKING AT HEIGHT PERMIT

Area : _____ Date: _____ Time: _____

Name of Site Engineer (Permit Requesting Authority): _____ Sign: _____

Name of Work Performing Contractor: _____

Name of Package In charge: _____ Sign: _____ Date: _____

Description of Work: _____

Work Execution Date: _____ Time Valid from: _____ to _____

The above signing person(s) will be responsible to ensure that the above described work will be done under all the safety precautions mentioned on the permit to work.

The following precautions are to be taken:

No.	Item	Yes	Not required
1.	All workers on job are medically fit for working at height (Person should not have vertigo)		
2.	Scaffolding with valid tag available for use		
3.	Safety harness with life line support/ fall arrester are checked and in working condition		
4.	Safety shoes (non-slip), Helmet with chin strip available with employees		
5.	Safety nets are provided as per design and provided 25 ft. below working area & extending 8 ft beyond.		
6.	Horizontal life lines are provided to cater to design specification of 2300kg per person.		
7.	Ladders have been inspected and provided as per BHEL standard/contract.		
8.	All lifting / tightening tools, hand tools/equipment checked and in good condition		
9.	Access and exit marked and without obstruction.		
10.	Lighting arrangement adequate.		
11.	Unwanted and rubbish material removed from working platform.		
12.	Electrical cable, welding Hose/Compressed air hose properly secured and lay down without obstruction.		
13.	Signboards provided on working platforms		
14.	Hazards in the vicinity are identified and communicated to the worker.		
15.	Other		

Name of Contractor Safety Officer: _____ Sign: _____ Date: _____ Time: _____

Reviewed and approved by BHEL Site Engineer (Permit Issuing Authority):

Name: _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Safety Representative: _____ Sign: _____

I understand the precaution to be taken as described above and as per project requirement and hereby confirm that work will be executed under my supervision by following all precaution and Safety Rules.

Name of Work Performing Authority: _____ **Sign:** _____ **Date:** _____ **Time:** _____**Permit Cancellation:**

I hereby declare that the work is complete, all workers under my control have been withdrawn and the site restored to safe tidy condition.

Name of Work performing Authority: _____ Sign: _____ Date: _____ Time: _____

Name of Site Engr. (Permit Requesting Authority): _____ Sign: _____ Date: _____ Time: _____

Name of BHEL Site Engr. (Permit Issuing Authority): _____ Sign: _____ Date: _____ Time: _____

(This permit is valid only for the date it is issued)

Original at BHEL site**Second Copy – BHEL SAFETY****Third Copy : Contractor**

TENDER NO: PSER:SCT:BAR-C1962:19

VOLUME -IE

FORMS & PROCEDURES

FOR

**APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS
FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER
THERMAL POWER PROJECT, STAGE-I,**

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVT. OF INDIA UNDERTAKING)

POWER SECTOR – EASTERN REGION

PLOT NO. – 9 / 1, DJ – BLOCK,

SECTOR – II, KARUNAMOYEE,

SALT LAKE CITY,

KOLKATA – 700091.

FORMS & PROCEDURES

INDEX

SN	Description	Form No	Remarks
1.0	Forms		
1.1	Offer forwarding Letter/Submission of Tender	F-1 (Rev 00)	
1.2	Declaration by Authorised Signatory	F-2 (Rev 00)	
1.3	No Deviation Certificate	F-3 (Rev 00)	
1.4	Declaration confirming knowledge about Site Conditions	F-4 (Rev 00)	
1.5	Declaration for relation in BHEL	F-5 (Rev 00)	
1.6	Non Disclosure Certificate	F-6 (Rev 00)	
1.7	Bank Account Details for E-Payment	F-7 (Rev 00)	
1.8	Form for seeking clarifications	F-8 (Rev 00)	
1.9	Capacity Evaluation of Bidder for current Tender	F-9 (Rev 00)	
1.10	Contract Agreement	F-10 (Rev 00)	
1.11	Bank Guarantee for Security Deposit	F-11 (Rev 00)	
1.12	Bank Guarantee for ~~Interest Bearing Refundable~~ Advance	F-12 (Rev 00)	
1.13	Extension of Validity of Bank Guarantee	F-13 (Rev 00)	
1.14	Monthly Plan & Review with Contractors	F-14 (Rev 00)	
1.15	Monthly Performance Evaluation of Contractor	F-15 (Rev 01)	Revised
1.16	~~Evaluation of Contractor Performance (Quarterly)~~	~~F-16 (Rev 00)~~	Deleted
1.17	Evaluation of Contractor Performance (Annual)	F-17 (Rev 01)	Under revision ##
1.18	Evaluation of Contractor Performance for the Contract (Overall)	F-18 (Rev 01)	Under revision ##

FORMS & PROCEDURES

SN	Description	Form No	Remarks
1.19	Milestone Completion Certificate	F-19 (Rev 00)	
1.20	Completion Certificate	F-20 (Rev 01)	Revised
1.21	Indemnity Bond	F-21 (Rev 00)	
1.22	Consortium Agreement	F-22 (Rev 00)	
1.23	Refund of Security Deposit	F-23 (Rev 00)	
1.24	Refund of Guarantee Money	F-24 (WAM-11)	
1.25	Power of Attorney for Submission of Tender/Signing Contract Agreement	F-25 (Rev 00)	
1.26	Analysis of Unit Rates Quoted	F-26 (Rev 00)	
1.27	RA Bill Format	WAM-6	
1.28	Final Bill Submission format with No Claim Certificate and No Demand Certificate	WAM-7	
1.29	PROFORMA FOR PERFORMANCE BANK GUARANTEE		
1.30	BANK GUARANTEE FOR SD CUM PBG BOND		
2.0	Procedures		
2.1	Procedure and Business Rules for Reverse Auction	As per Company Policy	
2.2	Integrity Pact	As per Company Policy	
3.0	Customer specific procedures		
3.1			

- BANK GUARANTEE FORMATS FOR "RELEASE OF AMOUNTS WITHED/ LIQUIDATED DAMAGES AMOUNT", "SUPPLY FREE ISSUE MATERIAL" & "EARNEST MONEY" IS ALSO GIVEN.

: will be released later

FORMS & PROCEDURES

Form No: F-01 (Rev 00)

OFFER FORWARDING LETTER / TENDER SUBMISSION LETTER (To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

Offer Reference No:.....

Date:.....

To,

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

Dear Sir,

Sub : Submission of Offer against Tender Specification No:

I/We hereby offer to carry out the work detailed in the Tender Specification issued by Bharat Heavy Electricals Limited, Power Sector-....., in accordance with the terms and conditions thereof.

I/We have carefully perused the following listed documents connected with the above work and agree to abide by the same.

1. Amendments/Clarifications/Corrigenda/Errata/etc issued in respect of the Tender documents by BHEL
2. Notice Inviting Tender (NIT)
3. Price Bid
4. Technical Conditions of Contract
5. Special Conditions of Contract
6. General Conditions of Contract
7. Forms and Procedures

Should our Offer be accepted by BHEL for Award, I/we further agree to furnish 'Security Deposit' for the work as provided for in the Tender Conditions within the stipulated time as may be indicated by BHEL.

I/We further agree to execute all the works referred to in the said Tender documents upon the terms and conditions contained or referred to therein and as detailed in the appendices annexed thereto.

I/We have deposited/depositing herewith the requisite Earnest Money Deposit (EMD) as per details furnished in the Check List.

Authorised Representative of Bidder

Signature :

Name :

Address :

Place:

Date:

FORMS & PROCEDURES

Form No: F-02 (Rev 00)

DECLARATION BY AUTHORISED SIGNATORY OF BIDDER

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

To,

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

Dear Sir,

Sub : **Declaration by Authorised Signatory**

Ref : 1) NIT/Tender Specification No:,
2) All other pertinent issues till date

I/We, hereby certify that all the information and data furnished by me with regard to the above Tender Specification are true and complete to the best of my knowledge. I have gone through the specifications, conditions, stipulations and all other pertinent issues till date, and agree to comply with the requirements and Intent of the specification.

I further certify that I am authorised to represent on behalf of my Company/Firm for the above mentioned tender and a valid Power of Attorney to this effect is also enclosed.

Yours faithfully,

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

Date:

Enclosed : Power of Attorney

FORMS & PROCEDURES

Form No: F-03 (Rev 00)

NO DEVIATION CERTIFICATE

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

To,

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

Dear Sir,

Sub : **No Deviation Certificate**

Ref : 1) NIT/Tender Specification No:
2) All other pertinent issues till date

We hereby confirm that we have not changed/ modified/materially altered any of the tender documents as downloaded from the website/ issued by BHEL and in case of such observance at any stage, it shall be treated as null and void.

We also hereby confirm that we have neither set any Terms and Conditions and nor have we taken any deviation from the Tender conditions together with other references applicable for the above referred NIT/Tender Specification.

We further confirm our unqualified acceptance to all Terms and Conditions, unqualified compliance to Tender Conditions, Integrity Pact (if applicable) and acceptance to Reverse Auctioning process.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized
representative of the bidder)

FORMS & PROCEDURES

Form No: F-04 (Rev 00)

DECLARATION CONFIRMING KNOWLEDGE ABOUT SITE CONDITIONS

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

To,

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

Dear Sir,

Sub : **Declaration confirming knowledge about Site conditions**

Ref : 1) NIT/Tender Specification No:
2) All other pertinent issues till date

I/We, _____ hereby declare and confirm that we have visited the Project Site as referred in BHEL Tender Specifications and acquired full knowledge and information about the Site conditions including Wage structure, Industrial Climate, the Law & Order and other conditions prevalent at and around the Site. We further confirm that the above information is true and correct and we shall not raise any claim of any nature due to lack of knowledge of Site conditions.

I/We, hereby offer to carry out work as detailed in above mentioned Tender Specification, in accordance with Terms & Conditions thereof.

Yours faithfully,

(Signature, Date & Seal of Authorized
Representative of the Bidder)

Date :

Place:

FORMS & PROCEDURES

Form No: F-05 (Rev 00)

DECLARATION FOR RELATION IN BHEL

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder failing which the offer of Bidder is liable to be summarily rejected)

To,

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

Dear Sir,

Sub : **Declaration for relation in BHEL**

Ref : 1) NIT/Tender Specification No:,

I/We hereby submit the following information pertaining to relation/relatives of Proprietor/Partner(s)/Director(s) employed in BHEL

Tick(✓) any one as applicable:

1. The Proprietor, Partner(s), Director(s) of our Company/Firm DO NOT have any relation or relatives employed in BHEL

OR

2. The Proprietor, Partner(s), or Director(s) of our Company/Firm HAVE relation/relatives employed in BHEL and their particulars are as below:

(i)

(ii)

Signature of the Authorised Signatory

Note:

1. Attach separate sheet, if necessary.
2. If BHEL Management comes to know at a later date that the information furnished by the Bidder is false, BHEL reserves the right to take suitable action against the Bidder/Contractor.

FORMS & PROCEDURES

Form No: F-06 (Rev 00)

NON DISCLOSURE CERTIFICATE

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

NON DISCLOSURE CERTIFICATE

I/We understand that BHEL PS __ is committed to Information Security Management System as per their Information Security Policy.

Hence, I/We M/s.....
who are submitting offer for providing services to BHEL PS __ against
Tender Specification No: _____,
hereby undertake to comply with the following in line with Information
Security Policy of BHEL PS __, _____

- To maintain confidentiality of documents & information which shall be used during the execution of the Contract.
- The documents & information shall not be revealed to or shared with third party which shall not be in the business interest of BHEL PS__.

(Signature, date & seal of Authorized
Signatory of the bidder)

Date:

FORMS & PROCEDURES

Form No: F-07 (Rev 00)

BANK ACCOUNT DETAILS FOR E-PAYMENT

(To be given on Letter head of the Company /Firm of Bidder, and **ENDORSED (SIGNED & STAMPED) BY THE BANK** to enable BHEL release payments through Electronic Fund Transfer (EFT/RTGS))

1. Beneficiary Name :
2. Beneficiary Account No. :
3. Bank Name & Branch :
4. City/Place :
5. 9 digit MICR Code of Bank Branch :
6. IFSC Code of Bank Branch :
7. Beneficiary E-mail ID :
(for payment confirmation)

NOTE: In case Bank endorsed certificate regarding above has already been submitted earlier, Kindly submit photocopy of the same

FORMS & PROCEDURES

Form No: F-08 (Rev 00)

FORMAT FOR SEEKING CLARIFICATION

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

To,

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

Dear Sir,

Sub : **Request for Clarification**

Ref : 1) NIT/Tender Specification No:,

2) All other pertinent issues till date

Sl no	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
1				
2				
3				

Yours faithfully,

(Signature, date & seal of Authorized
Representative of the Bidder)

FORMS & PROCEDURES

FORMS & PROCEDURES

Form No: F-09 (Rev 00)

CAPACITY EVALUATION OF BIDDERS FOR CURRENT TENDER

SL NO.	DESCRIPTION OF WORK (Similar to Tendered Scope)	WORK ORDER REF & DATE	CONTRACT VALUE (Rs. LACS)	CUSTOMER NAME & ADDRESS	CURRENT STATUS OF THE JOB ALONG WITH LATEST MILE STONE COMPLETED	%AGE OF WORK COMPLETED	VALUE OF BALANCE WORK (Rs. Lacs)
1							
2							
3							
4							
5							

NOTES:

1. BIDDERS ARE REQUIRED TO FURNISH ALL THE JOBS OF SIMILAR NATURE WHICH THEY ARE EXECUTING (IN PROGRESS) AT THE TIME OF SUBMISSION OF TENDER, AS PER ABOVE FORMAT.

2. BIDDERS HEREBY UNDERTAKE THAT THEY HAVE FURNISHED THE DETAILS SOUGHT AS PER POINT NO. 1 IN TOTALITY AND THAT THE DETAILS FURNISHED IS COMPLETE IN ALL RESPECT.

3. BHEL WILL TAKE APPROPRIATE ACTION AS DEEMED FIT , IN CASE, IT IS FOUND AT A LATER DATE THAT THE CONTRACTOR HAD SUPPRESSED THE FACTS AND HAVE NOT FURNISHED THE CORRECT & COMPLETE INFORMATIONS.

Signature

DATE :

PLACE:

Name, Designation & Seal of Bidder

FORMS & PROCEDURES

CONTRACT AGREEMENT

Form No: F-10 (Rev 00)

BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)
Power Sector – Region

CONTRACT AGREEMENT

AGREEMENT NO. _____

NAME OF WORK	
NAME OF THE CONTRACTOR WITH FULL ADDRESS	
VALUE OF WORK AWARDED	
LETTER OF INTENT NO.	
TIME ALLOTTED FOR COMPLETING THE WORK (DATE OF COMPLETION)	

SIGNATURE OF CONTRACTOR

(SIGNATURE OF BHEL OFFICER)

FORMS & PROCEDURES

CONTRACT AGREEMENT

THIS AGREEMENT MADE THIS _____ DAY OF _____ between BHARAT HEAVY ELECTRICALS LIMITED (A Government of India Enterprise) a Company incorporated under the Companies Act, 1956, having its Registered Office at BHEL House, Siri Fort New Delhi- 110049 (herein after called BHEL) of the ONE PART.

AND

M/S _____
_____ (hereinafter called the 'Contractor') of the SECOND PART.

WHEREAS M/s -----state that they have acquired and possess extensive experience in the field of -----

And Whereas in response to an Invitation to Tender No. ----- issued by BHEL for execution of ----- the contractor submitted their offer No.- -----dated -----And whereas BHEL has accepted the offer of the Contractor on terms and conditions specified in the Letter of Intent No.-----dated -----read with the references cited therein.

THIS AGREEMENT WITNESSES AND it is hereby agreed by and between the parties as follows:

1. That the contractor shall execute the work of -----and more particularly described in Tender Specification No -----including Drawings and Specifications (hereinafter called the said works) in accordance with and subject to terms and conditions contained in these presents, instructions to Tenderers, General Conditions of Contract, Special Conditions, Annexures, Letter of Intent dated -----and such other instructions, Drawings, Specifications given to him from time to time by BHEL.
2. The Contractor is required to furnish to BHEL Security deposit in the form of cash/ approved securities/ Bank Guarantee valid upto ----- for a sum of Rs.----- towards satisfactory performance and completion of the Contract.
3. The Contractor has furnished a Bank Guarantee bearing no.-----dated -----for a sum of Rs.-----executed by ----- in favour of BHEL towards Security Deposit valid upto -----

OR

The Contractor has furnished to BHEL an initial Security Deposit of Rs.-----in the form of cash / approved Securities/ B.G No.----- dated ----- for Rs.-----executed by ----- in favour of BHEL valid upto ----- and has agreed for recovery of the balance security deposit by BHEL @ 10% of the value of work done from each running bill till the entire Security Deposit is recovered.

OR

FORMS & PROCEDURES

The contractor has furnished to BHEL an initial Security Deposit of Rs.----- (Rs.----- vide Bank draft No.----- dated ----- and by adjusting EMD of Rs.----- submitted vide Bank draft No.----- dt.-----) and has agreed for recovery of balance Security Deposit by BHEL @ 10% of the value of work done from each running bill till the entire security deposit is recovered.

4. The Contractor hereby agrees to extend the validity of the Bank Guarantee for such further period or periods as may be required by BHEL and if the Contractor fails to obtain such extension(s) from the Bank, the Contractor, shall pay forthwith or accept recovery of Rs.----- from the bills in one installment and the contractor further agrees that failure to extend the validity of the Bank Guarantee or failure to pay the aforesaid amount in the manner specified above shall constitute breach of contract. In addition to above, BHEL shall be entitled to take such action as deemed fit and proper for recovering the said sum of Rs.-----

OR

In case the contractor furnishes the bank guarantee at a later date the contractor hereby agrees to extend the validity of bank guarantee for such further period or periods as may be required by BHEL and if the contractor fails to obtain such extension(s) from the bank, the contractor shall pay forthwith or accept recovery of the amount of bank guarantee given in lieu of security deposit from the bills in one installment and the contractor further agrees that failure to extend the validity of bank guarantee or failure to pay the aforesaid amount in the manner specified above shall constitute breach of contract. In addition to above, BHEL shall be entitled to take such action as deemed fit and proper for recovering the said sum.

5. That in consideration of the payments to be made to the Contractor by BHEL in accordance with this Agreement the Contractor hereby covenants and undertakes with BHEL that they shall execute, construct, complete the works in conformity, in all respects, with the terms and conditions specified in this Agreement and the documents governing the same.
6. That the Contractor shall be deemed to have carefully examined this Agreement and the documents governing the same and also to have satisfied himself as to the nature and character of the Works to be executed by him.
7. That the Contractor shall carry out and complete the execution of the said works to the entire satisfaction of the Engineer or such other officer authorised by BHEL, within the agreed time schedule, the time of completion being the essence of the Contract.
8. That BHEL shall, after proper scrutiny of the bills submitted by the Contractor, pay to him during the progress of the said works such sum as determined by BHEL in accordance with this Agreement.
9. That this Agreement shall be deemed to have come into force from ----- the date on which the letter of intent has been issued to the Contractor.

FORMS & PROCEDURES

10. That whenever under this contract or otherwise, any sum of money shall be recoverable from or payable by the Contractor, the same may be deducted in the manner as set out in the General Conditions of Contract or other conditions governing this Agreement.
11. That all charges on account of Octroi, Terminal and other taxes including sales tax or other duties on material obtained for execution of the said works shall be borne and paid by the Contractor.
12. That BHEL shall be entitled to deduct from the Contractor's running bills or otherwise Income Tax under Section 194 (C) of the Income Tax Act, 1961.
13. That BHEL shall be further entitled to recover from the running bills of the Contractor or otherwise such sum as may be determined by BHEL from time to time in respect of consumables supplied by BHEL, hire charges for tools and plants issued (Where applicable) and any other dues owed by the Contractor.
14. That it is hereby agreed by and between the parties that non-exercise, forbearance or omission of any of the powers conferred on BHEL and/or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents and the liability of the Contractor with respect to compensation payable to BHEL or Contractor's obligations shall remain unaffected.
15. It is clearly understood by and between the parties that in the event of any conflict between the Letter of Intent and other documents governing this Agreement, the provisions in the Letter of Intent shall prevail.

16. The following documents

1. Invitation to Tender No-----
and the documents specified therein.
2. Contractor's Offer No-----
dated-----.
3. _____
4. _____
5. _____
6. Letter of Intent No_____ dated_____.
7. _____

shall also form part of and govern this Agreement.

IN WITNESS HEREOF, the parties hereto have respectively set their signatures in the presence of

WITNESS

(CONT

RACTOR)

FORMS & PROCEDURES

1. (to be signed by a person holding
a valid Power of Attorney)

2.

WITNESS (For and on behalf of BHEL)

1.

2.

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

In consideration of the Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its Unit at Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700091 having agreed to exempt (Name of the Vendor / Contractor / Supplier) having its registered office at _____¹ (hereinafter called the said Contractor which term includes supplier), from demand under the terms and conditions of the Contract reference No. _____² dated _____² valued at Rs. ² (Rupees -----)² for <Nature of the Work>³ (hereinafter called the said Contract) of Security Deposit for the due fulfilment by the said contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs. _____⁴ (Rupees _____ only), we _____ (indicate the name and address of the Bank) having its Head Office at _____ (address of the head Office) (hereinafter referred to as the Bank) at the request of _____ [Name of Contractor(s)] do hereby undertake to pay to the Employer an amount not exceeding Rs. _____ in the event of any breach by the said Contractor(s) of any of the terms and conditions contained in the said Contract.

We, _____ (indicate the name of the Bank), do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Employer. Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claim satisfied or discharged or till _____⁵ or till the office/Department/Division of Bharat Heavy Electricals Limited certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) and also including the satisfactory performance of the equipment during guarantee period and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the _____⁶, (3 months more than the present date of validity of Bank Guarantee) we shall be discharged from all the liability under this guarantee thereafter.

We, _____ (indicate the name of the Bank) _____ further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We,..... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁷
- b) This Guarantee shall be valid up to ⁸
- c) Unless the Bank is served a written claim or demand on or before _____⁹ (3 months more than the present date of validity of Bank Guarantee) all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ (indicate the name of the Bank) _____ lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Any claim or dispute arising under the terms of this document shall only be enforced or settled in the courts of at Kolkata only.

Date _____ Day of _____
for _____ (indicate the name of the Bank) _____

(Signature of Authorised signatory)

¹ NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER .

² DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

³ PROJECT/SUPPLY DETAILS

⁴ BG AMOUNT IN FIGURES AND WORDS

⁵ VALIDITY DATE

⁶ DATE OF EXPIRY OF CLAIM PERIOD

⁷ BG AMOUNT IN FIGURES AND WORDS.

⁸ VALIDITY DATE

⁹ DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 2/3 months after validity date.

2. In Case of Bank Guarantees submitted by Foreign Vendors-

- a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
- b. **From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter-Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.

- b.2** In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
- b.3** The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.
- b.4** The BG should clearly specify that the demand or other document can be presented in electronic form.

BANK GUARANTEE FOR ADVANCE

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of the Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its Unit at Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700091 having awarded to (Name of the Vendor / Contractor / Supplier) having its registered office at _____¹ (hereinafter called "the Contractor" which expression shall include its successors and permitted assigns) a contract Ref No.....dated ²valued at Rs.....(Rupees -----) for <Nature of Work> ³(hereinafter called the 'Contract')

AND WHEREAS the Employer has agreed to advance to the Contractor, a sum of Rs..... (Rupees..... only), equivalent to _____% of the said value of the Contract (hereinafter called "the said Advance"), upon the condition, that the said Advance shall be secured by undertaking guarantee for Rs ----- (Rupees -----)⁴ from a Bank as hereinafter appearing.

We, ..., (hereinafter referred to as the Bank), having registered/Head office at and a branch at being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums upto a maximum amount but not exceeding Rs ----- (Rupees -----).

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor/ Supplier in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Contractors/Supplier shall have no claim against us for making such payment.

We the Bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Contractor/Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor/Supplier and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor/Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Contractor/Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall remain in force upto and including.....⁵ and shall be extended from time to time on the request of the Employer for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor/Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the ⁶ (3 months more than the present date of validity of Bank Guarantee) we shall be discharged from all liabilities under this Guarantee.

We, ... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁷
- b) This Guarantee shall be valid up to ⁸
- c) Unless the Bank is served a written claim or demand on or before ⁹ (3 months more than the present date of validity of Bank Guarantee) all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

We, ... Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Any claim or dispute arising under the terms of this document shall only be enforced or settled in the courts of at Kolkata only.

For and on behalf of
(Name of the Bank)

Date.....

Place of Issue.....

¹ NAME OF VENDOR /CONTRACTOR / SUPPLIER

² DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

³ PROJECT/SUPPLY DETAILS

⁴ BG AMOUNT IN FIGURES AND WORDS

⁵ VALIDITY DATE

⁶ DATE OF EXPIRY OF CLAIM PERIOD

⁷ BG AMOUNT IN FIGURES AND WORDS

⁸ VALIDITY DATE

⁹ DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 2/3 months after validity date.
2. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. **From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 **In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank** (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.
 - b.4 The BG should clearly specify that the demand or other document can be presented in electronic form.

FORMS & PROCEDURES

Form No: F-13 (Rev 00)

FORM for EXTENSION OF VALIDITY OF BANK GUARANTEE

1. To be typed on non judicial Stamp Papers of value as applicable in the State of India from where the BG has been issued or the State of India where the BG shall be operated
2. The non judicial stamp papers shall be purchased in the name of the Party on whose behalf the BG is being issued or the BG issuing Bank

BANK GUARANTEE No:

Date:.....

To

(Write Designation and Address of Officer of BHEL inviting the Tender)

Dear Sir

Sub : Validity of Bank Guarantee No:..... Dated for
..... Rs in favour of yourself, expiry date, on
account of M/s in respect of Contract
Number....., (herein after called the Original bank Guarantee)

At the request of M/s....., we Bank, having its
branch Office at and having Head office at, do
hereby extend our liability under the above mentioned Bank Guarantee number..... dated
..... for a further period of Months/years from to expire on
.....

Except as provided above, all other terms and conditions of the Original Bank Guarantee No
..... Dated..... shall remain unaltered and binding on us.

Kindly treat this extension as an integral part of the original Bank Guarantee to which it would be attached.

Yours faithfully

Signature.....

Name & Designation.....

Power of Attorney/Signing Power No

Seal of Bank

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#1.01	Cumulative number of days in the month, the nominated Quality Officer or his authorised nominee was not available	QUALITY	1.5		Quality Officer or his authorised nominee should be available for all the days of working at site	Daily Log Book entry/Incident Registers/letter references
#1.02	Number of instances of non- compliance wrt FQP, Standard Drawings, Specifications, E&C Manuals etc.	QUALITY	1.5		No deviation from FQP, Standard Drawings, Specifications, E&C Manuals etc. is allowed without BHEL Engineer's approval.	Daily Log Book entry/Incident Registers/letter references
#1.03	Percentage submission of test certificates for batches of welding electrodes, cement, sand, aggregate, consumable, Paints etc. as applicable for this month OR In case of MM & MH package, monthly checks for Storage/Preservation of material.	QUALITY	1		Submission of 100% Test certificates for materials as per FQP is mandatory. MM & MH package: Storage/Preservation as per manual/procedure.	Daily Log Book entry/Incident Registers/letter references
#1.04	Number of incidences of improper storage & preservation (not in accordance to the guidelines of BHEL MUs or approved FQP) of materials, consumables (viz. gases, welding electrodes & fluxes, fuel etc.) & bought-out items (paints, fasteners etc.) under the custody of the contractor	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#1.05	Rework/ Rejection instances in a month necessitated due to deviation from Standard Drawings /Specifications /Manuals /E&C procedures /FQPs or due to Poor Workmanship by contractor	QUALITY	2		Reworks/ Rejection should be as minimum as possible. Total number of reworks/ rejections due to reasons attributable to contractor.	Daily Log Book entry/Incident Registers/letter references
#1.06	Delay in preparation & submission of signed protocols / log sheets / site register / NDT test reports as per approved FQP/ Qualified Welder List along with photocopies of Welder ID cards / Welder Performance Evaluation records etc. in the month OR in case of MM / MH package reconciliation statement / verification report.	QUALITY	1		Within 2 days of measurements taken or within first 3 working days of next month, as advised by BHEL Engineer	Daily Log Book entry/Incident Registers/letter references
#1.07	Number of instances for Major equipment/product failure due to negligence/improper work/poor workmanship by contractor	QUALITY	1		No such event should happen	Daily Log Book entry/Incident Registers/letter references
#1.08	Total number of complaints received in the month on the quality of finish / aesthetics	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#2.01	Cumulative number of days of delay in submission of Plan FOR THE MONTH supported by deployment plan of Major T&Ps and Manpower (as per Form F-14) and relevant construction/layout drawings - like A4 plan / elevation views of plan status for structures / pressure parts/Civil Works, Piping isometrics for piping, Layout / PID / System reference sketch, Unloading / storage plans etc.as applicable.	PERFORMANCE	5		Number of days delayed from second working day of the month	Daily Log Book entry/Incident Registers/letter references
#2.02	Percentage of timely submission of Daily Reports for Progress of work, Resources, Consumables etc.	PERFORMANCE	1.5		Percentage of timely submission of daily reports/ Scheduled date is successive next day for each day	Daily Log Book entry/Incident Registers/letter references
#2.03	Number of days delayed for submission of FQP log sheets / protocols / Monthly Progress Reports for the work executed during the month under measurement	PERFORMANCE	1.5		Number of days delayed/Scheduled date is first 2 working days of next month	Daily Log Book entry/Incident Registers/letter references
#2.04	Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month as per Form-14	PERFORMANCE	35		As per Part-A of Form-14	Progress review formats
#2.05	Number of days delayed in submission of Running bills with complete supporting documents (including updated reconciliation statement of BHEL issued material) for the month	PERFORMANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#2.06	Number of times the Top Management of contractor did not respond to critical issues of site, for the month	PERFORMANCE	1		Total number of instances	Daily Log Book entry/Incident Registers/letter references
#2.07	Cumulative number of days in the month the works were stopped / refused on interpretation of contract clauses/scope due to tendency of taking undue advantage by interpreting contract clauses in their favour	PERFORMANCE	2		Cumulative number of days lost	Daily Log Book entry/Incident Registers/letter references
#2.08	Number of times rework was refused by contractor	PERFORMANCE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#2.09	Cumulative number of days in the month recording / logging was not done in daily log / history register / hindrance register / soft form in a PC maintained at BHEL Site Office	PERFORMANCE	1		Cumulative number of days recording or logging was not done / all days of the month	Daily Log Book entry/Incident Registers/letter references
#3.01	Percentage of Manpower Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7		As per Part-B2 of Form-14	Daily Log Book entry/Incident Registers/letter references
#3.02	Percentage of T&P Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7		As per Part-B1 of Form-14	Daily Log Book entry/Incident Registers/letter references
#3.03	Cumulative number of major instances in the month hampering / affecting progress of work due to breakdown or non-availability of major T&P and MME for the work, under the scope of Contractor	RESOURCES	3		Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references
#3.04	Cumulative number of major instances in the month hampering / affecting progress of work due to non-availability of Consumables/ use of improper consumables under the scope of contractor	RESOURCES	3		Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references
#4.01	Number of non-compliances during the month for Statutory requirements like validity of Labour Licence, Insurance Policy, Labour Insurance, PF, BOCW Compliance etc. and any other applicable laws/ Regulation, Electrical Licence, T&P fitness certificate, Contractors' All Risk Policy etc. as applicable	SITE INFRASTRUCTURE & SERVICE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#4.02	Cumulative number of days in a month poor illumination is reported at storage area, erection area, pre-assembly area and other designated areas by BHEL site.	SITE INFRASTRUCTURE & SERVICE	0.5		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.03	Cumulative number of days of non-availability of well-maintained toilets facilities for workers (separate for men and women) and non-availability of potable drinking water stations for workers in specified areas.	SITE INFRASTRUCTURE & SERVICE	1		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#4.04	Total number of instances in the month, Housekeeping NOT attended to in spite of instructions by BHEL -i.e. removal / disposal of surplus earth / debris / scrap / unused / surplus cable drums / other electrical items / surplus steel items / packing materials, thrown out scrap like weld butts, cotton waste etc. from the working area to identified locations	SITE INFRASTRUCTURE & SERVICE	2		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.05	Total number of instances in a month, Site Office with reasonably good facilities including enough nos. of computers and printers etc. for use by office and supporting staff was not made available/maintained.	SITE INFRASTRUCTURE & SERVICE	0.5		No discrepancy during regular or surprise visits	Photograph and report of the Engineer
#5.01	Number of days delayed in making labour payments for the last month	SITE FINANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#5.02	Number of complaints from labour/ sub supplier/ sub-contractor for non-receipt of payments from contractor	SITE FINANCE	1.5		Total number of complaints or reporting	Daily Log Book entry/Incident Registers/letter references
#5.03	Number of times the site operations were hampered for want of funds at the disposal of site-in-charge.	SITE FINANCE	1.5		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.01	Cumulative number of days in a month the nominated Safety Officer was not available	HSE & SA	1		Safety Officer should be available for all the days	Daily Log Book entry/Incident Registers/letter references
#6.02	Shortfall in number of weekly safety meetings in the month conducted or attended by the Safety Officer	HSE & SA	0.5		Safety meetings to be held every week	Copy of Minutes of meeting
#6.03	Level of compliance w.r.t decisions taken in previous Safety meetings	HSE & SA	0.5		Number of consolidated issues discussed in Safety meetings	Copy of Minutes of meeting, Non-compliance intimation documents from BHEL site
#6.04	Delay in submission of monthly report on safety (including electrical safety for equipment & personnel etc.) in the prescribed form	HSE & SA	1		Number of days delayed/Scheduled date is third working day of next month	Daily Log Book entry/Incident Registers/letter references
#6.05	Number of days taken for lodging FIRs from date of occurrence/notice of incident of theft / accident etc.	HSE & SA	0.5		Number of days delayed/Scheduled date is within 24 Hrs of occurrence/notice of incidence	Copy of FIR lodged by Contractor

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#6.06	Number of times written(email, letters etc.) warning issued for non-availability/ use of improper Fall protection and rescue arrangement as lifeline, fall arrestors, safety net, hand-railings, covered floors, man-basket, rescue basket & kit etc. by the contractor	HSE & SA	2		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.07	Number of times punitive fines imposed for unsafe practices as per contract like non-availability/use of PPEs as safety shoes, helmets, goggles, gloves, lifeline, safety belts etc.	HSE & SA	1		Total number of non-compliances	Non-compliance intimation documents from BHEL site
#6.08	Percentage compliance to Emergency preparedness and response plan: Portable Fire-extinguishers, Buckets, Fire-wardens, display of emergency numbers, mock-drills, Hazard Identification and Risk Assessment(HIRA) etc.	HSE & SA	1		Compliance should be 100% as per HSE Plan or as finalized in Safety Meetings	Non-compliance intimation documents from BHEL site
#6.09	Number of times the agency has defaulted on display of safety posters / safety slogans / safety barriers/emergency numbers etc. in identified areas	HSE & SA	0.5		Total number of instances	Non-compliance intimation documents from BHEL site
#6.10	Non compliances observed during HSE and Safety Audit	HSE & SA	0.5		Total number of non-compliances	Non-compliance intimation documents from BHEL site, Audit Reports
#6.11	Cumulative number of days in the month, non-availability of First Aid Kit, First Aider & Emergency Vehicles/Ambulance.	HSE & SA	0.5		Cumulative number of days	Non-compliance intimation documents from BHEL site
#6.12	Number of days taken for submission of Root Cause analysis (RCA) for the accident from the cut-off date intimated by BHEL for submission of RCA	HSE & SA	0.5		Number of days delayed/Scheduled date is cut-off date intimated by BHEL	Daily Log Book entry/Incident Registers/letter references
#6.13	Non conductance of training (induction, job specific, height work etc.), tool box meeting and health check-up as per Contract requirements	HSE & SA	0.5		Number of incidences of non-conductance during the month	Daily Log Book entry/Incident Registers/letter references
Total			100			

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
	Less Deduction in Score Due to Major Accidents (Fatal, Permanent Disability or bodily injury by which person injured is prevented to resume to work within 48 hours or more after accident,, Major Damage to Equipment etc.) attributable to the contractor @ 3 points/ accident					
	Less Deduction in Score Due to Minor Accidents attributable to the contractor @ 1 point/ accident					
	Less Deduction in Score Due to not Maintaining of Labour Colony (if applicable) as per BHEL HSE policy @2 points in a month on verification any day					
	Final Score					

Performance Score Summary for the Month	Total Score	Score Obtained
QUALITY	10	
PERFORMANCE	50	
RESOURCES	20	
SITE INFRASTRUCTURE & SERVICE	5	
SITE FINANCE	5	
HSE & SA	10	
OTHERS (deductions if any)	0	
TOTAL	100	

Note:

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

FORMS & PROCEDURES

Form No: F-19 (Rev 00)

MILESTONE COMPLETION CERTIFICATE **(issued by BHEL on the specific request of Contractor)**

Ref :

Date:

To,

(Name & address of Contractor)

Dear Sir,

References

1. Contract No:
2. Job Description:

This is to hereby confirm that the following Milestone Activity has been achieved in respect of the Contract /Job under reference

Sl No	Milestone Activity	Remarks

This certificate is issued as per your request vide letter no
without any prejudice to the rights of BHEL in line with the terms and conditions of the
above referred Contract

Yours faithfully,

For and on behalf of Bharat Heavy Electricals Limited

Construction Manager/Head (Subcontracts)

FORMS & PROCEDURES

Form No: F-20 (Rev 01)

CONTRACT COMPLETION CERTIFICATE (Issued by BHEL/HQ on the specific request of Contractor)

Ref :

Date:

To Whom so ever it may concern

1	DESCRIPTION OF WORK	
2	NAME AND ADDRESS OF THE CONTRACTOR	
3	CONTRACT NO	
4	CONTRACT VALUE	
5	LETTER OF INTENT NO & DATE	
6	CONTRACT PERIOD//CONTRACT DURATION	
7	DATE OF START/COMPLETION	
8	FINAL EXECUTED VALUE	
9	PERFORMANCE	GOOD SATISFACTORY UNSATISFACTORY

This certificate is issued as per your request vide letter no
without any prejudice to the rights of BHEL to use this certificate for evaluation of your offers for future
tenders

Yours faithfully,

For and on behalf of Bharat Heavy Electricals Limited

Head (Subcontracts)

FORMS & PROCEDURES

Form No: F-21 (Rev 00)

INDEMNITY BOND

(To be executed on a Non Judicial Stamp Paper of the requisite value as per Stamp Duty prevalent in the respective State)

This Indemnity Bond executed by <name of company> having their Registered Office at <xxxxxxxxxxx> in favour of M/s Bharat Heavy Electricals Limited, a Company incorporated under the Companies Act, 1956, having its Registered Office at BH EL House, Siri Fort, Asiad, New Delhi - 110049 through its Unit at Power Sector _____ Region, _____, _____ State.
(Hereinafter referred to as the Company)

And whereas the Company has entered into a Contract with M/s xxxxxxxxxx, the executants of this Deed (hereinafter referred to as the Contractor) as its contractor in respect of the work of "xxxxxxxxxxxxxxxxxxxxxxxxxxxx".

AND WHEREAS under the provisions of G C C further stipulates that the Contractor shall indemnify the Company against all claims of whatever nature arising during the course of execution of Contract including defects liability period of <xx Months > i.e till <xx xx xxxx>

Now this deed witnesses that in case the Company is made liable by any Authority including Court to pay any claim or compensation etc. in respect of all labourers or other matters at any stage under or relating to the Contract with the Contractor, the Contractor hereby covenants and agrees with the Company that they shall indemnify and reimburse the Company to the extent of such payments and for any fee, including litigation charges, lawyers' fees, etc, penalty or damages claimed against the Company by reason of the Contractor falling to comply with Central/States Laws, Rules etc, or his failure to comply with Contract (including all expenses and charges incurred by the Company).

The Contractor further indemnifies the Company for the amount which the Company may be liable to pay by way of penalty for not making deductions from the Bills of the Contractor towards such amount and depositing the same in the Government Treasury.

FORMS & PROCEDURES

The Contractor further agree that the Company shall be entitled to with hold and adjust the Security Deposit and/or with ho ld and adjust payment of Bills of Contractor pertaining to this Contract against any payme nt which the Company has made or is required to mak e for which the Contractor is liable under the Contract and that such amount can be withheld, adjusted by the Company till satisfactory and final settlement of all pending matters and the Contractor hereby gives his consent for the same.

The Contractor further agrees that the terms of indemnity shall s urvive the termination or completion of this contract.

The contractor further agrees that the liability of the contractor shall be extended on actual basis notwithstanding the limitations of liability clause, in respect of :

1. breach of terms of contract by the contractor
2. breach of laws by the contractor
3. breach of Intellectual property rights by the contractor
4. breach of confidentiality by the contractor

Nothing contained in this deed, shall be construed as absolving or limiting the liability of the Contractor under said Contract between the Company and the Contractor . That this Indemnity Bond is irrevocable and the condition of the bond is that the Contractor shall duly and punctually c omply with the terms and the conditions of this deed and contractu al provisions to the satisfaction of the Company.

In witness where of M/s xxxxxxxxxxxxxx these presents on the day, month and year first, above written at xxxxxxxx by the hand of its signatory Mr. xxxxxxxxxxxx.

Signed for and on behalf of
M/s xxxxxxxxxxxxxxxxxxxx

Witness:

1
2

FORMS & PROCEDURES

Form No: F-22 (Rev 00)

CONSORTIUM AGREEMENT

(To be executed on Rs. 50/- Non – Judicial Stamp Paper)

THIS AGREEMENT is made and executed on this _____ day of _____, by and between (1) M/s _____, (The First Party, i.e, the Bidder) a company incorporated under the Company's Act 1956, having its registered office at _____ (herein after called the "Bidder", which expression shall include its' successors, administrators, executors and permitted assigns) and (2) M/s _____, (The Second Party, i.e, the associates), a company incorporated under the Company's Act 1956, having its registered office at _____ (herein after called the " Associates", which expression shall include its' successors, administrators, executors and permitted assigns).

WHEAEAS the Owner, Bharat Heavy Electricals Ltd, a Government of India Undertaking, proposes to issue / issued an NIT (herein after referred to as the said NIT) inviting bids from the individual Bidders for undertaking the work _____ of _____ at _____ (herein after referred to as the said works).

WHEREAS the said NIT enables submission of a bid by a Consortium subject to fulfillment of the stipulations specified in the said NIT.

AND WHEREAS M/s _____ (The First Party, i.e, the Bidder) will submit its proposal in response to the aforesaid invitation to _____ bid by the Owner for _____ as detailed in the Bid doc. no. < TENDER REF----->

FORMS & PROCEDURES

AND WHEREAS M/s _____ (The First Party, i.e the Bidder) itself is meeting all the qualifying requirements except the qualifying requirements of _____ (as detailed in the NIT) and in order to fully meet the qualifying requirements of NIT, this tie-up agreement is _____ being entered into with M/s _____ (The Second Party, the Associates), who fully meet the balance part of the said work _____ s _____).

WHEREAS the First Party and the Second Party are contractors engaged in the business of carrying out various items of works. WHEREAS the two parties have agreed to constitute themselves into a consortium for the purpose of carrying out the said works, and that the consortium will be continued till the completion of the works in all respects.

WHEREAS the parties have agreed to certain terms and conditions in this regard:

NOW THEREFORE THIS AGREEMENT WITNESSETH AS FOLLOWS :

1. First and Second parties hereby constitute themselves into a Consortium for the purpose of bidding and undertaking the said works pursuant to the said NIT as hereinafter stated.
2. The First Party will be the leader (Lead Partner) and will be responsible for the entire works.

FORMS & PROCEDURES

CONSORTIUM AGREEMENT

3. The First Party shall undertake the following part(s) of work detailed in _____ the NIT namely _____

4. The Second Party shall undertake the following part(s) of work detailed _____ in the said NIT namely _____

5. The parties hereby declare and confirm that each of them will fulfill the required minimum qualifying requirements as prescribed in the said NIT for the works agreed to be undertaken by them as stated here-in-above.
6. It is also agreed between the parties hereto that all of them shall be individually and severally responsible for the completion of the said works as per the schedule. Further, if the Employer/Owner sustains any loss or damage on account of any breach of the Contracts, we the, Consortium partners individually and severally undertake to promptly indemnify and pay such losses / damages caused to the Employer/Owner on its written demand without any demur, reservation, contest or protest in any manner whatsoever.
7. The parties hereby agree and undertake that they shall provide adequate finances, suitable Tools, Plants, Tractors, Trailers, other transportation equipment, other Tools & Plants, Measuring & Monitoring Equipments (MMEs), Men and Machinery etc. for the proper and effective execution of the works to be undertaken by them as specified here-in-above.

FORMS & PROCEDURES

8. It is agreed interse between t he parties hereto that all the consequences liabilities etc., arising out of any default in the due execution of the said works shall be borne by the party in default, that is by party in whose area of works default has occurred, provided however, so far as M/s Bharat Heavy Electricals Limited is concerned, all the parties shall be liable jointly and severally.

IN WITNESS HEREOF the parties above named have signed this agreement on the day month and year first above written at _____(Place) .

WITNESS

For

1. NAME (FIRST PARTY)

2. OFFICIAL ADDRESS

WITNESS

For

1. NAME (SECOND PARTY)

2. OFFICIAL ADDRESS

[The successful bidder shall have to execute the " JOINT DEED OF UNDERTAKING " in the format to be made available by BHEL at the time of awarding].

FORMS & PROCEDURES

Form No: F-23 (Rev 00)

REFUND OF SECURITY DEPOSIT

To,
The Construction Manager
BHEL Site Office

Dear Sir,

Sub : **Refund of Security Deposit**

Ref : Contract No:

Work:.....

I/We have submitted Final Bill in respect of the above Contract/Work vide our letter no:.....
dated In line with Tender conditions (GCC clause no 1.11), kindly arrange to
release/refund the Security Deposit along with Final Bill payments.

The details of Security Deposit are as below:

1. Cash Portion :
2. BG Portion :

Thanking You

Date: _____

Authorised representative of Contractor

To be filled up by BHEL

1. Security Deposit to be refunded:
 - a. Cash Portion:
 - b. BG Portion :
2. Less
 - a. Amount spent by BHEL on behalf of Contractor:
 - b. Payments made by BHEL on behalf of Contractor:
 - c. Other recoveries for Services etc
 - d. Any other recoveries
 - e. Total of 'a' to 'd':
3. Net Amount to be released (1-2) :
4. Certified that
 - a. The payment recommended for release is in order and there are no demands other than those included in the claim outstanding from the Contractor
 - b. Contract Guarantee period of Months commenced wef : _____
 - c. All objections raised so far have been settled
 - d. A note for refund of Security Deposit has been made in the Measurement Book

Signature of BHEL Engineer

Construction Manager

Date:-----

FORMS & PROCEDURES

Form No: F-24 (Rev 00)

REFUND OF GUARANTEE MONEY

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR, _____ REGION

Ref No:

Date:

1. Name and Address of Contractor :
2. Contract Agreement/LOI No :
3. Date of Contract Agreement/LOI :
4. Name of the Work undertaken :
5. Date of commencement of the Work :
6. Date of Completion of the Work :
7. Period of Maintenance :
(Guarantee Period)
8. Date on which the Final Bill was paid :
9. Last date of making good the defect :
during Maintenance Period
10. Expenditure incurred by BHEL during :
Maintenance Period, if any, recoverable
11. Date on which Guarantee Money refund:
falls due as per Contract
12. Amount of Guarantee Money to be refunded:
13. Less Amounts recoverable (with details)
 - a. Amount spent by BHEL on maintenance :
 - b. Payments made by BHEL on behalf of Contractor:
 - c. Court dues/penalties/compensation :
 - d. Other recoveries for Services, etc :
 - e. Total of 'a' to 'd' :
14. Net Amount recommended for release (12-13) :

FORMS & PROCEDURES

Signature of BHEL Engineer

Date: _____

CERTIFICATE TO BE FURNISHED BY THE CONTRACTOR

I/We have no claim or demand outstanding against BHEL _____, for the work done or for labour or material supplied or any other account arising out of or connected with the Contract Agreement/LOI (No _____ dated _____) and the payment of this bill shall be in full and final settlement of all my/our claims and demands including the 'Deposits' of the Contract Agreement/LOI referred to.

Signature of Contractor

Date: _____

CERTIFICATE TO BE FURNISHED BY SENIOR ENGINEER/CONSTRUCTION MANAGER

1. Certified that
 - a. The payment recommended for release is in order and there are no demands other than those included in the claim outstanding from the Contractor
 - b. Maintenance period (Contract Guarantee period) is over and the Contractor has carried out the works required to be carried out by him during the period of maintenance (Guarantee) to our satisfaction, and all expenses incurred by the Company on carrying out such works have been included for adjustment
 - c. All objections raised so far have been settled
 - d. A note for refund of Guarantee Amount has been made in the Measurement Book and Contract Agreement/Work Order

Signature of BHEL Engineer

Construction Manager

Date:-----

FOR USE IN ACCOUNTS DEPARTMENT

Passed for Rs _____ (Rupees _____ only)

Accountant

Accounts Officer

ACKNOWLEDGE BY THE CONTRACTOR

Received Rs _____ in full and final settlement of my/our claim

Signature of Contractor

Date: _____

FORMS & PROCEDURES

Form No: F-25 (Rev 00)

POWER OF ATTORNEY for SUBMISSION OF TENDER/SIGNING CONTRACT AGREEMENT

(To be typed on non judicial Stamp Papers of appropriate value as applicable and Notarised)

KNOW ALL MEN BY THESE PRESENTS, that I/We do hereby make, nominate, constitute and appoint Mr, whose signature given below herewith to be true and lawful Attorney of M/s..... hereinafter called 'Company', for submitting Tender/entering into Contract and inter alia, sign, execute all papers and to do necessary lawful acts on behalf of Company with M/s Bharat Heavy Electricals Ltd, Power Sector _____ Region, _____, in connection with

.....
.....
..... vide Tender Specification No :
_____, dated _____.

And the Company do hereby agree to ratify and confirm all acts, deeds, things or proceedings as may be lawfully done by the said attorney and by or on behalf of the company and in the name of the company, by virtue of the powers conferred herein and the same shall be binding on the company and shall have full force and effect.

IN WITNESS WHEREOF the common seal of the company has been hereunto affixed in the manner hereinafter appearing on the document.

Dated at _____, this _____ day of _____

Director/CMD/Partner/Proprietor

Signature of Mr.....(Attorney)

Attested by: Director/CMD/Partner/Proprietor

Witness

Notary Public

FORMS & PROCEDURES

Form No: F-26 (Rev 00)

ANALYSIS OF UNIT RATES QUOTED

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

Offer Reference No:.....

Date:.....

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

Dear Sir,

Sub : Analysis of Unit Rates Quoted

Ref : Tender Specification No:

Analysis of Unit Rates quoted by us in respect of above Tender is as detailed

SN	DESCRIPTION	% OF QUOTED RATE	REMARKS
01	SITE FACILITIES VIZ., ELECTRICITY, WATER OTHER INFRASTRUCTURE.		
02	SALARY AND WAGES + RETRENCHMENT BENEFITS		
03	CONSUMABLES		
04	T&P DEPRECIATION & MAINTENANCE		
05	ESTABLISHMENT & ADMINISTRATIVE EXPENSES		
06	OVERHEADS		
07	PROFIT		
	TOTAL	100%	

Yours faithfully,

(Signature, Date & Seal of Authorized
Representative of the Bidder)

FORMS & PROCEDURES

Form WAM 6

BHARAT HEAVY ELECTRICALS LIMITED DIVISION.....

Running Account Bill

(Para 4.31.1 of Works Accounts Manual)

Name of the Contractor:
Name of the Work:
Sanctioned Estimate:
Code No:
Contract Agreement No :

Dated:

Departmental Bill no:
Division:
Date of written order to commence the work :
Date of commencement of the Work:
Due date of completion as per Agreement:

Date:
Sub-Division:

1. ACCOUNT OF WORK EXECUTED

On account payment for work not previously previously measured**			Item No of	Description of Work	Quantity as per agree- ment	Quantity executed up to date	Rate	Unit	Payment on the basis of actual measure- ment up to date	Quantity since last running account bill	Payment on the basis of actual measurement since last running account bill	Remarks
Total As per Running Account bill	since last running account bill	Total up to date										
Rs.	Rs.	Rs.					Rs.	P.	Rs.	P.	Rs.	P.
1	2	3	4	5	6	7	8	9	10	11	12	13

- * *1. Whenever payment is made on 'on account' basis without actual measurements the amount in whole rupees should be entered in columns 1 to 3 only and not in columns 7 to 12.
2. whenever there is an entry in column 12 on the basis of actual measurement, the whole of the amount previously paid without detailed measurement should be adjusted by a minus entry in column 2 equivalent to the amount shown in column 1, so that the total up to date in column 4 may become nil.

FORMS & PROCEDURES

Form WAM 6 (contd...)

1	2	3	4	5	6	7	8	9	10	11	12	13

Total value of work done up to date (A) ...

Running Account Bill Deduct value of work shown on the last (B) ...

Net value of work done since last (C) ...

Rupees (in words)

.....only.

FORMS & PROCEDURES

Form WAM 6 (contd...)

II.MEMORANDUM OF PAYMENTS

		Rs.	P.		I	II
					Rs.	P.
1.Total value of work actually measured as per Account No. I. Column 10	(A)	.....				
2.Total up to date 'on account' payment for work covered by approximate Or plan measurements as per Account No. I, Column 3	(B)	.....				
3.Total up to date secured advances on security of materials as per column 8 Of the enclosed Account (Form WAM 10)	(C)	.....				
4.Total up to date payments [(A) + (B) + (C)]	(D)	.....				
5.Total amount of payments already made as per Entry (D) of last Running Account Bill No..... Dated.....forwarded to the Accounts Office on	(E)					
6.Balance [(D)-(E)]		.....				
7.Payments now to be made:						
a) by cash/cheque					.....	
b) by deduction for value of materials supplied						
c) by BHEL vide Annexure A attached					.....	
d) by deduction for hire of tools and plant vide						

FORMS & PROCEDURES

Annexure B attached	.....	
e) by deduction for other charges vide Annexure C		
Attached	.....	
f)by deduction on account of security deposit	.....	
h) by deduction on account of Income Tax	.....	.....

Note: Amounts relating to items 4 to 6 above should be entered in column II and those relating to item 7 in column I. The amount shown against item 6 and the total of item 7 should agree with each other.

III.CERTIFICATE OF THE ENGINEER IN CHARGE

Form WAM 6 (contd...)

1. The measurements on which the entries in column 7 to 12 of Part I of this Bill (Account of work executed) are based were made by.....and are recorded at pages.....of
(Name and Designation)

Measurement Book No

2. Certified that the methods of measurement are correct and the work has been carried out in accordance with the terms and conditions, schedules, specifications and drawings etc, forming part of the contract agreement, subject to deviations included in the deviation statement (Annexure D).
3. Certified that in addition to and quite apart from the quantities of work actually executed as shown in column 10 of Part I, some work has actually been done in connection with several items and the value of the such work is, in no case, less than 'on account' payments as per column 3 of Part I, made or proposed to be made, for the convenience of the contractor in anticipation of, and subject to the results of, detailed measurement which will be made as soon as possible.

Signature of Contractor

Signature of Engineer in charge

Date:

Designation:

Date:

1. Certified that measurements have been check measured to the prescribed extent by at site and also by the undersigned and the relevant entries have been intialled in the Measurement book. (vide pages.....)
(Name and Designation)

2. Certified that all the measurements recorded in the measurement book have been correctly billed for

3. Certified that all recoberable amounts in respect of materials tools and plant etc, and other charges have been correctly made vide Annexures A to C attached.
Certified for payment * of Rs.....(Rupees.....only)
To be paid in cash/by cheque in the presence of

The expenditure is chargeable as under and to be included in the accounts for.....20.....

Credit (Deductions)

Rs.	P.

Signature of Senior Engineer
Date:

Form WAM 6 (contd...)

Accounts Bill No Dated.....
Entered in Journal Book vide entry No..... Dated.....
Passed for.....Rs.....
Less Deductions.....Rs.....
Net Amount Payable.....Rs.....
(Rupees.....only)
Payable to Shri/M/s.....by cheque/cash
Entered in Contractor's Ledger No.....Page.....

Code no:

Debit		Credit	
(Gross amount)		(Gross amount)	
Rs.	P.	Rs.	P.

Credit		(Deductions)	
Rs.	P.	Rs.	P.

Ledger Head

	Rs.	P.
1. 10000	10000	10000
2. 10000	10000	10000
3. 10000	10000	10000
4. 10000	10000	10000
5. 10000	10000	10000
6. 10000	10000	10000
7. 10000	10000	10000
8. 10000	10000	10000
9. 10000	10000	10000
10. 10000	10000	10000
11. 10000	10000	10000
12. 10000	10000	10000
13. 10000	10000	10000
14. 10000	10000	10000
15. 10000	10000	10000
16. 10000	10000	10000
17. 10000	10000	10000
18. 10000	10000	10000
19. 10000	10000	10000
20. 10000	10000	10000
21. 10000	10000	10000
22. 10000	10000	10000
23. 10000	10000	10000
24. 10000	10000	10000
25. 10000	10000	10000
26. 10000	10000	10000
27. 10000	10000	10000
28. 10000	10000	10000
29. 10000	10000	10000
30. 10000	10000	10000
31. 10000	10000	10000
32. 10000	10000	10000
33. 10000	10000	10000
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75. 10000	10000	10000
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77. 10000	10000	10000
78. 10000	10000	10000
79. 10000	10000	10000
80. 10000	10000	10000
81. 10000	10000	10000
82. 10000	10000	10000
83. 10000	10000	10000
84. 10000	10000	10000
85. 10000	10000	10000
86. 10000	10000	10000
87. 10000	10000	10000
88. 10000	10000	10000
89. 10000	10000	10000
90. 10000	10000	10000
91. 10000	10000	10000
92. 10000	10000	10000
93. 10000		

Rs. P.

FORMS & PROCEDURES

Assistant Date:	Accountant Date:	Account Officer Date:	Total	-----	-----

VI. Received Rs.....(Rupees.....only) as per
Memorandum of Payments on account of this work.

Signature of witness Address :	Revenue	Stamp Signature of Contractor Date:

VII. ENTRIES TO BE MADE BY TREASURY SECTION

Cash Book entry No. and date:	Amount paid	Rs.....
	Amount unpaid	Rs.....
	Total	Rs.....
	Signature of Cashier	
	Date:	

Form WAM 6 (contd...)

ANNEXURE A

FORMS & PROCEDURES

Statement showing details of materials issued to the contractor Shri/M/s.....

In respect of Contract Agreement No Dated.....

Sl. No.	Stores issue Voucher No. and date	Issue voucher No. and date allotted by stores to the SIV	Description of material issued to the contractor	Quantity issued	Quantity actually incorporated in the work	Whether recoverable from the contractor or supplied free	If recoverable from the contractor				REMARKS
							Rate at which recoverable	Amount recoverable	Amount recovered up to previous bill	Balance now recovered	
							Rs. P.	Rs. P.	Rs. P.	Rs. P.	
1	2	3	4	5	6	7	8	9	10	11	12
Total											

Signature of contractor

Signature of Engineer in Charge

Signature of Senior Engineer

Date:

Date:

Date:

FORMS & PROCEDURES

Form WAM 6 (contd...)

ANNEXURE B

Statement showing tools and plant issued to the contractor Shri/M/s.....

In respect of Contract Agreement No Dated.....

Sl. No	Description of tools and plant issued	Period for which	Rate at which	Amount recover-	Amount recovered	Balance now	Remarks
		Issued	recovery	able	upto	recovered	
			Is to be		previous		
			Made		bill		
			Rs. P.	Rs. P.	Rs. P.	Rs. P.	
1	2	3	4	5	6	7	8

Total

Signature of contractor

Signature of Engineer in Charge

Signature of Senior Engineer

Date:

Date:

Date:

FORMS & PROCEDURES

Form WAM 6 (contd...)

ANNEXURE C

Statement showing details of other recoveries to be made from the contractor Shri/M/s.....

In respect of Contract Agreement No Dated.....

Sl. No	Particulars	Unit	Quantity	Rate	Amount recover- able	Amount recovered upto pre- vious bill	Amount now recovered	Remarks
				Rs. P.	Rs. P.	Rs. P.	Rs. P.	
1	2	3	4	5	6	7	8	9

1. Water Charges
2. Electricity charges
3. Seignorage charges
4. Medical charges
5. Cost of empty gunny bags and
Empty containers not returned
- 6.
- 7.
- 8.
- 9.

FORMS & PROCEDURES

10.

Total

Signature of contractor

Signature of Engineer in Charge

Signature of Senior Engineer

Date:

Date:

Date:

FORMS & PROCEDURES

Form WAM 6 (contd...)

ANNEXURE D

Name of the Contractor:
Name of the Work:

Contract Agreement No:
Date:

Sl. No.	Description of item	Unit	Quantity as per Agreement	Quantity as executed	Quantity further anticipated	Total quantity anticipated on completion	Rate as per agreement Rs. P.
1	2	3	4	5	6	7	8

Rate as the executed with any Rs. P.	Amount as per agreement Rs. P.	Amount as executed Rs. P.	Amount further anticipated Rs. P.	Total amount anticipated on completion Rs. P.	Difference Excess savings Rs. P. Rs. P.	Reason for deviation authority, if
9	10	11	12	13	14 15	16

Signature of Engineer in Charge
Date:

Signature of Senior Engineer
Date:

FORMS & PROCEDURES

[illegible]

[illegible]

[illegible]

[illegible]

V. ENTRIES TO BE MADE IN THE ACCOUNTS OFFICE													
Account Bill no..... Dated										ALLOCATION			
Entered in Journal book vide entry No.....Dated.....										Estimate No: Code No			
Passed for.....Rs.....										Name of the Work			
Less Deductions.....Rs.....													
(Rupees.....Only)										Ledger Head Debit Credit			
Payable to Shri/M/s..... by cheque/cash										(Gross Amount) (Deduction)			
Entered in contractors' Ledger no..... Page										Rs P Rs			
Assistant Date:		Accountant Date:		Accounts officer Date:						Total			
VI. Received Rs.....(Rupees.....Only) in full and final settlement of all moneys due under this contract and I / we have no further claims of this contract.													
Signature of Witness Address													
										Revenue Stamp			
										Signature of Contractor			
										Date:			
VII . ENTRIES TO BE MADE BY TREASURY SECTION													
Cash book entry no and date :								Amount Paid Rs.....					
								Amount unpaid Rs.....					
								Total Rs.....					
								Signature of Cashier					
								Date:					

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

BHARAT HEAVY ELECTRICALS LIMITED DIVISION..... And Final bill (Para 4.3.2 Of Works Accounts Manual)														
Name of Contractor							Departmental Bill no				Date			
Name of the Work							Division				Division			
Sanctioned Estimate							Date of written order to commence the work							
Contract Agreement/work Order No							Date of commencement of work							
							Due date of completion as per agreement							
							Date of actual completion of the work							
I. ACCOUNT OF WORK EXECUTED														
On Account payment for the work not previously measured **										Payment on the basis of actual measurement up to date Rs P	Quantity since last running account bill	Payment on the basis of actual measurement since last running account bill Rs P	Remarks	
Total as per last running account bill Rs.	Since last running account bill Rs	Total up to date Rs												
1	2	3	4	5	6	7	8	9	10	11	12	13		

BHARAT HEAVY ELECTRICALS LIMITED,
POWER SECTOR - EASTERN REGION, KOLKATA
TENDER NO. PSER:SCT:BAR-C1962:19

1	2	3	4	5	6	7	8	9	10	11	12	13

Total Value of Work Done up to date (A)	
Deduct Value of work shown on the last running account bill (B)	
Net value of work done since last running account bill (C)	

Rupees (In Words).....Only

II MEMORANDUM OF PAYMENT

		Rs.	P
1	Total Value of work actually measured as per Account no I coloumn 10	(A)	
	Deduct amount of paym,ents already made as per last running account bill No Dated.....		
2	Forwarded to the Accounts Office on	(B)	
3	Payments now to be made { (A) - (B)}	(C)	
4	Deduct ammounts recoverable from the contractor on account of :	Rs	P
	a Material suplied by BHEL vide annexure A attached		
	b Hire of Tools & Plants vide Annexure B attached		
	c Other charges vide Annexure C attached		
	d Income Tax		
	Total deduction		
5	Balance		
6	Refund of 50% of security deposite on completion of work		
7	Net amount to be paid to the Contractor		

III. CERTIFICATE OF THE ENGINEER IN CHARGE

The measurement on which the entries in coulms 7 to 12 of Part I of this bill (Account of work executed) are based were made by

1	(Name and designation)
2	A statement showing the quantities of stores issued to the contractor (whether free or on recovery basis) and their disposal is attached.

Date:

Signature of Engineer in charge
Designation

V. ENTRIES TO BE MADE IN THE ACCOUNTS OFFICE

Account Bill no..... Dated
Entered in Journal book vide entry No.....Dated.....
Passed for.....Rs.....
Less Deductions.....Rs.....
(Rupees.....Only)
Payable to Shri/M/s..... by cheque/cash
Entered in contractors' Ledger no..... Page

ALLOCATION		Code No
Estimate No:		
Name of the Work		
Ledger Head	Debit (Gross Amount) Rs P	Credit (Deduction) Rs
.....		
Total	.....	.....

Assistant	Accountant	Accounts officer
Date:	Date:	Date:

VI. Received Rs.....(Rupees.....Only) in full and final settlement of all moneys due under this contract and I / we have no further claims of this contract.

Signature of Witness
Address

Revenue Stamp
Signature of Contractor
Date:

VII . ENTRIES TO BE MADE BY TREASURY SECTION

Cash book entry no and date :

Amount Paid Rs.....
Amount unpaid Rs.....
Total Rs.....

Signature of Cashier
Date:

ANNEXURE A

Part I

Statement showing details of material issued to the contractor Shri/M/s..... In respect of Contract

Agreement/Work Order No..... Dated

SI No	Stores Issue voucher No and date	Issue voucher No and date alloted by stores to the SIV	description of material issued to the contractor	Quantity issued	Quantity actually incorporated in the work	Whether recoverabl e from the contractor or supplied free	Rate at which recoverable		Amount Recoverabl e		Amount recoverable upto previous bill		Balance Now recovered		Remarks
							Rs	P	Rs	P	Rs	P	Rs	P	
1	2	3	4	5	6	7	8		9		10		11		12

Total

Signature of Contractor
Date

Signature of Engineer in charge
Date

Signature of Senior Engineer
Date

ANNEXURE A

Part II

Statement showing details of material issued to the contractor Shri/M/s..... in respect of Contract Agreement/Work Order No..... Dated and not covered by the agreement

SI No	Stores Issue voucher No and date	Issue voucher No and date alloted by stores to the SIV	description of material issued to the contractor	Quantity issued	Quantity actually incorporated in the work	Issue Rate	Amount Recoverabl e	Amount recoverable upto previous bill	Balance Now recovered	Remarks
1	2	3	4	5	6	Rs P	Rs P	Rs P	Rs P	11

Total

Add Departmental Charges

Add Sales Tax (wherever applicable)

Total

Signature of Contractor
Date

Signature of Engineer in charge
Date

Signature of Senior Engineer
Date

ANNEXURE B

Statement showing TOOLS & PLANTS issued to the contractor Shri/M/s..... in respect of Contract Agreement/Work Order No..... Dated and not covered by the agreement

SI No 1	Description of tools & plants issued 2	Period for which issued 3	Rate at which Recivry is to be made 4	Amount recoverabl e Rs P 5		Amount recoverable upto previous bill Rs P 6		Balance Now recovered Rs P 7		Remarks 8

Total

Signature of Contractor
Date

Signature of Engineer in charge
Date

Signature of Senior Engineer
Date

ANNEXURE C

showing detail of other recoveries to be made from the contractor Shri/M/s.....
ment/Work Order No.....Dated.....

Sr.No	Particulars	Unit	Quantity	Rate Rs. P.	Amount recoverable Rs. P	Amount recovered upto previous bill Rs. P.	Amount now recovered Rs. P.	Remarks
1	2	3	4	5	6	7	8	9
	1 Water Charges							
	2 Electricity Charges							
	3 Seignorage Charges							
	4 Medical Charges							
	Cost of empty gunny bags and empty containers not 5 returned							
	6							
	7							
	8							
	9							
	10							
Total								

Signature of Contractor
Date

Signature of Engineer Incharge
Date

Signature of Sr. Engineer
Date

Form WAM 7 (Contd.)

ANNEXURE D -
DEVIATION STATEMENT :

Name of the Contractor :

Contract Agreement/Work Order No. :

Name of the Work :

Date :

Sl. No.	Description of item	Unit	Quantity as per agreement	Quantity as executed	Rate as per agreement Rs. P.	Rate as executed Rs. P.	Amount as per agreement Rs. P.	Amount as executed Rs. P.	Difference		Reason for the deviation with authority, if any
									Excess	Savings	
1	2	3	4	5	6	7	8	9	10	11	12

Signature of Engineer in Charge

Date :

Signature of Senior Engineer

Date :

ANNEXURE E

Statement showing the consumption of materials issued to the contractor Shri/M/s.....
in respect of Contract Agreement/Work Order No..... Dated.....

Name of the Work :

ON RECOVERY BASIS

Sl. No.	Description of material	Unit	Quantity actually issued	Quantity actually incorporated in the work	Balance	Particulars of disposal of balance	Quantity to be issued as per approved data for work actually done	Variation in consumption (Difference between column 5 and 8)		Rate chargeable for excess/short consumption, if any	Amount recoverable for excess/short consumption, including materials not returned	
								More	Less	Rs. P.	Rs. P.	
1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Cement											
2.	Bricks											
3.	Wood.....											
4.	Asbestos Sheet											
5.	Iron Materials											
6.												
7.												
8.												
9.												
10.												

Signature of Contractor

Date :

Signature of Engineer in Charge

Date :

Signature of Senior Engineer

Date :

Note : 1. The quantities shown in columns 4 and 5 above should tally with those shown in columns 5 and 6 respectively of Annexure A (Part I and II).

2. Data statement of theoretical consumption should be attached in support of quantity specified in column 8.

QUESTIONNAIRE TO BE ANSWERED BY ENGINEER IN CHARGE AND SENIOR ENGINEER	
(Correct particulars and answers to be recorded)	
Name of the work :	
Name of the Contractor :	
Date of commencement of the work:	
Contract agreement/work ordered no. and date:	
Reference to supplementary agreement no,if any :	
Whether administrative approval and technical sanction has been accorded by the competent authority ? If so ,cite reference	
Whether sanction of the competent authority and financial concurrence of the Accounts Department for award of the work has been accorded ? If so,cite reference.	
Whether the work has been completed in time ? If not ,whether penalty has been levied or sanction of the competent authority for extension of time granted and communicated to the Accounts Department with reasons for grant of extension? (Due and actual date of completion of the work and reference to letter no. and date granting the extension of time should be given)	
(a) Whether the rates allowed in the bill have been checked with the contract agreement ? (b) Whether the rates for extra/supplemental items have been approved by the competent authority and the sanction communicated to the accounts Department together with rate analysis? If so,cite reference.	
Whether deviations have been approved by the competent authority? If yes, give reference to the approval; if not, give reasons.	
Whether the rates of recovery of stores issued to the contractor which are not provided for in the Contract Agreement have been settled in consultation with Finance?	
Whether discrepancies pointed out by the Accounts Department in the store statement have been reconciled and accepted by the Accounts Department?	

QUESTIONNAIRE TO BE ANSWERED BY ENGINEER IN CHARGE AND SENIOR ENGINEER	
(Correct particulars and answers to be recorded)	
Whether materials issued to the contractor in excess of the theoretical requirements have been returned to the Stores Department and the no. and date of such returned stores vouchers have been shown in stores statement? If not, whether the cost of such excess material has been recovered at the prescribed rate? Whether consumption statements in respect of materials chargeable to the work have been attached to the bill?	
Whether consumption of materials shown has been technically checked by Senior Engineer?	
Whether materials issued and used in the work is not less than that required for consumption in work according to our specification? If consumption is less, whether necessary recovery has been made in the bill?	
Whether measurements have been checked by the Engineer and Sr. Engineer to the extent required and certificates of check recorded in the measurement books?	
Whether contractor has signed the bill and the measurement books without reservations? If not, whether reasons have been intimated to the Accounts Department?	
Whether arithmetical calculations have been checked and certificate recorded in the measurement books by a person other than the one who calculated initially	
Whether any work was done at the risk and cost of the contractor and whether such cost has been recovered from him? Give particulars.	
Whether all advance payments on running Accounts have been recovered?	
Whether all the recoveries due to services given to the contractor like rent of accommodation, water charges, electricity charges etc. have been recovered and whether payments made by the company on behalf of the contractor have been adjusted?	
Whether the files containing abstracts from measurement books/ standard measurement books have been completed/ updated?	
Whether hire charges of tools and plant have been recovered and the statement of hire charges with full details attached?	

QUESTIONNAIRE TO BE ANSWERED BY ENGINEER IN CHARGE AND SENIOR ENGINEER	
(Correct particulars and answers to be recorded)	
Whether the certificate of workmanship and completion of work according to specifications, drawings etc. is recorded by Engineer/ Sr. Engineer and whether recoveries have been made for defective works, if any?	
Whether all corrections in the bill/measurement books etc. have been neatly made and attested and there are no overwriting?	
Whether final measurements have been taken as soon as possible after completion of work and the certificate of completion issued? If not, whether reasons for delay have been recorded and communicated to Accounts?	
In respect of Quantities reduced in the final bill as compared to the running payment, whether adequate reasons have been recorded and communicated to Accounts?	
Whether the Expenditure has been classified correctly according to heads of Account recorded in the sanctioned estimate?	
Whether the work has been completed within the estimated cost? If not, what is the percentage of excess over the sanctioned estimate/ administrative approval? In case the excess is beyond the competency of Sr. Engineer, what action has been taken for the obtaining the approval of the authority competent to sanction the excess?	
(a) If the contractor has furnished bank guarantee in lieu of cash security deposit towards proper execution of works and guarantee against defects during the maintenance period, whether the period of currency of the bank guarantee covers the entire maintenance period? (b) If not, whether security deposit has been proposed to be recovered from the final bill?	
Whether all the previous audit objections raised on running Account bills have been settled? If so, cite reference.	
Signature of Engineer in Charge	Signature of Engineer in Charge
Date:	Date:



PS-

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page 1 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART- A: PLAN/ REVIEW OF WORK FOR THE MONTH OF

Date of Plan/ Review.....

SN.	Description of Work	Unit of Measurement	Unit Rate	Planned		Cumulative Shortfall attributable to contractor upto last month (Refer Note 1)		Achieved		Shortfall attributable to BHEL w.r.t Plan (as per Col. 3 of Part-D)		Cumulative Shortfall attributable to Contractor upto & including this month		REMARKS (Reasons for Shortfall attributable to Contractor. Supporting documents to be kept as record.)
				(QTY Planned for the month as per Part –C of last month)										
(a)	(b)	(c)	(d)	A		B		C		D		E=A+B-C-D		
				Phy.	Financial	Phy	Financial	Phy.	Financial	Phy.	Financial	Phy.	Financial	
	Value of Other Items not mentioned above but planned to be executed in this month													
Total					ΣA		ΣB		ΣC		ΣD		ΣE	

CONTRACTOR
(Sign with name, designation and date)

 PS-	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 2 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART- A: Contd.....

Note 1: **In addition to the work planned as per Col. 'A', Contractor shall also make full efforts to minimize the 'Cumulative shortfall attributable to contractor upto the month' as mentioned in Col. 'B' by enhancing its resources, so as to achieve the completion of activities as per agreed schedule. In case contractor is not able to execute the entire shortfall, then BHEL 'Engineer in-charge', shall decide the priority of work to be executed and it shall be binding on the contractor.**

Note 2: Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month = $[(\Sigma E - \Sigma B) / (\Sigma A - \Sigma D)] \times 100$
In case, $(\Sigma E - \Sigma B)$ is negative, then it shall be treated as zero percent."

Note 3: Form 14 should include all items being planned in the current month, and all items against which shortfall was attributable to contractor till previous month. However, for practical reason, if it is not possible to mention some of the items in Form-14 being planned to be executed in this month, then also value of such items shall necessarily be included in calculation of Total Value.

Note 4: In case reason for shortfall attributable to contractor is w.r.t. T&P and Manpower, it should be in conformity with Part B1 and B2.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 PS-	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 3 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – B-1: PLAN/REVIEW OF DEPLOYMENT OF MAJOR T&Ps FOR THE MONTH OF

Date of Plan/ Review.....

CONTRACTOR'S SCOPE: -

SN.	PLAN				DEPLOYMENT STATUS			
	Major T&P to be deployed as per work planned for the month	QTY	Deployment Period (in days)	Weightage assigned to planned T&P (in fraction such that $\Sigma C = 1$)	Actual Deployed Quantity	Actual Deployment Period (in days)	Weighted T&P Deployed	REMARKS (Works affected due to non-deployment of T&Ps)
		A	B	C	D	E	$F = (C \times D \times E) / (A \times B)$	

Note: In case, $E > B$, it shall be considered as $E = B$. Similarly, in case $D > A$, it shall be considered as $D = A$.
Percentage of T&P Deployed = $\Sigma F \times 100$

BHEL SCOPE: -

SN.	PLAN				DEPLOYMENT STATUS		
	Major T&P to be deployed as per work planned for the month	QTY	Deployment Period (in days)	Actual Deployed Quantity	Actual Deployment Period (in days)	REMARKS (Works affected due to non-deployment of T&Ps)	

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 PS-	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 4 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – B-2: PLAN/ REVIEW OF DEPLOYMENT OF MANPOWER FOR THE MONTH OF

Date of Plan/ Review.....

CONTRACTOR'S SCOPE: -

SN.	Area of Work	Category of Labour	No. of Labour required as per category	Deployment Period (in days)	No. of Labour actually deployed	Actual Deployment Period (in days)	REMARKS (Works affected due to non-availability of labour)
			A	B	C	D	

Percentage of Manpower Deployed= $100 \times \frac{\sum(C \times D)}{\sum(A \times B)}$

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 PS-	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 5 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – C: PLAN(PHYSICAL) FOR THE NEXT MONTH i.e.

Date of Plan

SN.	Description of work	Original Planned Quantity	Planned Quantity (excluding shortfalls attributable to contractor till date)	Unit of Measurement	T&Ps Required				Manpower Required		REMARKS (Reasons for difference in Original Planned Quantity w.r.t. Planned quantity to be given)
					Contractor Scope		BHEL Scope		Category of Labour	No. of Labour required as per Category	
					Major T&P to be deployed as per work planned for the month	Quantity	Major T&P to be deployed as per work planned for the month	Quantity			

Note 1: Planned quantity should be based on available/ expected fronts/ inputs in the next month

Note 2: “Original Planned Quantity” shall be as per latest jointly agreed programme between BHEL and Contractor before commencement of work or at the time of latest Time Extension, as the case may be.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 PS-	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 6 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – D: REASONS FOR SHORTFALL ATTRIBUTABLE TO BHEL IN RESPECT OF PLAN FOR THE MONTH.....

SN.	Description of Work (from Part-A)	Quantities Affected		Reasons for Shortfall attributable to BHEL	Agency responsible for reasons for Shortfall	Remarks (Supporting Documents in respect of agency responsible)
		(Physical Quantity)	Unit of Measu- rement			
1	2	3	4	5	6	7

Note1: Reasons for shortfall shall include non-availability of fronts/ drawings/ materials/ T&P (BHEL Scope)/ clearances etc. and other hindrances for which contractor is not responsible.

Note2: Agency responsible may be BHEL Site/ MUs/ Design Centre/ BHEL Customer/ other Contractors etc.

BHEL
(Sign with name, designation and date)

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of the Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its Unit at Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700091 having awarded to (Name of the Vendor / Contractor / Supplier) having its registered office at _____¹ hereinafter referred to as the 'Contractor/Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No.....dated ² valued at Rs.....² (Rupees -----)for <Nature of Work>³ (hereinafter called the 'Contract') and the Contractor having agreed to provide a Contract Performance Guarantee, equivalent to% (.... Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we, ..., (hereinafter referred to as the Bank), having registered/Head office at and inter alia a branch at being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer a maximum amount Rs ----- (Rupees -----)⁴ without any demur, immediately on a demand from the Employer, .

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor/ Supplier in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the contractors/supplier shall have no claim against us for making such payment.

We the bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Contractor/Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor/Supplier and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor/Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Contractor/Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall remain in force upto and including.....⁵ and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor/Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the ⁶ (3 months more than the present date of validity of Bank Guarantee) we shall be discharged from all liabilities under this guarantee thereafter.

We, ... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁷
- b) This Guarantee shall be valid up to ⁸
- c) Unless the Bank is served a written claim or demand on or before ⁹ (3 months more than the present date of validity of Bank Guarantee) all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Any claim or dispute arising under the terms of this document shall only be enforced or settled in the courts of at Kolkata only.

For and on behalf of
(Name of the Bank)

Dated.....

Place of Issue.....

¹ NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

² DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

³ PROJECT/SUPPLY DETAILS

⁴ BG AMOUNT IN FIGURES AND WORDS

⁵ VALIDITY DATE

⁶ DATE OF EXPIRY OF CLAIM PERIOD

⁷ BG AMOUNT IN FIGURES AND WORDS.

⁸ VALIDITY DATE

⁹ DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 2/3 months after validity date.

2. In Case of Bank Guarantees submitted by Foreign Vendors-

- a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.

- b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**
- b.1** In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
- b.2** **In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank** (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
- b.3** The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.
- b.4** The BG should clearly specify that the demand or other document can be presented in electronic form.

**BANK GUARANTEE FOR SECURITY DEPOSIT CUM PERFORMANCE BANK GUARANTEE
BOND**

B.G. NO.

Date

This deed of Guarantee made this ----- day of -----two thousand ---- by <Name and Address of Bank> hereinafter called the "The Guarantor" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns) in favour of M/s Bharat Heavy Electrical Limited (A Govt. of India Undertaking) a company incorporated under the Companies Act, 1956, having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its unit at <Address of Power Sector Region¹> hereinafter called "The Company" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns)

WHEREAS < Contractor's Name and Address> (hereinafter referred to as the Contractor) have entered into a contract arising out of Letter of Intent no. < LOI REF & Date > (hereinafter referred to as "the contract") for < Name of Work > with the company.

AND WHEREAS the contract inter-alia provides that the contractor shall furnish to the company a sum of Rs.----- (Rupees-----) towards security deposit for due and faithful performance of the contract in the form and manner specified therein.

AND WHEREAS the contractor has approached the Guarantor and in consideration of the arrangement arrived at between the contractor and the Guarantor, the Guarantor has agreed to give the Guarantee as hereinafter mentioned in favour of the company.

The Guarantor do hereby guarantee to the company the due and faithful performance, observance or discharge of the Contract by the contractor and further unconditionally and irrevocably undertake to pay to the Company without demur and merely on a demand, to the extent of Rs.----- (Rupees-----) against any claim by the company on them for any loss, damage, costs, charges and expenses caused to or suffered by the company by reasons of the contractor making any default in the performance, observance or discharge of the terms, conditions, stipulations or undertakings or any of them as contained in the contract.

The decision of the company whether any default has occurred or has been committed by the contractor in the performance, observance or discharge of any of the terms, conditions, stipulations or undertakings or any one of them as contained in the contract and / or as to the extent of loss, damage, costs, charges and expenses caused to or suffered by the company by reason of the contractor making any default in the performance, observance or discharge of any of the terms, conditions, stipulations or undertakings or any one of them shall be conclusive and binding on the Guarantor irrespective of the fact whether the contractor admits or denies the default or questions the correctness of any demand made by the company in any Court, Tribunal or Arbitration proceedings or before any other Authority.

The company shall have the fullest liberty without affecting in any way the liability of the Guarantor under this Guarantee, from time to time to vary any of the terms and conditions of the contract or extend time of performance by the contractor or to postpone for any time and from time to time any of the powers exercisable by it against the contractor and either enforce or forebear from enforcing any of the terms and conditions governing the contract or securities available to the company and the Guarantor shall not be released from its liability under these presents by any exercise by the company of the liberty with reference to the matters aforesaid or by reasons of time being given to the contractor or any other forbearance, act or commission on the part of the company or any indulgence by the company to the contractor or any other matter or thing whatsoever which under the law relating to sureties would, but for this provision have the effect of so releasing the Guarantor from its liability under this guarantee.

The Guarantor further agrees that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the contract and its claim satisfied or discharged and till the company certifies that the terms and conditions of the contract have been fully and properly carried out by the contractor and accordingly discharges this Guarantee, subject however, that the company shall have no claim under this Guarantee after ----- i.e. (3 months more than the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time, as the case may be) unless a notice of the claim under this Guarantee has been served on the Guarantor before the expiry of the said period in which case the same shall be enforceable against the Guarantor notwithstanding the fact that the same is enforced after the expiry of the said period.

**BANK GUARANTEE FOR SECURITY DEPOSIT CUM PERFORMANCE BANK GUARANTEE
BOND**

The Guarantor undertakes not to revoke this Guarantee during the period it is in force except with the previous consent of the Company in writing and agrees that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the contractor or the Guarantor shall not discharge the Guarantor's liability hereunder.

It shall not be necessary for the company to proceed against the contractor before proceeding against the Guarantor and the Guarantee herein contained shall be enforceable against them notwithstanding any security which the Company may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the Guarantor hereunder be outstanding or unrealized.

Notwithstanding anything contained herein before, our liability under the Guarantee is restricted to Rs.-----
- (Rupees-----). Our guarantee shall remain in force until -----, i.e. (the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time) unless a claim or demand under this guarantee is made against us on or before ----- (3 Months more than the validity date) we shall be discharged from our liabilities under this Guarantee thereafter.

Any claim or dispute arising under the terms of this documents shall only be enforced or settled in the courts of at < **Name of place²** > only.

The Guarantor hereby declares that it has power to execute this guarantee and the executant has full powers to do so on behalf of the Guarantor.

IN WITNESS whereof the ----- (Bank) has hereunto set and subscribed its hand the day, month and year first, above written.

(Name of the Bank)

Signed for and on behalf of the Bank
(Designation of the Authorized Person Signing the Guarantee)

(Signatory No.-----)

DATED:

SEAL

Notes :

1. **Address of Power Sector Regions (inviting the Tender)** is as below:
 - PSNR : Bharat Heavy Electricals Limited, Power Sector Northern Region, HRDI & PSNR Complex, Plot No 25, Sector 16-A, Noida – 201 301 (Uttar Pradesh)
 - PSER : Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700 091
 - PSWR: Bharat Heavy Electricals Limited, Power Sector Western Region, Shree Mohini Complex, 345 Kingsway, Nagpur 440 001
 - PSSR: Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600 035
2. **Name of place (for jurisdiction of Courts)** is as below:
 - PSNR : Delhi
 - PSER : Kolkata
 - PSWR: Nagpur
 - PSSR : Chennai
3. The BG shall be executed on non-judicial stamp papers of adequate value procured in the name of the Bank in the State where the Bank is located.
4. The BG is required to be sent by the executing Bank directly to BHEL at the address where tender is submitted / accepted under sealed cover.

BANK GUARANTEE FOR RELEASE OF AMOUNTS WITHHELD/LIQUIDATED DAMAGES AMOUNT

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of the Bharat Heavy Electricals Limited ¹(hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its Unit at Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700091 having awarded to (Name of the Vendor / Contractor / Supplier) incorporated under the having its registered office at _____ ¹(hereinafter referred to as the 'Contractor', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No.....dated ²valued at Rs.....(Rupees -----) for <Nature of Work>³(hereinafter called the 'Contract')

The Contractor as per Contract should have completed the work/ supplies under the contract by.....(date). As per terms and conditions of the Contract, the Employer is entitled to levy Liquidated Damages (LD) for delays and the Employer has withheld an amount of Rs by way of LD as per the Contract. Now, on the request of the Contractor, the Employer having agreed to release the amount of Rs.....withheld from the Contractor's invoices as Liquidated damages under the terms and conditions of the Contract on production of a Bank Guarantee for Rs. _____ (Rupees.....only) ⁴

We, ..., (hereinafter referred to as the Bank), having registered/Head office at and inter alia a branch at being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer a maximum amount of Rs ----- (Rupees -----) without any demur, merely on a demand from the Employer

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor/ Supplier in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the contractors/supplier shall have no claim against us for making such payment.

We the bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Contractor/Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor/Supplier and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor/Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Contractor/Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's/ Supplier's liabilities.

This Guarantee shall remain in force upto and including.....⁵ and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor/Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the ⁶ (3 months more than the present date of validity of Bank Guarantee) we shall be discharged from all liabilities under this guarantee thereafter.

We, ... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁷
- b) This Guarantee shall be valid up to ⁸
- c) Unless the Bank is served a written claim or demand on or before ⁹ (3 months more than the present date of validity of Bank Guarantee) all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, ... Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Any claim or dispute arising under the terms of this document shall only be enforced or settled in the courts of at Kolkata only.

For and on behalf of
(Name of the Bank)

Dated.....

Place of Issue.....

¹ NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

² DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

³ PROJECT/SUPPLY DETAILS

⁴ BG AMOUNT IN FIGURES AND WORDS

⁵ VALIDITY DATE

⁶ *DATE OF EXPIRY OF CLAIM PERIOD*

⁷ *BG AMOUNT IN FIGURES AND WORDS.*

⁸ *VALIDITY DATE*

⁹ *DATE OF EXPIRY OF CLAIM PERIOD*

Note:

- 1. Units are advised that expiry of claim period may be kept 2/3 months after validity date.**
- 2. In Case of Bank Guarantees submitted by Foreign Vendors-**
 - a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**
 - b.1** In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2** In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
 - b.3** The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.
 - b.4** The BG should clearly specify that the demand or other document can be presented in electronic form.

BANK GUARANTEE FOR SUPPLY FREE ISSUE MATERIAL.

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of the Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its Unit at Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700091 having awarded to (Name of the Vendor / Contractor / Supplier).having its registered office at _____¹ (hereinafter referred to as the 'Contractor/Supplier/Fabricator' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref. No.....dated ² valued at Rs.....(Rupees -----) for <Nature of Work>³ (hereinafter called the 'Contract')

and, the Employer having agreed as per the terms and conditions of the Contract to supply free issue material costing Rs._____ for the manufacture/fabrication of the equipment at the Contractor's site on on furnishing a Bank Guarantee for Rs._____ (Rupees.....)⁴ in the manner hereinafter specified for the due safeguard of the free issue material,

we, ..., (hereinafter referred to as the Bank), having registered/Head office at and inter alia a branch at being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer a maximum amount of Rs ----- (Rupees -----) without any demur, merely on a demand from the Employer, .

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor/ Supplier in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Contractors/Supplier shall have no claim against us for making such payment.

We the Bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Contractor/Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor/Supplier and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor/Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Contractor/Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor/Supplier/ Fabricator and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's/Supplier's/ Fabricator's liabilities.

This Guarantee shall remain in force upto and including.....⁵ and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor/ Supplier/ Fabricator but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the ⁶ (3 months more than the present date of validity of Bank Guarantee) we shall be discharged from all liabilities under this guarantee thereafter.

We, ... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁷
- b) This Guarantee shall be valid up to ⁸
- c) Unless the Bank is served a written claim or demand on or before ⁹ (3 months more than the present date of validity of Bank Guarantee) all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Any claim or dispute arising under the terms of this document shall only be enforced or settled in the courts of at Kolkata only.

For and on behalf of
(Name of the Bank)

Dated.....

Place of Issue.....

¹ NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER .

² DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

³ PROJECT/SUPPLY DETAILS

⁴ BG AMOUNT IN FIGURES AND WORDS

⁵ VALIDITY DATE

⁶ DATE OF EXPIRY OF CLAIM PERIOD

⁷ BG AMOUNT IN FIGURES AND WORDS.

⁸ VALIDITY DATE

⁹ DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 2/3 months after validity date.
2. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. **From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 **In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank** (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.
 - b.4 The BG should clearly specify that the demand or other document can be presented in electronic form.

PROFORMA OF BANK GUARANTEE FOR EARNEST MONEY
(On non-Judicial paper of appropriate value)

Bank Guarantee No.....

Date.....

To

(Employer's Name and Address)

.....

Dear Sirs,

In accordance with the terms and conditions of your Invitation for Bids/Notice Inviting Tender No.....¹(Tender Conditions) M/s. having its registered office at ² (hereinafter referred to as the '**Tenderer**'), is submitting its bid for the work of..... for.....³. at Bharat Heavy Electricals Limited, Power Sector Eastern Region, BHEL Bhawan, Plot No 9/1, DJ Block, Sector-II, Salt lake City, Kolkata – 700091.⁴(name of the Employer)

The Tender Conditions provide that the **Tenderer** shall pay a sum of Rs as Earnest Money Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of ⁵ is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,,

we, the[Name & address of the Bank] having our Head Office at(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs. ⁵(*).....without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand. Any such demand made by the 'Employer' shall be

conclusive and binding on us irrespective of any dispute or difference raised by the Tenderer.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

We Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to extend the time of submission of bids from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Tenderer and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Tendered or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Tenderer and notwithstanding any security or other guarantee that the Employer may have in relation to the Tenderer's liabilities.

This Guarantee shall be irrevocable and shall remain in force upto and including.....⁶ and shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the ⁷ we shall be discharged from all liabilities under this Guarantee.

We, ... Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....5.....
- b) This Guarantee shall be valid up to 6
- c) Unless the Bank is served a written claim or demand on or before _____⁷ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of

(Name of the Bank)

Date.....

Place of Issue.....

¹ *Details of the Invitation to Bid/Notice Inviting Tender*

² *Name and Address of the Tenderer*

³ *Details of the Work*

⁴ *Name and Address of BHEL Unit/Division/Region (Already filled up)*

⁵ *BG Amount in words and Figures*

⁶ *Validity Date*

⁷ *Date of Expiry of Claim Period*

Note:

1. Units are advised that expiry of claim period may be kept 2/3 months after validity date. As per Works Policy, the Bank Guarantee shall be valid for at least six months.

2. In Case of Bank Guarantees submitted by Foreign Vendors-

- a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
- b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**

 - b.1** In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter-Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2** **In case, Foreign Vendors intend to provide BG from** Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
 - b.3** The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.
 - b.4** The BG should clearly specify that the demand or other document can be presented in electronic form.

TENDER NO: PSER:SCT:BAR-C1962:19

VOLUME -IF

TECHNICAL CONDITIONS OF CONTRACT
(TCC)

FOR

**APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE
CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL
POWER PROJECT, STAGE-I,**

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVT. OF INDIA UNDERTAKING)

POWER SECTOR – EASTERN REGION

PLOT NO. – 9 / 1, DJ – BLOCK,

SECTOR – II, KARUNAMOYEE,

SALT LAKE CITY,

KOLKATA – 700091.

CONTENT

CLAUSE NO	DESCRIPTION
1.0	PROJECT SYNOPSIS AND GENERAL INFORMATION
2.0	SITE VISIT
3.0	SCOPE OF WORK
4.0	INSURANCE
5.0	DEVIATIONS/CLARIFICATIONS
6.0	DEWATERING
7.0	LAND
8.0	WATER
9.0	ELECTRICITY
10.0	CONSUMABLE
11.0	TEST CERTIFICATES
12.0	IMTE
13.0	QUALITY CONTROL & QUALITY ASSURANCE
14.0	WORK AND SAFETY REGULATIONS
15.0	PROJECT MANAGEMENT/ CONSTRUCTION MANAGEMENT
16.0	TEST CERTIFICATE FOR T&P
17.0	T&P TO BE PROVIDED BY BHEL
18.0	MATERIAL HANDLING (BHEL ISSUED MATERIAL)
19.0	ISSUE OF MATERIALS
20.0	RETURN OF MATERIALS
21.0	CONSUMPTION AND WASTAGE
22.0	RECONCILIATION OF BHEL ISSUED MATERIALS
23.0	RECOVERY OF MATERIAL
24.0	CONSTRUCTION OF TEMPORARY OFFICE, STORES ETC
25.0	TOOLS & PLANTS (TO BE PROVIDED BY CONTRACTOR)
26.0	CONSTRUCTION SCHEDULE
27.0	COMPLETION PERIOD
28.0	CERTIFICATE TOWARDS COMPLETION
29.0	MOBILIZATION ADVANCE/ INTEREST BEARING RECOVERABLE ADVANCE
30.0	REVISION ON ACCEPTED CONTRACT RATE
31.0	LIQUIDATED DAMAGE/PENALTY
32.0	CONTRACT PRICE
33.0	TAXES AND DUTIES
34.0	TERMS OF PAYMENTS
35.0	PRICE VARIATION COMPENSATION
36.0	OVER RUN CHARGES
37.0	METHOD OF MEASUREMENT
38.0	EXTRA/ ADDITIONAL ITEMS OF WORK
39.0	GUARANTEE
40.0	EXCLUSION
41.0	OTHER TERMS
	ANNEXURE-I

TENDER NO – PSER:SCT:BAR-C1962:19		
VOLUME-IF-CML-REV-00	TECHNICAL CONDITIONS OF CONTRACT (TCC)	PAGE 2 OF 26

These Technical conditions shall be construed as part of tender document and shall be read along with General Conditions of Contract. In case of any conflict or inconsistency between the general and these special conditions, the same shall be brought out by the bidder in writing to BHEL for clarification during pre-bid discussions; failing which most stringent interpretation / clause in favour of BHEL shall be adopted and the same shall be binding to the contractor.

CLAUSE NO	DESCRIPTION
1.0	PROJECT SYNOPSIS AND GENERAL INFORMATION
	Project name: BARH SUPER THERMAL POWER PROJECT, STAGE-I No. of Units x capacity: 3 X 660 MW Project setting up by: National thermal Power Corporation Project Location : (i) Place: BARH : (ii) District: PATNA : (iii) State: BIHAR Nearest Railway station: BARH Distance of project location from the Railway station: 3.0 KM (Approx.) Nearest town: BARH Distance of the town from the Project site: 4.0 KM Nearest Commercial Airport: PATNA Distance of airport from the project site: 75 KM. Nearest Road Head: National Highway-31.
	INSTRUCTIONS TO TENDERERS
	The Tenderer are advised to physically visit the site and fully acquaint themselves with site conditions, transportation routes, various distances and the fact that other contractors would be working in this area and their structures are to be protected. The material brought and stacked for construction should not make hindrance to other contractors. Necessary precaution and arrangements including sprinkling of water during work as acceptable to BHEL for safety & security for the above have to be made by the contractor. No claim will be entertained by BHEL on ground of lack of knowledge and the contractor's rates shall be deemed to have taken this into account. The contractor, in the event of this work awarded to him, shall establish an office at site and keep posted an authorized, responsible officer with valid Power of Attorney for the purpose of the contract. Any order or instructions of the 'Engineer' or his duly authorized representative, communicated to the contractor's representative at site office will be deemed to have been communicated to the contractor at his legal address.
2.0	SITE VISIT
	The bidder must visit the work site of 3x660 MW Barh Super Thermal Power Project, Stage-1 site, to acquire full knowledge and information about the conditions prevailing at site as well as, in and around the project site, together with the statutory, obligatory, mandatory requirements of various authorities before submission of the bid.
3.0	SCOPE OF WORK
3.1	Scope of this tender covers works Installation of Borosilicate Glass Lining along with all associated work in Flue can of U#1 Chimney completion as per drawing, Instruction of engineer, specification and price schedule.
3.2	Installation of Borosilicate Glass Lining inside MS Flue Cans, including surface preparation, application of primer, adhesive etc. as per the technical specifications and approved erection procedure under the expert supervision of Borosilicate Glass Lining manufacturer /supplier.
3.3	The work to be performed under this specification consists of providing all labour, materials, consumables, supervision scaffolding, power, fuel equipment, tools & plants, measuring, testing instruments, supplies temporary works, temporary storage sheds for contractors own use, temporary colony for labour and staff, temporary site offices, constructional plant's transportation/ handling and all incidental items not shown or specified but reasonably implied or necessary for the completion of subject scope, all in strict accordance with the specifications including revisions and amendments thereto as

	may be required during the execution of work. Borosilicate Glass Lining Materials, Primer, Adhesive (suitable fixing materials) and Expert Supervision of Manufacturer shall be provided by BHEL as Free of Cost (FOC).
3.4	All quality standards, tolerances, welding standards & other technical requirements shall be strictly adhered to. The Bidder shall fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, soil conditions, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications.
3.5	All works under this specification, unless specified otherwise, shall conform to the latest revision or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not covered specifically by Indian Standard Specification, any other standard practice as may be specified by the Engineer shall be followed.
3.6	The Contractor is to carry out the work as per the drawings issued to him, Approved drawing of Contractor, specification and/or the Engineer's instructions.
3.7	Before start of application one demo application on the area of approx. 500mmx500mm shall be done as per the direction of OEM/supplier.No any extra payment shall be applicable for this work .Succesful bidders should quote accordingly.
3.8	Proper 24V lighting arrangement arrangement required for the working inside the flue can and outside flue can shall be in scope of successful bidder within the quoted price.
3.9	For maintaining working atmosphere inside flue can, Dehumidifier and Fan Blower shall be provided by successful bidder free of cost to BHEL within the quoted price.
3.10	Access for moving platform inside the flue can shall be through the centerline axis of flue can from the bottom.Necessary dismantling and restoration of duct and duct supporting structure to be done accordingly by successful vendor without any extra cost to BHEL within quoted price.
4.0	INSURANCE
4.1	BHEL shall arrange 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 unit including theft, sabotage, fire, lightning and other natural calamities.
4.2	Contractor shall report to BHEL in writing any damages to equipment/components on receipt, storing, and during withdrawal of the materials from stores, in transit to site and unloading at place of work and during erection and commissioning till trial operation completion including handing over. The above report shall be as prescribed by BHEL site management. Any consequential loss arising out of non-compliance of this stipulation will be borne by contractor.
4.3	The contractor will take necessary precautions/ due care to protect the material at Project site, while in his custody from any damage/ loss till the same is handed over to BHEL/ customer at Project site. For lodging/ processing of insurance claim the contractor will submit necessary documents. BHEL will reserve the right to recover the loss from the contractor as detailed below in case the damage/loss is due to negligence/ carelessness on the part of the contractor. In case of theft of material under contractor's custody, the same shall be reported to police by the contractor immediately and copy of FIR and subsequently police investigation report shall be submitted to BHEL/ customer for taking up with insurance. However, this will not relieve the contractor of his contractual obligation for the materials in his custody.
4.4	In case the damage/loss/theft of materials are attributable to negligence/failure in discharging the duties and obligations of the contractor, the expenses incurred for repair/replacement of such components in excess of the amount realized from the underwriters, limited to Normal Excess (Deductible Franchise) shall be recovered from the contractor.
4.5	Other conditions of Insurance shall be as per relevant clause of GCC/SCC.
5.0	DEVIATIONS/CLARIFICATIONS
	The bidder is required to submit with his offer in the relevant schedule / format without any ambiguity. Any assumptions, presumptions, deviations etc. indicated or implied

	anywhere by the bidder except those indicated in the deviation schedule / format will not be recognized and will not form a part of consideration / offer. In the absence of such filled-up schedule / format it will be understood and agreed that the bidder's offer is based on strict conformance to the specification and no negotiation would be allowed in this regard. BHEL reserve the right not to recognize any / all deviations submitted after opening of the bid.
6.0	DEWATERING Contractor shall ensure at all times that his work area & approach/ access roads are free from accumulation of water, so that the materials are safe and the erection/ progress schedule are not affected. No separate claim in this regard shall be admitted by BHEL. No separate payments for dewatering of subsoil, surface water or catchments water, if required, at any time during execution of the work including monsoon period shall be considered by BHEL.
7.0	LAND
7.1	The contractor has to plan and use the existing land inside the Project Premise considering the use of land by other Civil / Mechanical / Electrical contractors and the storage of plant machineries and materials. The existing land shall be shared by all erections agencies. Land will be allocated with certain time frame and to the extent available / considered necessary, and will be reviewed by BHEL depending upon the area availability.
7.2	Land for labour colony shall be arranged by successful bidder at their own. The contractor shall construct labour colony / hutment as per his requirements after obtaining approval of formalities from statutory body. Further, contractor must ensure minimum HSE norms and hygienic sanitary conditions in his labour colony.
7.3	The contractor will be responsible for handing back all lands, as handed over to him by BHEL/NTPC.
7.4	Area within plant premises for fabrication, office, storage area etc. for construction purpose shall be provided as per availability free of cost as per approval of customer.
8.0	WATER
8.1	Contractor has to make his own arrangement for water for drinking and required to carry out the entire scope of work under this tender specification at his own cost. BHEL shall not be responsible, for providing any source of water to the contractor. The contractor may have to carry out the job even during the night. Hence all necessary arrangements may be deployed to ensure 24 hour working to ensure timely completion of the job.
9.0	ELECTRICITY
9.1	CONSTRUCTION POWER & GENERAL ILLUMINATION NET WORK: - BHEL Shall Provide Construction Power free of charges at 415V level at two points for Batching Plant and Power House area (within 500 M from his work places as mentioned) and bidders has to make his own distribution arrangement to draw electricity. General illumination system shall be provided by BHEL. However, provision of suitable temporary lights at various working areas for execution of the work & safety of workmen shall be provided by the vendor, within the quoted rate. The illumination should be such that minimum illumination requirement as specified by Indian standards for general illumination is maintained. However, Contractor has to make his own DG stand by arrangement for power supply, as shall be required to carry out the entire scope of work under this tender specification at his own cost. BHEL shall not be responsible, for failure of power supply. The contractor may have to carry out round the clock. Hence all necessary arrangements may be deployed to ensure 24 hour working to ensure timely completion of the job.
9.2	If any other voltage level (other than normally available) is required, the same shall be arranged by the contractor from power supply as above. Contractor will have to provide at his own cost necessary calibrated energy meters (tamper proof, suitably housed in a weather proof box with lock & key arrangement) at point of power supply along with calibration certificate from authorized / accredited agency for working out the power consumption. In case of recalibration required for any reason the necessary charges including replacement by calibrated meters is to be borne by the contractor. Supply of

	electricity shall be governed by Indian Electricity Act and Installation Rules and other Rules and Regulation as applicable. The contractor shall ensure usage of electricity in an efficient manner and the same may be audited by BHEL time to time. In case of any major deviation from normally accepted norms is observed, BHEL will reserve the right to impose penalty as deemed fit for such cases
9.3	The bidder shall have to provide earth leakage circuit breaker at each point..
9.4	Bidder will have to arrange sufficient illumination at their own work areas for execution of the work & safety of workmen.
9.5	The contractor shall have to make arrangement at their own cost for illumination/ in their labor colony
10.0	CONSUMABLE
10.1	All consumables, like gas, electrodes, chemicals, lubricants etc. required for the scope of work, shall be arranged by the contractor at his cost from approved brand / make of NTPC/ BHEL unless otherwise specifically mentioned in the contract prior to use.
10.2	In the event of failure of contractor to bring necessary and sufficient consumables, BHEL may arrange for the same at the risk and cost of the contractor. The entire cost towards this along-with overhead shall be deducted from the contractor's bills.
11.0	TEST CERTIFICATES
	Necessary test certificates of all materials supplied by contractor are to be produced to BHEL/NTPC prior to use of materials.
12.0	IMTE
	The contractor shall ensure deployment of reliable and calibrated instrument, measuring, and test Equipment (IMTE). The IMTE shall have test calibration certificate from authorized / Govt approved agencies. The contractor shall also keep provision of alternate engagement for such IMTE so that the work does not suffer when a particular IMTE is sent for calibration. Re-testing/ re-calibration shall also be arranged by the contractor at their own cost at regular interval during the period of use as advised by BHEL.
13.0	QUALITY CONTROL & QUALITY ASSURANCE
13.1	INSPECTION & FIELD QUALITY ASSURANCE
13.1.1	Contractor shall carry out all activities conforming to the approved Field Quality Plan (FQP) & technical instructions as revised from time to time. 'Total Quality' shall be the watchword of the work and contractor shall strive to achieve the quality standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards. Contractor shall provide the services of quality assurance engineer as per the relevant clauses.
13.1.2	Preparation of quality assurance log sheets and protocols with customer / consultants / statutory authority, welding logs, NDE records, testing & calibration records and other quality control and quality assurance documentation as per BHEL engineer's instructions, is within the scope of work / specification. These records shall be submitted to BHEL / customer for approval from time to time.
13.1.3	The protocols between contractor and customer / BHEL shall be made for correctness of foundations, materials, procedures, at each stage of installation, generally as per the requirement of customer / BHEL. This is necessary to ensure elimination of errors and to avoid accumulation and multiplication of errors.
13.1.4	A daily log book (with proper indexing) should be maintained by every supervisor / engineer of contractor, for respective area of work, on the job for detailing and incorporating alignment/ clearance / centering / levelling readings and inspection details of various equipment, etc. This log book shall be always accessible to BHEL engineers. High pressure welding (as applicable under the scope of this contract) details like serial number of weld joints, welders name, date of welding, details of repair, heat treatment etc. will be documented in welding log as per BHEL Engineer's instructions. Record of radiography (as applicable under the scope of this contract) containing details like serial number of weld joints, date of radiography, repairs, if any, re-shots etc shall also be maintained as per BHEL Engineer's instructions. Record of heat treatments (as applicable under the scope of this contract) performed shall be maintained as prescribed by BHEL.
13.1.5	The performance of welders (as applicable under the scope of this contract) will be reviewed from time to time as per the BHEL standards. Welders' performance record

	shall be furnished periodically for scrutiny of BHEL's Engineer. Corrective action as informed by BHEL shall be taken in respect of those welders not conforming to these standards. This may include removal/ discontinuance of concerned welder(s). Contractor shall arrange for the alternate welders immediately.
13.1.6	Only welders duly authorized by BHEL / customer / consultant after welder qualification test as per ASME Sec-Ix / AWS D1.1 (as applicable) shall be engaged on the work. All the welders shall carry identity cards as per the proforma prescribed by BHEL / Customer / Consultant.
13.1.7	Any re-laying or re-termination of cables / re-erection of instruments / recalibration of instruments etc. required due to contractor's mistake and found at any stage inspection, shall be carried out by the contractor at no extra cost. Repair / rectification procedure to be adopted to make any job acceptable shall be subject to the approval of BHEL.
13.1.8	Weekly Quality Review Meeting at site shall be organised by BHEL to discuss quality issues and next weeks inspection plans. Site in-charge of the contractor along with QAEs of the contractor must be present in the meeting with closure report of the issues raised by BHEL in the previous meetings.
13.2	REQUIREMENT OF ISO 9001
13.2.1	BHEL: PSER is accredited with ISO 9001 certification and as such this work is subject to various audits to meet ISO 9001 requirements.
13.2.2	The basic philosophy of the Quality Management System under ISO 9001 is to define the organizational responsibility, work as per documented procedures, verify the output with respect to acceptance norms, identify the non-conforming product / procedure and take corrective action for removal of non-conformance specifying the steps for avoiding recurrence of such non-conformities, & maintain the relevant quality records. The non-conformities are to be identified through the conduct of periodical audit of implementation of quality systems at various locations/stages of work. Suppliers / vendors of various products / services contributing in the work are also considered as part of the quality management system. As such the contractor is expected not only to conform to the quality management system of BHEL but also it is desirable that they themselves are accredited under any quality management system standard.
13.2.3	BHEL reserves the right to carry out quarterly quality audits and quality surveillance of the systems and procedures of contractor's quality management. Contractor shall provide all necessary assistance to enable BHEL to carry out such audit & surveillance.
13.2.4	Quality audits / approval of the results of test & inspection will not prejudice the right of BHEL to reject an equipment service not giving desired performance and shall not in no way limit the liabilities and responsibilities of the contractor in earning satisfactory performances of equipment / service as per specification.
13.3	MMEs / MMRs
13.3.1	Contractor shall ensure deployment of reliable and calibrated MMEs (Measuring and Monitoring Equipment). The MMEs shall have test / calibration certificates from authorised / Government approved / Accredited agencies traceable to National / International Standards. Re-testing / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such MMEs so that work does not suffer when the particular equipment / instrument is sent for calibration. Also if any MMEs not found fit for use, BHEL shall have the right to stop the use of such item and instruct the contractor to deploy proper item and recall i.e. repeat the readings taken by that instrument, failing which BHEL may deploy MME and retake the readings at Contractor's cost.
13.3.2	Contractor shall provide all the Measuring Monitoring Equipment (MMEs) required for completion of the work satisfactorily. These MMEs shall be of brand, quality and accuracy specified by BHEL Engineer and should have necessary calibration and other certificates as per the requirement of BHEL Engineer. Decision of BHEL Engineer regarding acceptance or otherwise of the measuring instruments / gauges / tools for the work under this specification, is final and binding on the contractor. BHEL shall give an indicative list of MMEs required for this work else where in this contract and to be made

	available by the contractor. The list will be reviewed by BHEL site as per the requirement of approved FQPs and the contractor shall meet any augmentation needed wherever required.
13.3.3	It is the responsibility of the contractor to prove the accuracy of the testing / measuring / calibrating equipment brought by him based on the periodicity of calibration as called for in the BHEL's quality assurance standards/BHEL Engineer's instructions.
13.3.4	Re-work necessitated on account of use of invalid MMEs shall be entirely to the contractor's account. He shall be responsible to take all corrective actions, including resource augmentation if any, as specified by BHEL to make-up for the loss of time.
	In the courses of erection, it may become necessary to carry repeated checks of the work with instruments recently calibrated, re-calibrated. BHEL may counter / finally check the measurements with their own MMEs. Contractor shall render all assistance in conduct of such counter / final measurements.
13.4	INSPECTION BY TS / FES / QA ENGINEERS OF BHEL UNITS / ENGINEERING CENTRES
13.4.1	Apart from day-to-day inspection by BHEL Engineers stationed at Site and Customer's Engineers, stage inspection of equipment under erection and commissioning at various stages may also be conducted by teams of Engineers from Field Engineering Services of BHEL's Manufacturing Units, Quality Assurance teams from Field Quality Assurance, Unit/Factory Quality Assurance and Commissioning Engineers from Technical Services etc. Contractor shall arrange all labour, tools and tackles etc along with proper access for such stage inspections free of cost.
13.4.2	Any modifications suggested by BHEL FES and QA Engineers' team shall be carried out. Claims of contractor, if any, shall be dealt as per applicable clause of the contract, and provided such modifications have not arisen for reasons attributable to the contractor.
13.5	CONFORMANCE TO THE STATUTORY REQUIREMENTS (AS APPLICABLE UNDER THE SCOPE OF THE CONTRACT)
13.5.1	The work to be executed under these specifications has to be offered for inspection, at appropriate stages of work completion, to various statutory authorities for compliance with applicable regulations. The work related statutory inspections, though not limited to, are as under: 1) Inspectorate of Steam Boilers and Smoke Nuisance 2) Electrical Inspector 3) Factory Inspector, Labour Commissioner, PF Commissioner and other authorities connected to this project work. The scope includes getting the approvals from the statutory authorities, which includes arranging for inspection visits of statutory authority periodically as per BHEL Engineer's instructions, arranging materials for ground inspection, taking rub outs for stamping of the pressure parts / pipes to be offered for inspection, submitting co-related inspection reports, documents, radiographs etc and following up the matter with them. Contractor shall also make all arrangements for offering the Products / Systems for inspection at location, as applicable, to the concerned authority.
13.5.2	Contractor should be qualified to execute pressure parts & piping work coming under the purview of IBR or Competent Inspecting Authority, for which he should register himself with CIB of state concerned / Competent Inspector. Contractor also should be aware of the latest Boiler regulations and Electricity Act, including the amendments thereof, as applicable under the scope of this contract.
13.5.3	Contractor shall comply with 'Qualification Tests for welders engaged in welding of Boilers and Steam Pipes under Construction, Erection and Fabrication at Site in India and in repairing Boilers and steam pipes by welding' in line with Chapter XIII of Indian Boiler Regulations-1950, for testing his welders / men / workers, including all associated fees, procedures, required instruments and equipment and their calibration thereof. It shall be contractor's responsibility to obtain approval of Statutory Authorities, wherever applicable, for the conducting of any work which comes under the purview of these authorities, at his cost.
13.5.4	The following fees shall be excluded from scope of Contractor: 1. Registration Fee as per Regulation 385 of Chapter IX of Indian Boiler Regulations-

	1950 or Registration Fee as per prevailing statutory boiler regulations. 2. Fees for inspection of Boiler at the site of Construction as per Regulation 395 A, sl no 4 of Chapter IX of Indian Boiler Regulations- 1950. However all other fees like visit fees charged by the Boiler Inspector and other arrangements for his visit or visits till satisfactory completion of work, shall be included in scope of Contractor.			
13.6	STORAGE & PRESERVATION OF WELDING ELECTRODES & OTHER BHEL-ISSUED MATERIAL			
13.6.1	The contractor shall be responsible for storage & preservation of welding electrodes & other BHEL-issued materials as per BHEL Storage & Preservation Guidelines / Instructions.			
13.7	PENALTIES ON VENDORS / SUB-CONTRACTORS AGAINST NON-COMPLIANCE OF QUALITY NORMS			
Sl. No.	Nature of Non-compliance	Penalty for Domestic Project	Penalty for Export Project	Remarks
GENERAL				
13.7.1	Unavailability of QAE deployment schedule (duly approved by BHEL Site) matching with manpower requirement of approved L2 schedule	0.10%	0.10%	Against each RA bill
13.7.2	Unavailability of required number of QAE with proper experience & NDT certification as per the requirement of the Contract	Rs. 1,000.00	\$16.00	Per person per day
13.7.3	Not attending quality meeting of BHEL by nominated member of vendor / sub-contractor	Rs. 2,000.00	\$32.00	Per meeting
CALIBRATION				
13.7.4	Use of MMEs without valid calibration certificate	Rs. 1,000.00	\$16.00	Per equipment per instance
13.7.5	Use of NDT equipment, welding equipment without having valid calibration certificate / condition not as per requirement	Rs. 1,000.00	\$16.00	Per equipment per instance
WELDING & NDT				
13.7.6	Unqualified welders carrying out welding / tack welding	Rs. 1,000.00	\$16.00	Per welder per instance. (Gatepass of the person shall be withheld)
13.7.7	Not using portable oven for welding consumables	Rs. 500.00	\$8.00	Per welder per instance. (The consumables in the oven shall be confiscated)
13.7.8	Not using electrodes pre-baked in baking oven	Rs. 500.00	\$8.00	Per instance. (The subject consumables shall be confiscated)
13.7.9	Not using welding consumables of approved make & not using correct type of electrode as per approved EWS / Drawing / WPS	Rs. 1,000.00	\$16.00	Per instance. (The subject consumables shall be

				confiscated)
13.7.10	Non-removal of welding slag and spatters after welding	Rs. 500.00	\$8.00	Per joint
13.7.11	Not using NDT equipment as prescribed in the manual / FQP / guidelines / Contract	Rs. 1,000.00	\$16.00	Per equipment per instance
13.7.12	Welder doing welding without valid job card	Rs. 500.00	\$8.00	Per instance
13.7.13	Discrepancy observed in the weld joints identified by BHEL / Customer for RT vs RT film offered	Rs. 2,000.00	\$32.00	per joint
MATERIAL MANAGEMENT				
13.7.14	Non-maintenance of grid pillar marking	Rs. 200.00	\$3.00	Per location week
13.7.15	Mismatch of location of material in store area w.r.t. location mentioned in stock register	Rs. 500.00	\$8.00	Per instance
13.7.16	Non-compliance of Preservation of material as per storage & preservation manuals	Rs. 1,000.00	\$16.00	Per equipment
13.7.17	Not offering received material for verification within stipulated time as per contract	Rs. 500.00	\$8.00	Per instance
PAINTING & ALLIED WORKS				
13.7.18	Not using primer / paints of approved make and as per Specifications	Rs. 1,000.00	\$16.00	Per instance
13.7.19	Painting without proper surface preparation as per approved schedule / drawing / FQP	Rs. 500.00	\$8.00	Per instance
PROTOCOLS & LOG SHEETS				
13.7.20	Delay in preparation of Protocols / Logsheets as per approved FQP within 3 days of completion of checks	Rs. 200.00	\$3.00	Per protocol per day delay
INSPECTION OF BOUGHT-OUT ITEMS / CONSUMABLES				
13.7.21	Delay in offering inspection of Bought-out Items / Consumables / Aggregates (for items which need site inspection as per approved QP) within 3 days of receipt of material at site	1% of the item value of the LOT	1% of the item value of the LOT	per item per day delay after receipt of material
13.7.22	Delay in submission of required documents (viz. Invoice, Inspection Release Note, COC, MDCC, MTC as the case may be) of Bought-out Items (shop inspection items / consumables) with in 3 days of receipt of material at site.	1% of the item value of the LOT	1% of the item value of the LOT	per item per day delay after receipt of material
NOTE: Any non-conformity requiring dismantling / rework, attributable to vendor / sub-contractor, shall be penalised at a rate mentioned above or cost to BHEL, which ever is higher.				
14.0	WORK AND SAFETY REGULATIONS			
14.1	General			
14.1.1	The contractor shall comply with all the requirements of "The Building and Other Construction Workers (Regulation of Employment , Conditions of Service) Act," 1996 and			

	its Central Rule 1998 / State Rules and any other statutory requirements as applicable.
14.1.2	The Contractor shall follow NTPC Safety Rules as issued from time to time with respect to safety in construction & erection.
14.1.3	The contractor shall have the approved Safety, Health and Environment (SHE) Policy in respect of Safety and health of Building Workers and it shall be circulated widely and displayed at conspicuous place in Hindi and local language understood by the majority of the workers. A copy of the safety policy should be submitted to Engineer in charge.
14.1.4	The contractor shall submit the safety plan comprising of methods to implement the Safety Policy/ Rules, Risk assessment and ensuring Safety at work areas, Safety audits, inspections and its compliance, Supervision and Responsibility to ensure Safety at various levels, Safety training to employees, review of Safety and accident analysis, ensure Health and Safety Procedures to prevent accidents to Engineer I/c for approval as per the format of Safety plan as annexed at Annexure - I.
14.1.5	The Contractors shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to the Employer or to others, working at the Site.
14.1.6	All equipments used in construction and erection by the contractor shall meet BIS I International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipments shall be strictly operated and maintained by the contractor in accordance with manufacturer's operation manual. The contractor should also follow Guidelines/Rules of the Employer in this regard.
14.1.7	The Contractors shall provide suitable latest Personal Protective Equipments of prescribed standard to all their employees and workmen according to the need. The Engineer I/c shall have the right to examine these safety equipments to determine their suitability, reliability, acceptability and adaptability. The contractor should also ensure these before their use at worksite.
14.1.8	The Contractor shall provide safe working conditions to all workmen and employees at his workplace including safe means of access, railings, stairs, and ladders, scaffolding, work platforms, toe boards etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection of scaffolds, access, work platforms etc. shall be good and the contractor shall use standard quality of material.
14.1.9	The Contractor shall follow and comply with all the Safety Rules, standards, code of practices of NTPC and relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any protest or contest or reservation. In case of any unconformity between statutory requirement and the Safety Rules of the Employer referred above, the latter shall be binding on the Contractor unless the statutory provisions are more stringent. As and when required he can refer / obtain copy of NTPC safety documents as stated above.
14.1.10	The contractor shall have his own arrangements with nearby hospitals for shifting and treatment of sick and injured. The medical examination of the workers employed in hazardous areas shall be conducted as per Rule 223 Of The Building and Other Construction Worker (Regulation of Employment and Condition of Service) Central Rule 1998 Their health records shall be maintained accordingly and to be submitted to Engineer I/c when asked for. If any worker found suffering from occupational health hazard, the worker should be shifted to suitable place of working and properly treated under intimation to Engineer I/c. The medical fitness certificate to be submitted to Engineer (I/c).
14.1.11	First Aid boxes equipped with requisite articles as specified in the Rule 231 of The Building and Other Construction Worker (Regulation of Employment and Condition of Service) Central Rule 1998 shall be provided at construction sites for the use of workers. Training has to be provided on first aid to workmen & office bearers working at site.
14.2	Emergency Action Plan The contractor shall prepare an emergency action plan approved by his competent authority to handle any emergency occurred during construction work. Regular mock drills shall be organized to practice this emergency plan. The Emergency Action Plan should be widely circulated to all the employees and suitable infrastructure shall be provided to handle the emergencies.
14.3	Scaffolding The contractor shall take all precautions to prevent any accidental collapse of scaffolding or

	fall of persons from scaffolding. The contractor should ensure that scaffolding are designed by a competent person and its erection and repairs should be done under the expert supervision. The scaffolding shall meet the required strength and other requirements for the purpose for which the scaffold is erected. The material used for scaffold should conform to the BIS / International standards.
14.4	Opening The contractor shall take all precautions while handling, using, storing or transporting of all explosives. Before usage of any explosive necessary warning / danger signals be erected at conspicuous places to warn the workers and general public. The contractor should strictly ensure that all measures and precautions required to be complied for use, handling, storing or transportation of explosives under the rules framed under the Explosives Act, 1884.
14.5	Fencing of Machinery The contractor shall provide suitable fencing or guard to all dangerous and moving parts of machinery The contractor shall not allow any of the employees to clean, lubricate, repair, adjust or examine during machinery in motion, which may cause injury to the person.
14.6	Overhead Protection The contractor shall ensure that any area exposed to risk of falling materials, articles or objects is roped off or cordoned off or otherwise suitably guarded from inadvertent entry of any person. Wherever there is a possibility of falling of any material, equipment or construction workers while working at heights, a suitable and adequate safety net should be provided. The safety net should be in accordance with BIS Standards.
14.7	Working at Heights All working platforms, ways and other places of construction work shall be free from accumulations of debris or any other material causing obstructions and tripping. Wherever workers are exposed to the hazard of falling into water, the contractor shall provide adequate equipment for saving the employees from drowning and rescuing from such hazards. The contractor shall provide boat or launch equipped with sufficient number of life buoys, life jackets etc. manned with trained personnel at the site of such work. Every opening at elevation from ground level through which a building worker, vehicle, material equipment etc. may fall at a construction work shall be covered and/or guarded suitably by the contractor to prevent such falls. Wherever the workers are exposed to the hazards of falling from height, the contractor shall provide full harness safety belts fitted with fall arresting systems to all the employees working at higher elevations and life line of 8 mm diameter wire rope with turn buckles for anchoring the safety belts while working or moving at higher elevations. Safety nets shall also be provided for saving them from fall from heights and such equipment should be in accordance with BIS standards. Wherever there is a possibility of falling of any material, equipment or construction workers while working at heights, a suitable and adequate safety net should be provided. The safety net should be in accordance with BIS Standards. The contractor shall provide standard prefabricated ladders on the columns where the workers are required to use them as an access for higher elevations till permanent staircase is provided. The workers shall be provided with safety belts permanent staircase is provided. The workers shall be provided with safety belts fitted with suitable fall arresting system (Fall arrestors) for climbing/getting down through ladders to prevent fall from height.
14.8	Handling of Hazardous Chemicals The Contractor will notify well in advance to the Engineer I/c of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. NTPC shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contract shall strictly adhere to and comply with such instructions. The Engineer I/c shall have the right at his sole discretion to inspect any such container or such construction plant / equipment for which material in the container is

	required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by NTPC and NTPC shall not entertain any claim of the Contractor towards additional safety provisions / conditions to be provided for / constructed. Further, any such decision of the Engineer I/c shall not, in any way, absolve the Contractor of his responsibilities and in case, use of such a container or entry thereof into the Site area is forbidden by NTPC, the Contractor shall use alternative methods with the approval of the NTPC without any cost implication to the NTPC or extension of work schedule. Where it is necessary to provide and / or store petroleum products or petroleum mixtures and explosives, the Contractor shall be responsible for carrying-out such provision and / or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosives Act 1948, and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of the Engineer I/c. In case any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the Contractor shall be responsible for obtaining the same. The Contractor shall be fully responsible for the safe storage of his and his Sub-contractor's radio-active sources in accordance with BARC/DAE (Bhabha Atomic Research Centre/ Department of Atomic Energy, Govt. of India) Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in connection with use, the contractor would take storage and handling of such material. The contractor shall provide suitable personal protective equipments to the workers who are handling the hazardous and corrosive substances including alkalis and acids. As a precautionary measure the contractor should keep the bottles filled with distilled` water in cupboard / Boxes near work place for emergency eye wash by worker exposed to such hazardous chemicals.
14.9	Eye Protection The contractor shall provide suitable personal protective equipment to his workmen depending upon the nature of hazards and ensure their usage by the workers engaged in operations like welding, cutting, chipping, grinding or similar operations which may cause injuries to his eyes.
14.10	Excavation The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding material or article from any bank or side of such excavation which is more than one and a half meter above his footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.
14.11	Electrical Hazards The contractor should ensure that all electrical installations at the construction work comply with the requirements of latest electricity acts / rules. The contractor shall take all adequate measures to prevent any worker from coming into physical contact with any electrical equipment or apparatus, machines or live electrical circuits which may cause electrical hazards during the construction work. The contractor shall provide the sufficient ELCBs / RCCBs for all the portable equipments, electrical switchboards, distribution panels etc. to prevent electrical shocks. The contractor should ensure use of single I double insulated hand tools or low voltage i.e., 110 volts hand tools. The contractor should also ensure that all temporary electrical installations at the construction works are provided with earth leakage circuit breakers.
14.12	Vehicular Traffic The contractor should employ vehicle drivers who hold a valid driving license under the

	Motor Vehicles Act, 1988.
14.13	Lifting Appliances, Tools & Tackles, Lifting Gear And Pressure Plant & Equipment etc. The contractor shall ensure all the lifting appliances, tools & tackles including cranes etc., lifting gear including fixed or movable and any plant or gear, hoists, Pressure Plant and equipment etc. are in good condition and shall be examined by competent person and only certified shall be used at sites. Periodical Examination and the tests for all lifting / hoisting equipment & tackles shall be carried out. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by the Engineer I/c or by the person authorized by him.
14.14	Excessive Noise, Vibration The contractor shall take adequate measures to protect the workers against the harmful effect of excessive noise or vibration. The noise should not exceed the limits prescribed under the concerned rules, Noise Pollution (Regulation and Control) Rules, 2000.
14.15	Electrical Installations The contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Employer or other contractors under any circumstances, whatsoever, unless expressly permitted in writing by the Engineer I/c to handle such fuses, wiring or electrical equipment. Before the contractor connects any electrical appliances to any plug or socket belonging to the other contractor or the NTPC, he shall - Satisfy the Engineer I/C that the appliance is in good working condition; - Inform the Engineer I/C of the maximum current rating, voltage and phases of the appliances; - Obtain permission of the Engineer I/C detailing the sockets to which the appliances may be connected. The Engineer I/C will not grant permission to connect until he is satisfied that: The appliance is in good condition and is fitted with suitable plug; having earth connection with the body. Wherever armored / metallic sheathed multi core cable is used, the same armored / sheathed should be connected to earth. - No repair work shall be carried out on any live equipment. The Engineer I/c must declare the equipment safe and a permit to work shall be issued by the NTPC / contractor as the case may be to carry out any repair / maintenance work. While working on electric lines / equipments whether live or dead, suitable type and sufficient quantity of tools will have to be provided by the contractor to electricians / workmen / Officers. - The contractor shall employ necessary number of qualified, full time Electricians / Electrical Supervisors to maintain his temporary electrical installation. The installations are provided with suitable ELCBs and RCCBs wherever required
14.16	Safety Organisation
14.16.1	The contractor employing more than 250 workmen whether temporary, casual, probationary, regular or permanent shall employ at least one full time safety officer exclusively to supervise safety aspects of the equipments and workmen, who will coordinate with the NTPC Safety Officer. Further requirement of safety officers, if any, shall be guided by Rule 209 of The Building and Other Construction Worker (Regulation of Employment and Conditions of Service) Central Rule 1998. In case the work is being carried out through subcontractor, the employees / workmen of the sub contractor shall also be considered as the contractor's employees/workmen for the above purpose.

	In case of contractor deploying less than 250 workmen he should designate one of his Engr / supervisor or the contractor himself (if he is directly supervising the work) as safety officer in addition to his existing responsibilities. The Engr./ supervisor should get atleast 2days safety training from any reputed organization or from NTPC before resuming the work. If already trained in past the declaration along with trg. certificate to be furnished to NTPC safety officer
14.16.2	The name and address of such Safety Officer of the Contractor will be promptly informed in writing to the EIC with a copy to the Project Safety Officer before he starts work or immediately after any change of the incumbent is made during currency of the Contract.
14.17	Reporting of Accident and Investigation
14.17.1	The Engineer VC shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipments. In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury / accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary appeal against the order of stoppage of work to the Project Manager within 3 days of such stoppage of work and decision of the Project Manager in this respect shall be conclusive and binding on the Contractor.
14.17.2	The Contractor shall not be entitled for any damages / compensation for stoppage of work, {Sub-Clause XVIII (I)} due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages.
14.18	Fire Protection The contractor shall provide sufficient fire extinguishers at place /s of work. The fire extinguishers shall be properly maintained as per relevant BIS Standards. The employees shall be trained to operate the fire extinguishers / equipment.
14.19	Penalties I. If the Contractor fails in providing safe working environment as per the Safety Rules of NTPC or continues the work even after being instructed to stop the work by the Engineer I/C as provided in Clause XVIII (1) above, the Contractor shall be penalized at the rate of Rs. 25,000/- per day or part thereof till the instructions are complied with and so certified by the Engineer I/C. However, in case of accident, the provisions contained in Sub-Clause XX (II) below shall also apply in addition to the penalties mentioned in this sub-clause. II. If the Contractor does not take all safety precautions and / or fails to comply with the Safety Rules as prescribed by the Employer or under the applicable law for the safety of the plant and equipment and for the safety of personnel and the contractor does not prevent hazardous conditions which cause injury to this own employees or employees of other contractors, or NTPC's employees or any other person who are at the Site or adjacent thereto, the Contractor shall be responsible for payment of penalty to NTPC as per the following schedule:- a) Fatal injury or accident causing death: Penalty @10% of contract value or Rs. 5,00,000/- per person, which ever is less. b) Majorinjuriesor accident causing 25% or more permanent disablement to workmen or employees: Penalty @2.5% of contract value or Rs. 1,00,000/- per person which ever is less Permanent disablement shall have the same meaning as indicated in The Workmen's Compensation Act' 1923. The penalty mentioned above shall be in addition to the compensation payable to the workmen / employees under the relevant provisions of the Workmen's Compensation Act' 1923 and rules framed there under or any other applicable laws as applicable from time to time. III. If any contractor worker found working without using the safety equipment like

	safety helmet, safety shoes, safety belts, etc. or without anchoring the safety belts while working at height the Engineer 1/c / Safety Officer of NTPC shall have the right to penalize the contractor for Rs. 200/- per person per day and such worker shall be sent out of the workplace immediately and shall not be allowed to work on that day. Engineer 1/c / Safety Officer of NTPC will also issue a notice in this regard to the contractor. IV. If two or more fatal accidents occur at same NTPC site under the control of contractor during the period of contract and he has (1) not complied with keeping adequate PPEs in stock or (2) defaulted in providing PPEs to his workmen (3) not followed statutory requirements / NTPC safety rules (4) been issued warning notice/s by NTPC head of the project on non observance of safety norms (5) not provided safety training to all his workmen, the contractor can be debarred from getting tender documents in NTPC for two years from the date of last accident. The safety performance will also be one of the overriding criteria for evaluation of overall performance of the contractors by NTPC. The contractor shall submit the accident data including fatal / non-fatal accidents for the last 3 years where he has undertaken the construction activities Projects-wise along with the tender documents. This will also be considered for evolution of tender documents. If the information given by the contractor found incorrect, his contract will be liable to be terminated.
14.20	The Contractor will make available minimum quantity of all safety equipments and safety personal protection equipments (PPEs) of required specifications as per suggestive list included bidding documents as a part of "List of minimum T & P". Further Contractor will ensure availability of additional requirement for individual worker and safety equipment as per site requirement during execution of the contract till its completion.
14.21	Award If the Contractor's performance on safety front is found satisfactory i.e. without any fatal/reportable accident in the year of consideration; he may be considered for suitable award "ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme of the employer.
14.22	Further details of applicable HSE norms shall be as per HSE clause of Tender SCC.
15.0	PROJECT MANAGEMENT/ CONSTRUCTION MANAGEMENT To meet the need of construction management at site, contractor shall provide the following services within quoted/ accepted rates.
15.1	PLANNING & MONITORING
15.1.1	The bidder shall prepare detail construction schedule (L-3) as per completion dates given in this document. This schedule must include all milestone and key activities for each sub-systems / components in the areas of engineering (wherever applicable), procurement, manufacture (wherever applicable), construction / erection. This network must conform to the overall project schedule. The bidder should also ensure monitoring of these activities at least weekly basis to start with and on daily basis whenever required by BHEL.
15.1.2	The bidder shall also prepare progress report indicating progress on key activities, management summary for critical activities, list of actions requiring attention of BHEL. This schedule is to be preferably made in PRIMAVERA / MS PROJECTS, so that the same is compatible with BHEL's project management software.
15.1.4	The contractor's site office must have facilities of communications like E-mail, and telephone with STD facility within a month from LOI.
15.2	PROGRESS REPORTING
15.2.1	The bidder shall submit daily, weekly and monthly progress reports for work force, materials reports, consumables (gases/electrodes) report and other reports as per pro-forma considered necessary by BHEL. In case of any failure on contractor's part to comply with this, BHEL may at its discretion, consider to withhold part payment against their RA bills.

15.2.2	The progress report shall indicate the progress achieved against planned with reasons indicating delays, if any, and shall give the remedial actions which the contractor intends to take to make good the slippage or lost time, so that further works again proceed as per the original program and the slippages do not accumulate and effect the overall program.	
15.2.3	The daily work force reports shall clearly indicate the work force deployed, category-wise specifying also the activities in which they are engaged.	
15.2.4	Weekly progress review meetings will be held at site during which actual progress during the week vis-à-vis scheduled program shall be discussed or actions to be taken for achieving targets. For discussions, the contractor shall present program of subsequent week. The contractor shall constantly update/revise his work program to meet the overall requirement.	
15.2.5	Periodic progress reviews on the entire activities of execution in respect of supply and works in scope of bidder will be held once in a month at Calcutta/site. These meetings will be attended by reasonably higher officials of the contractor and will be used as a forum for discussing all areas where progress needs to be speeded up. The contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.	
15.2.6	During construction contractor shall take an average twenty colour soft copies of digital photograph / slides each month (not less than four per week) of the works during progress. In case of failure in providing such photograph in each month, an amount of Rs. 10,000/- per month shall be deducted from contractor's RA bill.	
15.2.7	Successful bidder has to provide for electronic/ computerized storing and re-production/ printing/ plotting of various data, log sheets, protocols, measurements etc. These may be stored in CD (as per requirement) and handed over to BHEL as per requirement.	
15.3	SITE ORGANIZATION	
15.3.1	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all time for smooth execution of the contract headed by a competent construction manager for site operations with sufficient level of authority to take site decisions. The vendor will submit organization chart (showing the name of SITE-IN-CHARGE) with individual bio-data indicating various levels of experts to be posted for supervision in the fields of supervision and execution, quality, material management, planning, safety, etc. The organization shall be reinforced from time to time, as required to make up slippage (if any) from the schedule without any commercial implication to BHEL. The organization chart is to be submitted within 10 days from the date of LOI.	
15.3.2	Following (minimum) engineering manpower with power plant construction background to be deployed at site by the successful vendor for their day to day supervision etc.	
15.3.2.1	Qualified safety officers with assistants (exclusive for safety supervision for project jobs).	Officer – One No. (Civil)
15.3.2.2	Engineer & Supervisors for quality inspection.	One no Engineer (Civil)
15.3.2.3	Site supervising engineer and supervisors for civil works & planning	One no Engineer/Supervisor
15.3.3	Deputation of above man-power shall be jointly decided at site in line with construction schedule.	
15.3.4	Engineer/ supervisor for other functions like store & purchase, material management, fin, admn etc are to be provided as per site requirement and not considered above.	
15.3.5	In the event of non deputation of engineer/ supervisor by the bidder as per above agreed schedule, BHEL shall reserve the right to deduct Rs 50,000.00 per man-month for engineer, Rs 35,000.00 per man-month for the supervisor/ safety officer/chemist and Rs. 30,000 per man-month for safety supervisor from RA bills. Further induction of manpower regarding site supervisor & site engineer will be decided at site as per requirement without any financial implication.	
15.3.6	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 deviation in this regard will not be permitted unless specific &	

	reasonable justification is made.
15.3.7	In addition to above, a well experienced qualified engineer to be designated, as 'Project Co-coordinator', shall be deployed by the contractor. Such engineer shall have adequate exposure on the job and shall remain fully involved in all planning activities, guidance etc to contractor's own team during the complete execution period of contract.
15.3.8	The contractor should also submit to BHEL for approval a list of T&Ps along with their fitness certificates. The tools & tackles shall not be removed from site without written permission of BHEL.
15.3.9	The contractor should also submit network programs for the erection of various items. These networks shall show the NTPC/ BHEL hold points, which have to be cleared by NTPC/ BHEL, or their authorized representatives before further erection can take place. These programs for the erection would clearly identify responsibilities of the contractor and NTPC/ BHEL. It is the responsibility of the contractor to get the Networks approved by BHEL within four weeks of the date of finalization of award of work/ placement of LOI.
15.4	CONSTRUCTION MANAGEMENT
15.4.1	Based on the approved program, the contractor shall submit a program of construction/ erection. These programs would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detail monitoring. The three monthly rolling program with the first month's program being tentative based on the site condition would be prepared based on these programs. The contractor shall also be involved along with NTPC / BHEL to tie up detailed resources mobilization plan over the period of the contract matching with the performance targets.
15.4.2	The program would be jointly finalized by the site in-charge of the contractor with BHEL / NTPC's project coordinator as well as the site-planning representative. The erection program will also identify sequential events matching financial turnover.
16.0	TEST CERTIFICATE FOR T&P All T&P, lifting tackles and pulling devices to be deployed by the contractor must bear valid / latest test certificates for their suitability, and the documents shall be preserved at site.
17.0	T&P TO BE PROVIDED BY BHEL
17.1	Automatic mixing machine for the mixing of Adhesive membrane shall be provided by BHEL free of cost to the successful bidder.
17.2	No any other T&P except mentioned at clause no 17.1 above shall be provided by BHEL.
18.0	MATERIAL HANDLING (BHEL ISSUED MATERIAL)
18.1	Borosilicate glass liners and required adhesives / membrane and primer for installation of Borosilicate Glass Blocks only will be issued free of cost by BHEL for use in the work covered in this contract. All other materials required for proper completion of job shall be provided by contractor and quoted rates shall be inclusive of this.
18.4	It would be the responsibility of the contractor to keep in constant contact with BHEL / site to find out the delivery status, arrival of the consignments and arrange for escort to accompany the truck / trailer for transportation of above materials by BHEL'S supplier, as necessary. The lorry, truck way bill for the consignment as shall be received by BHEL would be handed over to the contractor immediately for unloading of materials including all arrangement for necessary gate passes etc. All arrangement for necessary gate passes etc shall be the responsibility of contractor.
18.5	Payment of all demurrages that may result due to contractor's fault/ delay would be the responsibility of the contractor. If BHEL have to make payment of demurrage together with freight, the amount so paid as demurrages for the reasons stated above, shall be recovered from the bills of the contractor. The decision of BHEL's engineer in this regard will be final and binding on the contractor. However the contractor has to clear all such charges, if any in this regard and complete the job without waiting for BHEL's decision.
18.6	It would be the responsibility of the contractor to sign on the delivery book acknowledgement slip of supplier/ transport authorities etc.
18.7	Consignments coming on Sundays and holidays are also required to be handled/ unloaded by the contractor. Since the offices and stores will probably remain closed on

	such days, it will be the responsibility of the contractor to contact BHEL engineers at their residence and obtain instructions.
18.8	Since the consignments are expected to arrive during any time of the day or night, contractor shall have, his workmen round the clock at site as well as other places as required to unload the materials immediately on arrival.
18.9	Unloading of materials at the storage yard or at places designated by BHEL, stacking & restacking, shifting & reshifting, using contractor's own cranes, trailers and other equipments with the valid road permit for their operation, unloading and stacking etc shall be responsibility of the contractor under this contract. All materials/equipments shall be stacked, stored above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete sleepers required for stacking the materials shall be arranged by contractor (successful bidder of this package). All other material handling equipments like winches, d-shackles, slings of various sizes, max puller, pulley blocks, jacks, trucks, tailors etc required for such material handling of steel, cements etc shall be arranged by contractor within quoted/accepted rates.
18.10	It will be the responsibility of the contractor to submit computerized account of all such consignments of materials received by them, daily to BHEL.
18.11	BHEL reserve the right to recover from the contractor any loss arising out of damage/ theft or any other causes of the materials issued to him at any point.
18.12	Open land (very limited space) for storage shall be provided by BHEL on free of cost basis as per availability. You shall maintain one centralized fenced store cum bar bending yard (Area Approx. 70mx70m). Hard surfacing of this yard and all round drain shall be carried out by you at your own cost within the accepted rate. You shall make complete arrangement of necessary security personnel, to safeguard all such materials in your custody. Materials issued will be used only for construction of permanent work. You shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. Barbed wire fencing of the steel storage yard, batching plant area, reinforcement bending yard area etc. are to be done by the contractor at his own cost. Contractor shall also remove grass, bushes, trees etc. wherever required off the land provided to him and shall make proper continuous up-keepment of the open yard/ land by removing grass, bushes trees etc and same is included under the scope of his work & no extra payment shall be made to the contractor in this regard.
18.13	The contractor shall in no case be entitled for any compensation or damages on account of any delay in supply or non-supply thereof for all or any such material.
18.14	Deleted.
18.15	Deleted.
18.16	No material shall be issued to the contractor except as those indicated above, i.e. Borosilicate glass liners and required adhesives / membrane and primer for installation of Borosilicate Glass Blocks unless otherwise expressly provided for in the contract. Contractor will have to make his own arrangement at his own cost for procurement of any other material as required for the works and of such quality as acceptable to BHEL.
18.17	The contractor shall maintain proper store account for all the BHEL issued materials and shall give three copies of monthly computerised reconciliation statement of such account to the BHEL.
18.18	Contractor shall carry out in complete association with BHEL, material management functions and execution like day to day update of materials, issued to contractor, accounting for surplus/ scrap material returned etc. These functions shall also be carried out through computerised system utilizing suitable software. Contractor shall provide experienced software personnel to associate on dedicated basis for efficient discharge of the same.
18.19	The contractor shall solely be responsible for the safety & quality of material after it is handed over and issued to contractor by BHEL.
18.20	BHEL issued materials shall not under any circumstances be taken out of the project

	site unless otherwise permitted by BHEL.		
18.21	All the necessary lifting tackles, cranes, tools & plants including tractors, trailers, trucks, pulley blocks, jacks, winches, wire ropes etc, of suitable capacities and other equipments incidental to carry out this work shall have to be arranged by the contractor at his cost. BHEL engineer reserves the right to inspect lifting tackles and equipment before allowing their use. Such approval however shall not relieve the responsibility of the contractor to ensure safe handling of equipment taking the precautions to avoid any accident and damage to other equipment and personnel.		
18.22	No separate rate will be applicable for the above job. The contractor will quote the rate for the items inclusive of all charges for the above job.		
19.0	ISSUE OF MATERIALS		
19.1	ISSUE OF BOROSILICATE GLASS BLOCK(Free Issue item)		
	Borosilicate Glass block shall be issued as received vide challan of the transporter in sqm worked out by multiplication of block sizes by no of block.		
19.2	ADHESIVES / MEMBRANCE(Free Issue item)		
	Shall be issued in Kg/Litre as received in drum		
19.3	PRIMER PAINT(Free Issue item)		
	Shall be issued in Litre as received in drum		
19.4	The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by contractor from BHEL stores.		
20.0	RETURN OF MATERIALS		
20.1	BOROSILICATE GLASS BLOCK		
	All unused Borosilicate blocks shall be taken back by BHEL in sqm worked out by multiplication of block sizes by no. of block		
20.2	ADHESIVES / MEMBRANCE		
	All unused untampered adhesive / membranCe drum shall be taken back by BHEL in Kg as received during issue. Open drum / partially used drum shall not be taken back		
20.3	PRIMER PAINT		
	All unused untampered drum containing paint shall be taken back by BHEL in litre as received during issue. Open drum / partially used drum shall not be taken back		
21.0	CONSUMPTION AND WASTAGE		
21.1	BOROSILICATE GLASS BLOCK		
21.1.1	Consumption shall be calculated based on actual required of no. of block /sqm or supplier recommendation which ever is less.		
21.1.2	Allowable wastage: One and half percent (+2%) of theoretical consumption unless specified otherwise in the technical specification. Consumption beyond 1.5% shall be recovered at penal rate. Basis of recovery shall be as follows:		
	Sl no	Borosilicate Glass Block consumption	Basis of issue & penal recovery
	B-1	Theoretical consumption (without considering any wastage or loss).	Free
	B-2	Actual consumption being Limited to one and half percent (+2%) of aforesaid theoretical consumption towards allowable wastage.	Free
	B-3	Actual consumption beyond one and half percent (+2%) of above (B-1).	Penal rate
22.2	ADHESIVES / MEMBRANCE		
22.2.1	Actual consumption of adhesive / membrane per sqm or supplier recommendation which ever is less.		
22.2.2	Allowable wastage: Three percent (+5%) of theoretical consumption unless specified otherwise in the technical specification. Consumption beyond 3% shall be recovered at penal rate. Basis of recovery shall be as follows:		
	Sl no	Adhesives / Membrane consumption	Basis of issue & penal recovery
	C-1	Theoretical consumption (without considering any wastage or loss).	Free
	C-2	Actual consumption being Limited to one and half percent (+5%) of aforesaid theoretical consumption towards allowable wastage.	Free
	C-3	Actual consumption beyond one and half percent (5%) of above (C-1).	Penal rate
22.3	PRIMER PAINT		

	Actual consumption of paint per sqm or supplier recommendation which ever is less.	
	Allowable wastage: Three percent (+10%) of theoretical consumption unless specified otherwise in the technical specification. Consumption beyond 10% shall be recovered at penal rate. Basis of recovery shall be as follows:	
	Sl no	PRIMER PAINT consumption
	P-1	Theoretical consumption (without considering any wastage or loss).
	P-2	Actual consumption being Limited to one and half percent (+15%) of aforesaid theoretical consumption towards allowable wastage.
	P-3	Actual consumption beyond one and half percent (+15%) of above (P-1).
		Basis of issue & penal recovery
		Free
		Free
		Penal rate
22.0	RECONCILIATION OF BHEL ISSUED MATERIALS	
22.1	At the time of submission of bills, the contractor shall properly account for the material issued to him as specified herein to the satisfaction of BHEL certifying that the balance materials are available with contractor's custody at site.	
22.2	If it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified.	
23.0	RECOVERY OF MATERIAL	
23.1	If wastage exceeds the specified limit, the recovery of excess wastage shall be made from monthly RA bill at the penal rate stipulated below.	
23.2	PENAL RATE OF MATERIALS	
	ITEM	Penal rate (Rs)
	BOROSILICATE GLASS BLOCK	Rs 28000 / Sqm
	ADHESIVES / MEMBRANCE	Rs. 2500 / Kg
	PRIMER PAINT	Rs. 300 / Litre
24.0	CONSTRUCTION OF TEMPORARY OFFICE, STORES ETC	
24.1	The contractor shall arrange at his own cost cleaning of area allotted, construction of his temporary office, stores, etc. and also the watch and ward of all the above. Materials required for the same shall be provided by contractor at his own cost.	
25.0	TOOLS & PLANTS (TO BE PROVIDED BY CONTRACTOR)	
25.1	Tentative list of Major T&P to be deployed by contractor for successful completion of work is detailed below.	
	Major T&P items	Tentative Mobilizing time from date of intimation to start the work by BHEL
25.1.1	01 No DG set 250KVA	Within 15 days
25.1.2	01 No moving platform arrangement with safety device for working inside flue can. Rope Suspended Annular Circular Platform for Boro-Silicate application with 4no. rope climbing machine and other accessories and having self-operating facility from the platform with Safe Working Load= 1.3 MT (capacity – 2.5 MT) of M/S Tractel or equivalent reputed manufacturer make to be approved by BHEL.	Within 15 days
25.1.3	01 No. Material cum passenger lift (minimum 1 Ton capacity)	Within 15 days
25.1.4	02 Nos. double drum winch arrangement (Lift & Misc Lifting activities) of capacity matching with the dead & live load of the lift.	Within 15 days
25.1.5	01 no Truck /Tractor with Trailer (14 Ton)	As required.
25.1.6	01 no Air Compressor (Capacity 340 CUM/Hr)	Within 15 days
25.1.7	Welding Machines (As required)	As per Site requirement
25.1.8	Heating Oven(As required)	As per Site requirement
25.1.9	Portable Oven(As required)	As per Site requirement
25.1.10	Pipe Cutting Machine	As per Site requirement

25.1.11	Portable fire extinguishers as below: Soda acid – 2 sets. Dry chemical powder – 2 sets CO2 – 2 sets. Water & sand bucket (4 buckets in one stand) – 2 sets. Fire hose with nozzle (50 M length) – 2 sets.	Within 30 days	
25.2	T&P shown in the above mentioned list are tentative based on planned progress requirement. Actual Mobilisation schedule, based on front availability, drawings, construction schedule and material availability at site is to be reviewed and mutually agreed with CM, BHEL site periodically from time to time for mobilisation of major T&Ps, and the same have to be adhered to. No change will be permitted without written approval of Construction Manager, BHEL site. Further requirement will be reviewed time to time at site and contractor will provide additional T&P/equipments to ensure completion of entire work within schedule time without any financial implication to BHEL. All other T&Ps shall be provided by the contractor without any extra cost to BHEL. Vendor will give advance intimation & certification regarding capacity etc prior to dispatch of heavy equipments.		
25.3	All T&P and all IMTEs, which are required for successful and timely execution of the work covered within the scope of this tender, shall be arranged and provided by the contractor at his own cost in working condition.		
25.4	In the event of any failure on the part of the contractor to deploy T & P to sustain desired work progress, BHEL may at his discretion also terminate the contract on this ground and take out any or whole amount of the contract from the scope of the contractor. In the event of failure of contractor to deploy necessary and sufficient T&P/ IMTEs to maintain work progress, BHEL will be at liberty to arrange the same at the risk & cost of contractor including transportation cost of same from any of BHEL site/ other agency & charges as applicable shall be deducted from contractor's RA bill. Decision of BHEL in this regard will be final & binding on contractor.		
	If any one of T&P mentioned above is not needed for proper execution of scope of work, provided contractor has not utilized BHEL free issued T&P for completing such work, no recovery from contractor shall be applicable.		
25.5	In case deployment of T&P w.r.t requirement, is delayed or deployed for a shorter period or abnormal down time of T&P or 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 from outside, the recovery shall be done from the contractor as under:		
25.5.1	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.		
25.5.2	In case BHEL had to deploy the T&P from outside, actual hiring cost plus applicable overheads shall be recovered.		
26.0	CONSTRUCTION SCHEDULE		
26.1	The bidder shall strictly adhere to the time schedule furnished below and mobilise resources accordingly so as to complete the entire scope of the work under this contract within the stipulated time of 10 Months from date of start of work as per intimation of BHEL (to be issued by Project Manager, BHEL or Construction Manager, BHEL).		
26.2	Sl no.	Major Milestone	Months from date of start of work
	1	Completion of Borosilicate lining work including installation of associated items U#1	3
27.0	COMPLETION PERIOD		
	The entire work under this scope shall be successfully completed in all respect within 03 (Three) months from the date of start of work.		
	Mobilisation period is 15 days from date of LOI by BHEL.		

28.0	CERTIFICATE TOWARDS COMPLETION The work under the scope of the contractor shall be deemed to have been completed in all respects only when so certified by BHEL/ NTPC. The decision of BHEL in this regard shall be final and binding on the contractor.
29.0	MOBILIZATION ADVANCE/ INTEREST BEARING RECOVERABLE ADVANCE Not applicable for this tender.
30.0	REVISION ON ACCEPTED CONTRACT RATE Not applicable in this tender.
31.0	LIQUIDATED DAMAGES/ PENALTY
31.1	If the completion of work is delayed beyond the completion period referred above due to reasons attributable to the contractor, they shall pay to BHEL as penalty a sum @ 0.5 % of contract price per week of delay or part thereof subject to a maximum of 10 % of the total contract value.
31.2	All other terms shall be as per the provision of GCC in this regard.
31.3	In case of LD recovery, the applicable GST shall also be recovered from the contractor.
32.0	CONTRACT PRICE
32.1	The bidder shall quote their rates strictly in accordance with prescribed Price schedule of Volume-III.
32.4	The quantities of the various items mentioned in the respective Price schedules, Volume-III are approximate, based on very preliminary information and may vary to any extent or to be deleted altogether. The quoted rates of each item will remain firm throughout the period of execution including extension, for reasons whatsoever, as long as variation in the total value of the work executed under any part of this contract including extra items, if any, but excluding any price variation, remains within +/- 15 % (plus/minus fifteen percent) of the awarded price (as per LOI / WO).
32.5	Unless otherwise specified in price schedule, contractor shall obtain prior approval from BHEL/ owner regarding manufacturer / make of all brought out items under contractor's scope of supply.
33.0	TAXES AND DUTIES
33.1	All taxes excluding GST & BOCW Cess (as specified elsewhere in the tender) but including, Charges, Royalties, any State or Central Levy and other taxes for materials if any obtained for the work and for execution of the contract shall be borne by successful bidder and shall not be payable extra by BHEL. Any increase of above at any stage during execution of contract, including extension of the contract, shall have to be borne by successful bidder contractor. Bidder's quoted/ accepted rates/ price shall be inclusive of all such requirements.
33.2	GST along with Cess (as applicable) legally leviable & payable by successful bidder as per GST Law shall be paid by BHEL, extra. Hence, bidder shall not include GST along with Cess (as applicable) in their quoted rates/ price.
33.3	Successful bidder shall furnish proof of GST registration with GSTN Portal covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by successful bidder on BHEL for this project / work.
33.4	Since GST on output will be paid by BHEL separately as enumerated above, bidder's your quoted rates / price should be after considering the Input Credit under GST law at bidder's end.
33.5	TDS under Income Tax shall be deducted at prevailing rates on gross invoice value from the running bills (RA bills) unless exemption certificate from the appropriate authority / authorities is furnished.
33.6	TDS under GST shall be deducted at applicable rates on gross invoice value from the running bills (RA bills).
33.7	Bidder shall note that GST Tax Invoice complying with GST Invoice Rules (Section 31 of GST Act & Rules referred thereunder) wherein the 'Bill To' details shall encompass following. BHEL GSTN – Refer attached GSTN code table of BHEL. Name - BHARAT HEAVY ELECTRICALS LIMITED Address - Shall be intimated later. Specific details of BHEL GSTN, Name and Address as stated above, have been specified elsewhere in the tender.

33.8	Successful bidder to intimate immediately on the day of removal of goods (in case of any supply of goods) to BHEL along with all relevant details and send a scanned copy of Tax Invoice to BHEL through following communication mode for enabling BHEL to meet its GST related compliances. Portal address. and Email address – Shall be intimated later. Specific details of above shall be intimated to successful bidder by BHEL at appropriate juncture.
33.9	In case of delay in submission of above mentioned documents on the date of despatch, BHEL may incur penalty / interest for not adhering to Invoicing Rules under GST Law. The same will be liable to be recovered from successful bidder, in case such delay is not attributable to BHEL.
33.10	In case of raising any Supplementary Tax Invoice (Debit / Credit Note), successful bidder shall issue the same containing all the details as referred to in Section 34 read with Section 31 of GST Act & Rules referred there under.
26.11	Successful bidder shall comply with the Time Limit prescribed under the GST Law and rules thereof for raising of the Tax Invoice. If any supply of goods is applicable, successful bidder shall also ensure prompt delivery of goods after despatch.
33.12	Bidder shall note that in case GST credit is delayed / denied to BHEL due to delayed / non receipt of goods and / or Tax Invoice or expiry of the timeline prescribed in GST Law for availing such ITC, or any other reasons, not attributable to BHEL, GST amount shall be recoverable from successful bidder along with interest levied/ leviable on BHEL, as the case may be.
33.13	Successful bidder shall upload the invoices raised on BHEL in GSTR-1 within the prescribed time as given in the GST Act. Bidder shall note that in case of delay in declaring such invoice in your return and GST credit availed by BHEL is denied or reversed subsequently as per GST Law, GST amount paid by BHEL towards such ITC reversal as per GST law shall be recoverable from the successful bidder along with interest levied / leviable on BHEL.
33.14	Way Bill: Successful bidder to arrange for way bill / e-waybill for any transfer of goods for the execution of the contract. Successful bidder has to make their own arrangement at their cost for completing the formalities, if required, with Issuing Authorities, for bringing materials, plants & machinery at site for execution of the works under this contract, Road Permit / Way Bill, if required, shall be arranged by successful bidder and BHEL will not supply any Road Permit/ Way Bill for this purpose.
33.15	Any new taxes & duties, if imposed subsequent to due date of offer submission as per NIT & TCN, by statutory authority during contract period (including extension, if the same is not attributable to you), shall be reimbursed by BHEL on production of relevant supporting document to the satisfaction of BHEL. However, you shall obtain prior approval from BHEL before depositing new taxes and duties.
33.16	Benefits and / or abolition of all existing taxes must be passed on to BHEL against new taxes, if any, proposed to be introduced at a later date.
34.0	TERMS OF PAYMENTS
34.1	Interim Payment shall be limited to 95% of gross bill amount. All admissible recovered/ adjustments etc. shall be made from the interim payable amount.
34.2	Balance 5 % retained from each RA bill will be released on completion of guarantee period along with final bill. However, this 5 % payment can be released against submission of bank guarantee valid for the guarantee period as stated above in Proforma / Format of performance bank guarantee, subject to receipt of certificate that all works are completed in all respects. Submission of bank guarantee towards retention is separate and other bank guarantee(s) cannot be utilized for this purpose. This retention bank guarantee will be refunded after guarantee period.
34.3	1.5 % of gross bill amount shall be paid in the following manner on certification by BHEL engineer after compliance of each of following activity in each month. In case of non-fulfilment of respective activity by vendor in each month, no payment shall be made by BHEL against corresponding activity and no claim of bidder at a later date, whatsoever, in this regard shall be entertained by BHEL.
34.3.1	0.7 % shall be paid on compliance of housekeeping of vendor's working area and store/ office areas.
34.3.2	0.3 % shall be paid on compliance of general illumination of vendor's working area and

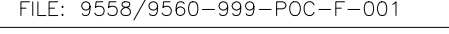
	stores, office area.
34.3.3	0.2 % shall be paid on compliance of applicable OHSAS requirement as per guidelines of BHEL/ PSER and as specified in the tender.
34.3.4	0.3 % shall be paid on compliance of applicable safety requirement as per guidelines of BHEL/ PSER and as specified in the tender.
34.4	Applicable GST, which can be claimed at any point, shall be released to the successful bidder upon compliance of following:
34.4.1	Vendor declaring such Invoice in his GSTR-1
34.4.2	Receipt of Goods/ services and Tax Invoice by BHEL
34.4.3	Confirmation of payment of GST thereon by you on GSTN Portal
34.4.4	Above is subject to receipt of goods/ service and tax invoice thereof along with vendor declaring invoice in their return and paying GST within timeline prescribed for availing ITC by BHEL.
34.5	Contractor's RA bill, complete & correct in all respects, certified by BHEL engineer, shall be paid after 60 days of receipt of bill with all supporting documents.
34.6	BHEL site at its discretion, may further split up the above percentages of break up and effect payment to suit the site condition, cash flow requirement, according to the progress of work.
34.7	Such payment as above shall be effected only on certification by BHEL against completion of each stage.
34.8	No interest, whatsoever, shall be payable by purchaser on the security deposit, any bank guarantee submitted or any amount due to successful bidder/ contractor.
35.0	PRICE VARIATION COMENSATION (PVC)
	Not applicable for this tender.
36.0	OVER RUN CHARGES (ORC)
	Not applicable for this tender.
37.0	METHOD OF MEASUREMENT
	Method of measurements shall be as per standard specifications included in the tender. For other items measurements shall be as per relevant IS Codes.
38.0	EXTRA/ ADDITIONAL ITEMS OF WORK
	It shall be as per relevant clause of GCC.
39.0	GUARANTEE
	Guarantee period shall be 12 months from the date of start of guarantee period as per relevant clause of GCC. Commencement of guarantee period shall be from the date of completion of work under the contract as certified by BHEL.
40.0	EXCLUSION
40.1	Removal of insulation outside the flue can is excluded from the successful Bidder's scope.
40.2	Supply of Borosilicate lining block, Adhesive membrane and epoxy primer is excluded from the scope of successful Bidder.
41.0	OTHER TERMS
41.1	Contractor shall provide temporary barricade all round the working area to avoid any untoward incident.
41.2	Any other non-conformity in safety noticed not mentioned elsewhere will also be fined. The decision of BHEL engineer is final on the above. The amount will be deducted from bills of the contractor.
41.3	The contractor shall comply with all state and central laws, various labour laws, statutory rules and regulations, etc.
41.4	The payment of wages act, minimum wages act, workman compensation act, Employers Liability act, Industrial Dispute Act, Employees Provident Fund Scheme, Employees State Insurance, Contract Labour (Regulation and abolition) Act and other acts, rules & regulation for labour as may be enacted by the Government during the tenure of the contract and having force or jurisdiction at site. The contractor shall give to the local government body police and other relevant authorities all such notices as may be required by law.
41.5	While bidder's scope includes deployment of all resources, like T&P, materials, consumables, manpower including supervision etc for proper completion of the subject job and no sub-contracting for execution of the job is allowed by BHEL, depending on

TENDER NO – PSER:SCT:BAR-C1962:19		
VOLUME-IF-CML-REV-00	TECHNICAL CONDITIONS OF CONTRACT (TCC)	PAGE 25 OF 26

	project's requirement and on prior acceptance of BHEL, bidder may associate agencies for deployment of skilled/ unskileld manpower only for site execution. Bidder should arrange all resources, like T&P, materials, consumables, supervision etc directly for the subject job.
41.6	Drawing showing enough details for the construction as per the specification shall be furnished to the contractor in a phased manner as far as possible.
41.7	All other term & conditions of this specification, not mentioned above shall be governed by the pertinent provisions of GCC, Volume-IB.

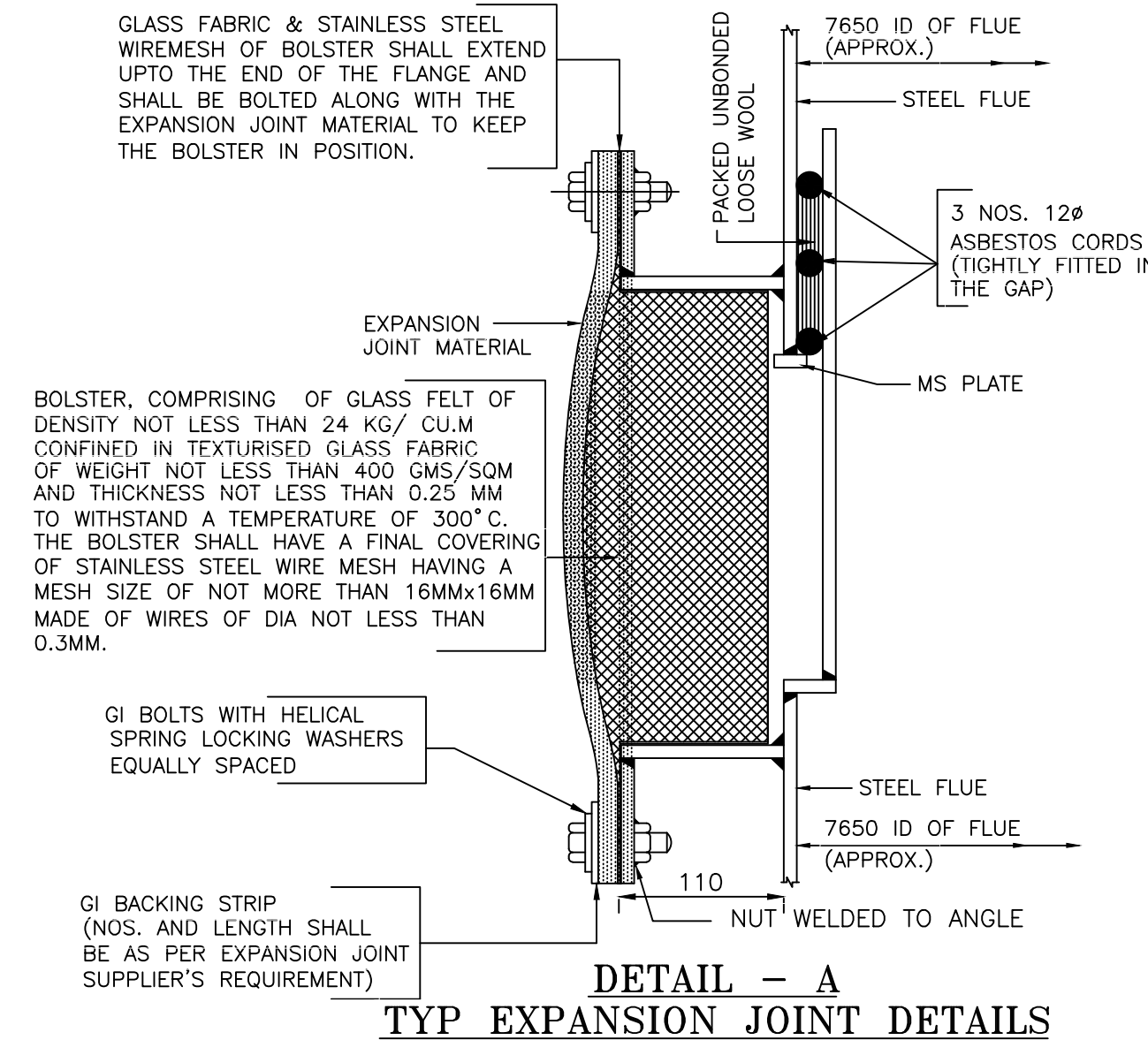
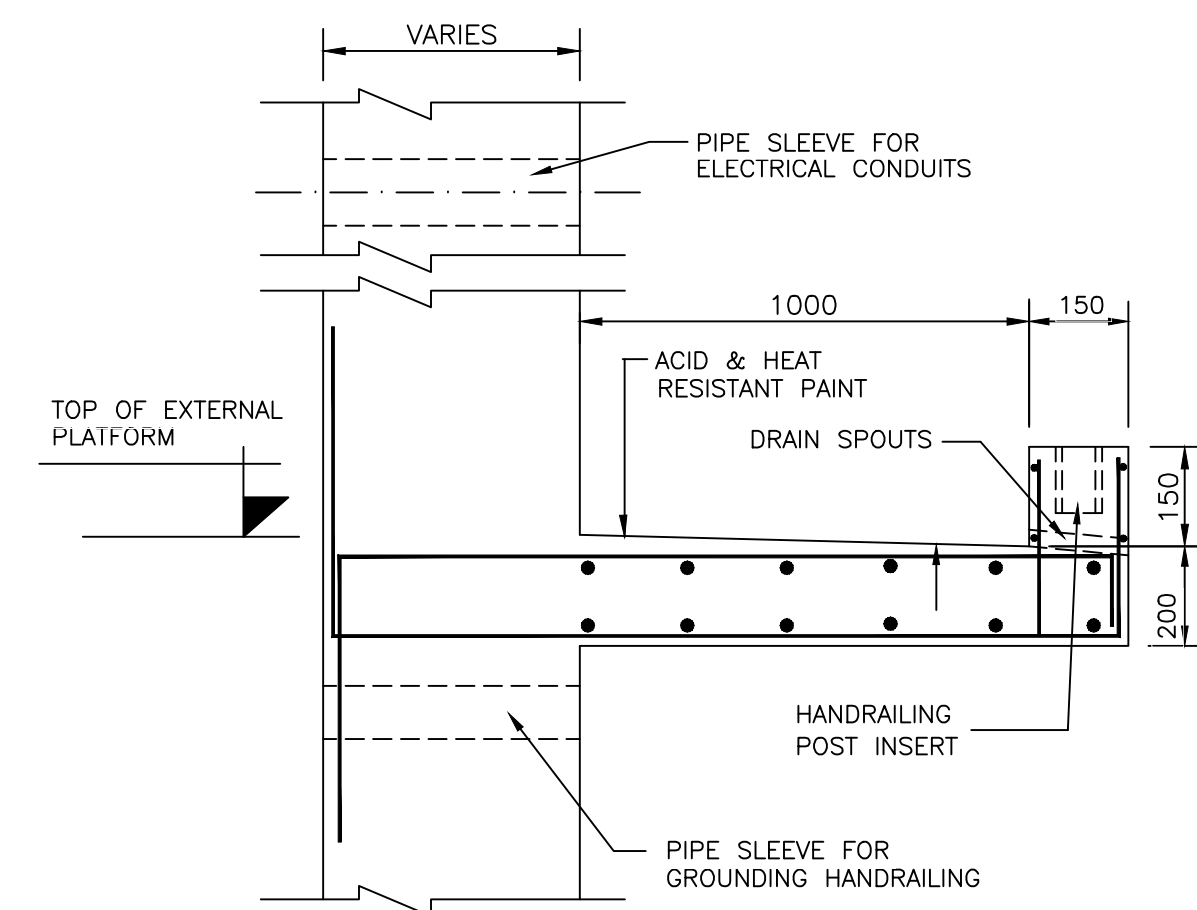
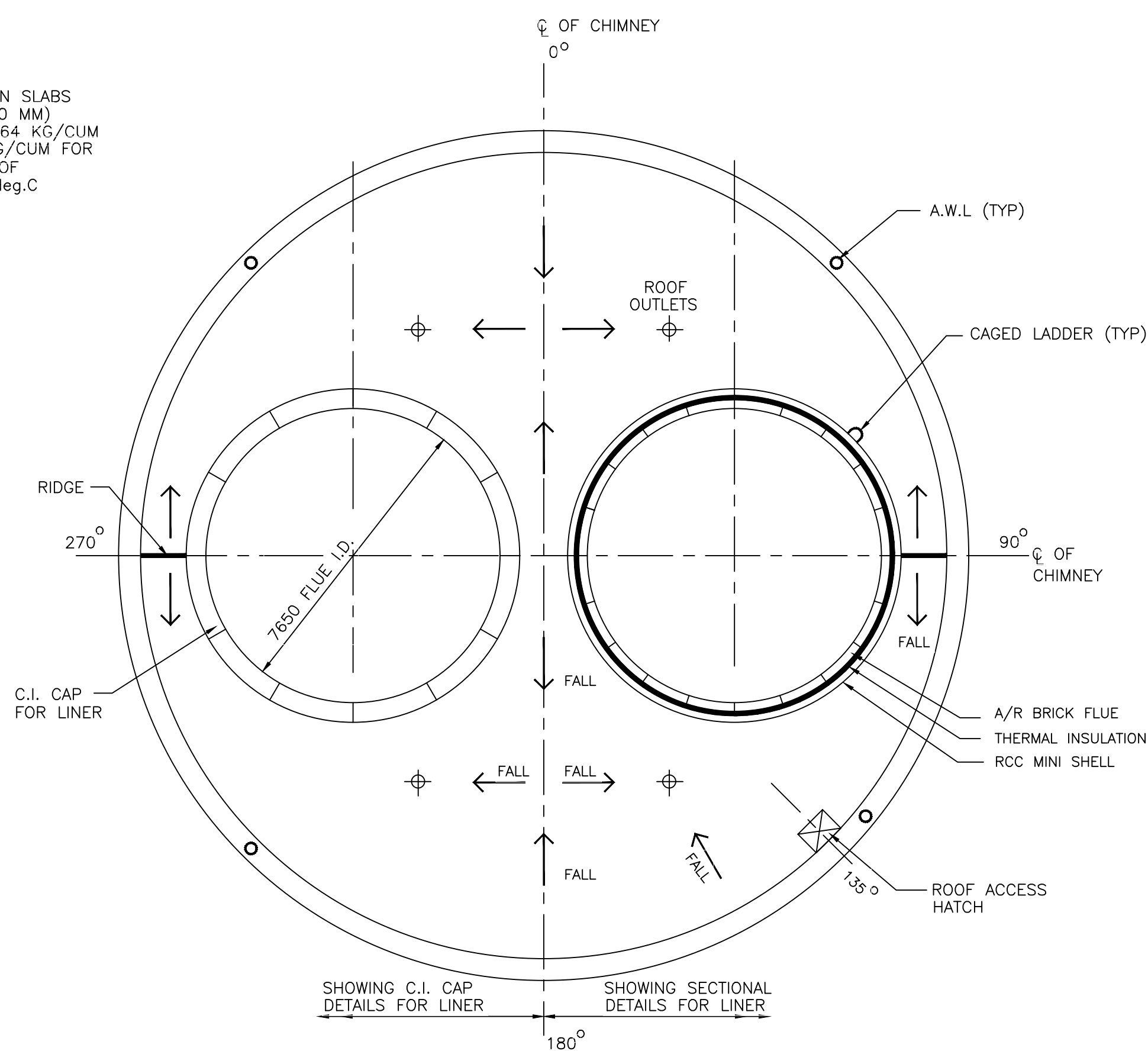
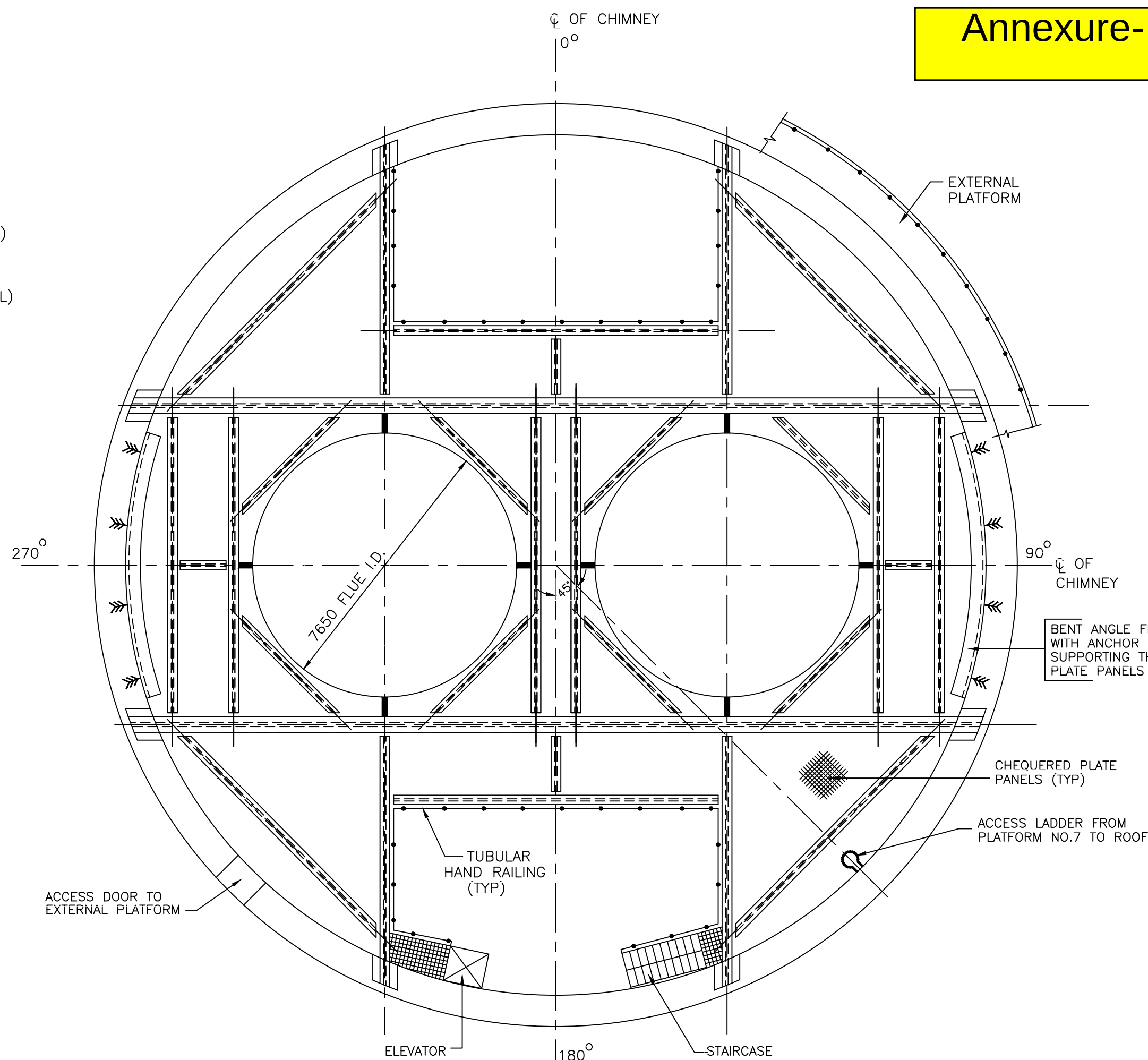
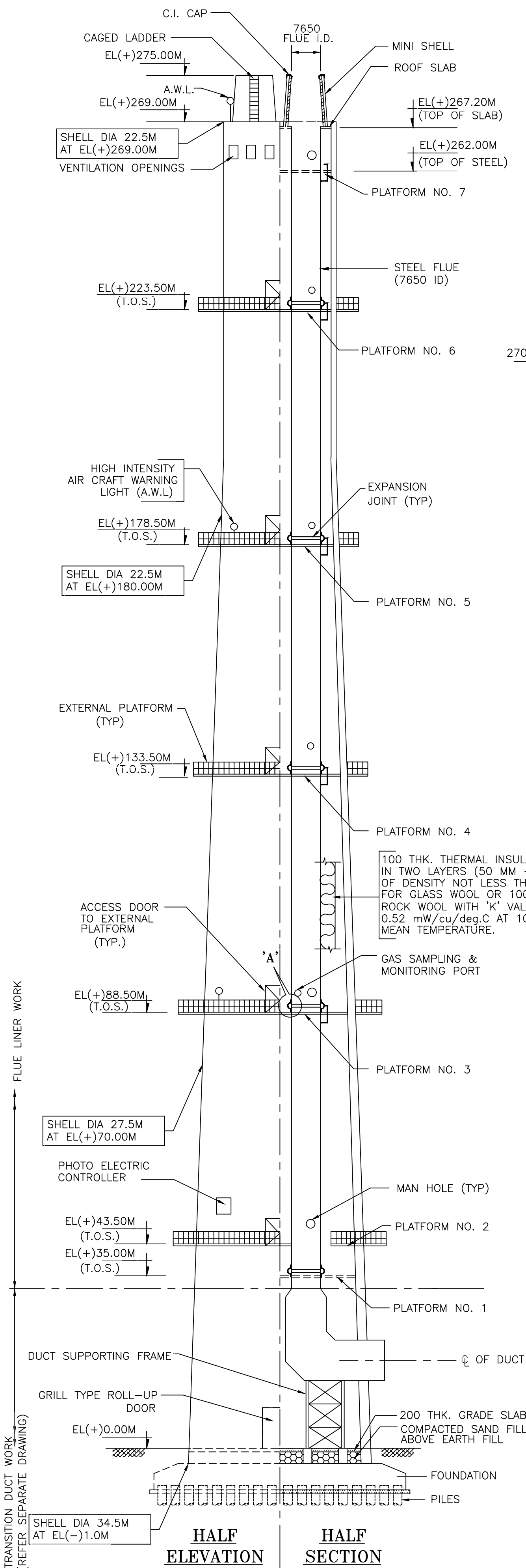
ANNEXURE-I

	SAFETY PLAN 01. Safety Policy of the Contractor to be enclosed: 02. When was the Safety Policy last reviewed: 03. Details of implementation procedure / methods to implement Safety Policy / Safety Rules: 04. Name, Qualification, experience of Safety Officer 05. Review of Accidents Analysis Method, Methods to ensure Safety and Health: 06. Unit executive responsible to ensure Safety at various levels in work area: 07. List of employees trained in safety employed before execution of the job. Give the details of training: 08. Safety Training Targets, Schedules, methods Adopting to providing safety training to all employees: 09. Details of checklist for different jobs / work and responsible person to ensure compliance (copy of checklist to be enclosed): 10. Regular Safety Inspection Methods and Periodicity and list of members to be enclosed: 11. Risk Assessment, Safety Audit by Professional Agencies, Periodicity: 12. Implementation of Recommendations of Audit / Inspections. Procedures for implementation and follow up: 13. Provision for treatment of injured persons at work site: 14. Review of overall safety by top Management and Periodicity: 15. System for Implementation of Statutory legislations: 16. Issue of PPEs to employees, Periodicity / stock on hand etc:



Annexure-III, page-2

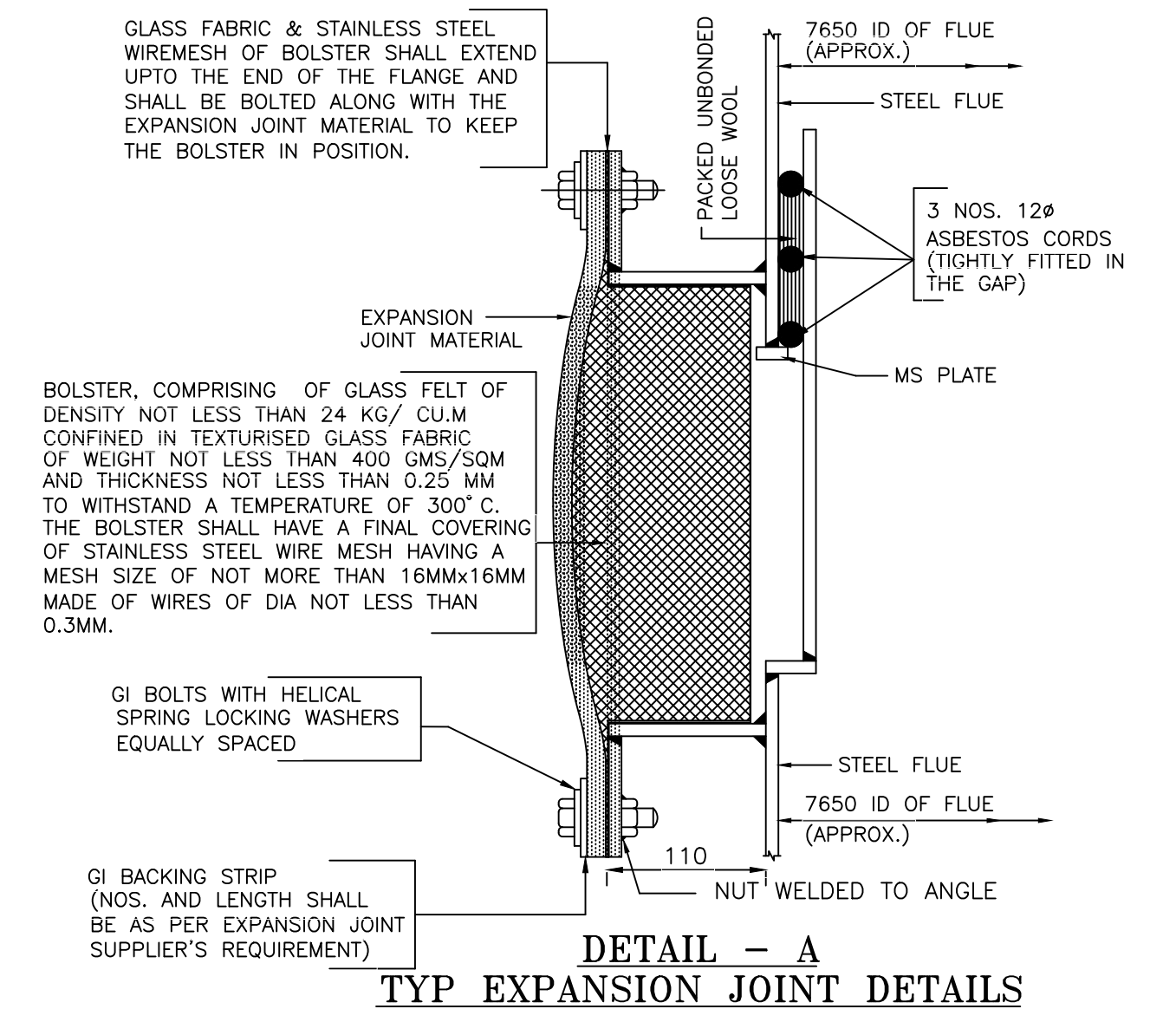
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**NOTES:-**

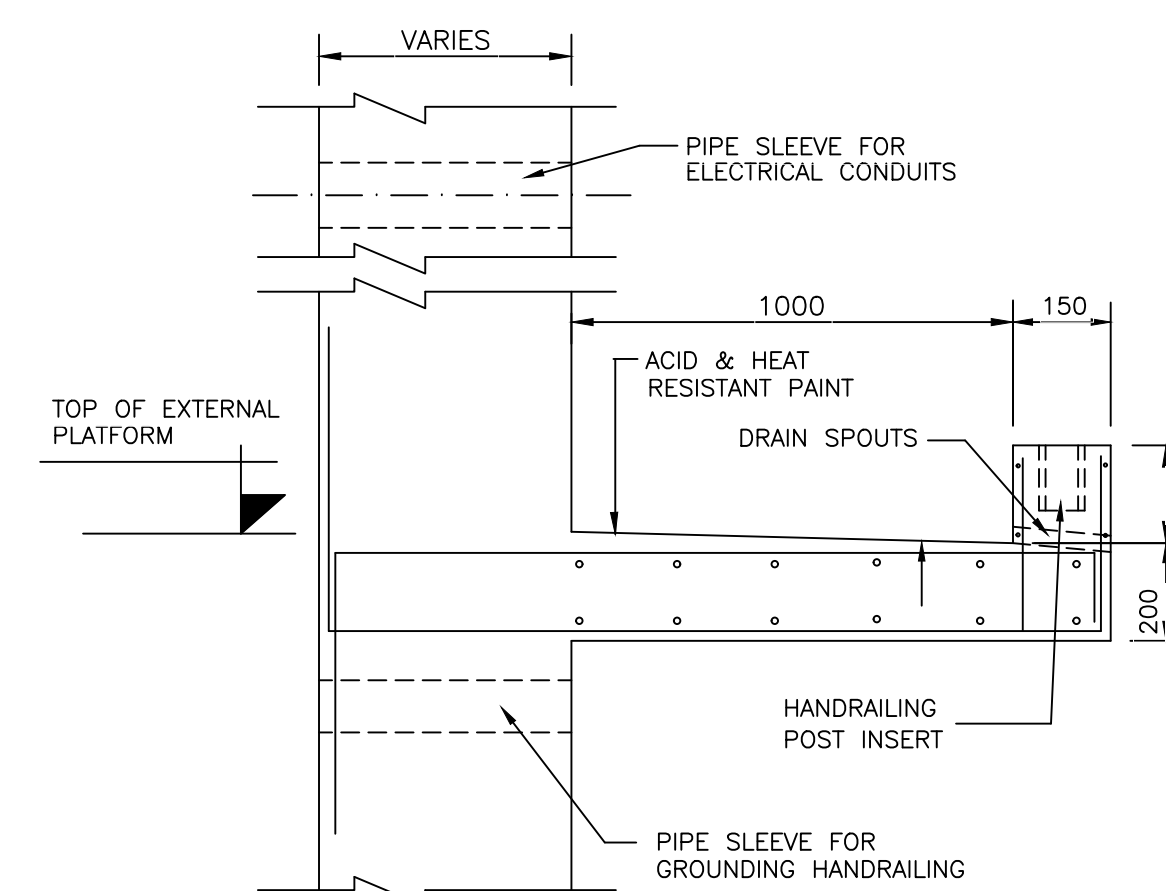
- ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES.
- EL(+/-) CORRESPONDS TO RL(+/-)46.70M.

FOR TENDER PURPOSE ONLY

PROJECT				
BARH SUPER THERMAL POWER PROJECT (3X660 MW)				
TITLE				
GENERAL ARRANGEMENT OF TWIN FLUE CHIMNEY FOR UNITS 1 & 2 (2X660 MW)				
SIZE	SCALE	DRG. NO.	REV. NO.	
A2	NTS	9558-317-POC-A-001	A	



DETAIL - A
TYP EXPANSION JOINT DETAILS



DETAILS OF EXTERNAL PLATFORM

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES.
2. EL(+/-) CORRESPONDS TO RL(+)46.70M.

FOR TENDER PURPOSE ONLY

PROJECT				BARH SUPER THERMAL POWER PROJECT (3X660 MW)	
TITLE				GENERAL ARRANGEMENT OF SINGLE FLUE CHIMNEY FOR UNIT 3 (1X660 MW)	
SIZE	SCALE	DRG. NO.		REV. NO.	
A2	NTS	9558-317-POC-A-001		A	

SUB-SECTION-II-A10

PROJECT INFORMATION- BARH-I 3X660 MW

CLAUSE NO.	Project Information
1.00.00 1.01.00 1.02.00 1.03.00 1.04.00 1.05.00 1.06.00 2.00.00	BACKGROUND Barh Super Thermal Power Project, Stage-I (3x660 MW) & Stage-II (2 x 660MW) coal based is being set up by NTPC near Barh town in Patna district of Bihar. LOCATION AND APPROACH The proposed power station is located at the latitude and longitude of 25 deg 29' 10" (N) and 85 deg. 45' 40" (E) respectively. The plant site is situated between National Highway (NH-31) and Patna-Mokama main railway line. The ash disposal area is located on the south of the railway line. Barh, the nearest town, is about 4.0 kms away from the project site. The nearest rail head Barh Railway Station on Patna - Mokama Section of main trunk route, is approximately 3.0 km away from the project site. The nearest airport at Patna is located at a distance of approximately 75 kms from the project site. The Vicinity Plan of the project is enclosed at drawing section at Annexure-I. The nearest airport at Patna is located at a distance of approximately 75 kms. from the project site. The Vicinity Plan of the project is enclosed at ANNEXURE-I. Further to the information's given in this sub-section, Bidders are also advised visit the project site and collect data on local site conditions. LAND About 3200 acres of land is acquired/under acquisition under Stage-I of the project. No additional land is envisaged to be acquired under Stage-II. The plant, ash disposal and township shall be accommodated within the land acquired/under acquisition under Stage-I. WATER The project site is located near the river Ganges. The make up water requirement for the expansion project is approximately 71 cusecs and the same is proposed to be drawn from river Ganges near village Nawada, at a distance of 2.0 kms. Make-up water pump house is already constructed at the river end in Stage-I with space provision for Stage-II pumps and the plant water requirement will be pumped to the plant through makeup water piping. COAL a) Coal requirement for the project shall be met from Amrapali block of North Karanpura Coalfields of CCL. b) The coal quality parameters and Fuel oil characteristics are attached below. RAILWAY SIDING For bringing the equipment and material to the power house through rail, a permanent railway siding is proposed to be constructed near the project site to provide rail access to unloading bays and transformer yard. Steam Generator and ESP data: refer Table-6. NOT USED
LOT-IA PROJECTS FLUE GAS DESHULPURISATION (FGD) PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2 SUB SECTION II-A10 PROJECT INFORMATION BARH STPP STAGE-I (3X660 MW) PAGE 1 OF 30

CLAUSE NO.	Project Information			
3.00.00	Capacity Stage-I : 3 x 660 MW - Under Construction -Present proposal Stage-II : 2 x 660 MW - Under Operation			
4.00.00	METEOROLOGICAL DATA The meteorological data from the nearest observatory at Patna is placed as ANNEXURE-II.			
5.00.00	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments. A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration ‘g’) in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I. Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values. The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4).			
LOT-IA PROJECTS FLUE GAS DESHULPURISATION (FGD) PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2	SUB SECTION II-A10 PROJECT INFORMATION BARH STPP STAGE-I (3X660 MW)	PAGE 2 OF 30

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Steel structures	:	2%
b)	Reinforced Concrete structures	:	5%
c)	Reinforced Concrete Stacks	:	3%
d)	Steel stacks	:	2%

CLAUSE NO.	Project Information एनटीपीसी NTPC		
	1.01.00 Method of Analysis Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1). In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1). The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve. For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear ($\bar{V}_B$) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B. For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (A_h) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Appendix-I. Design/Detailing for Ductility for Structures The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.		
LOT-IA PROJECTS FLUE GAS DESHULPURISATION (FGD) PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2	SUB SECTION II-A10 PROJECT INFORMATION BARH STPP STAGE-I (3X660 MW)	PAGE 4 OF 30

CLAUSE NO.	Project Information एनटीपीसी NTPC
	APPENDIX – I (Contd.) <u>SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT</u> The various site specific seismic parameters for the project site shall be as follows: 1) Peak ground horizontal acceleration : 0.24g 2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra a) for moment resisting steel frames designed and detailed as per IS:800 : 0.072 b) for braced steel frames designed and detailed as per IS:800 : 0.054 c) for moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.043 d) for RCC Chimney : 0.144 e) for Liquid retaining tanks : 0.087 f) for Steel chimney, Absorber tower : 0.11 g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below : 0.072 3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted : 0.144 Note: g = Acceleration due to gravity The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.
LOT-IA PROJECTS FLUE GAS DESHULPURISATION (FGD) PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2 SUB SECTION II-A10 PROJECT INFORMATION BARH STPP STAGE-I (3X660 MW) PAGE 5 OF 30

APPENDIX – I (Contd.)

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS**In units of 'g' for BARH STPP**

Period (Sec)	Damping Factor (as a percentage of critical damping)					
	0.80%	1%	1.60%	2%	3%	5%
0.000	1.000	1.000	1.000	1.000	1.000	1.000
0.030	1.000	1.000	1.000	1.000	1.000	1.000
0.040	1.373	1.361	1.327	1.310	1.275	1.212
0.050	1.755	1.728	1.653	1.615	1.539	1.406
0.058	2.066	2.026	1.913	1.856	1.744	1.552
0.059	2.106	2.063	1.945	1.886	1.770	1.570
0.060	2.145	2.101	1.978	1.916	1.795	1.588
0.061	2.184	2.138	2.010	1.946	1.820	1.605
0.062	2.224	2.176	2.043	1.976	1.845	1.623
0.065	2.343	2.289	2.140	2.065	1.920	1.675
0.070	2.542	2.478	2.302	2.214	2.044	1.760
0.071	2.582	2.516	2.334	2.244	2.069	1.776
0.074	2.702	2.630	2.431	2.332	2.143	1.826
0.084	3.107	3.012	2.754	2.627	2.385	1.987
0.094	3.516	3.398	3.077	2.919	2.622	2.142
0.104	3.930	3.787	3.398	3.210	2.856	2.292
0.114	4.349	4.178	3.720	3.498	3.086	2.436
0.120	4.608	4.414	3.912	3.671	3.222	2.521
0.121	4.608	4.445	3.944	3.699	3.245	2.535
0.123	4.608	4.445	4.018	3.757	3.290	2.563
0.124	4.608	4.445	4.018	3.798	3.313	2.577
0.126	4.608	4.445	4.018	3.798	3.368	2.604
0.133	4.608	4.445	4.018	3.798	3.368	2.708
0.601	4.608	4.445	4.018	3.798	3.368	2.708
0.604	4.586	4.445	4.018	3.798	3.368	2.708
0.617	4.489	4.348	4.018	3.798	3.368	2.708
0.622	4.453	4.314	3.982	3.798	3.368	2.708
0.632	4.383	4.245	3.919	3.739	3.368	2.708
0.667	4.153	4.022	3.714	3.543	3.192	2.708
0.767	3.611	3.498	3.229	3.081	2.776	2.356
0.867	3.195	3.095	2.857	2.725	2.456	2.084
0.967	2.865	2.775	2.562	2.444	2.202	1.869
1.067	2.596	2.515	2.321	2.215	1.995	1.694
1.167	2.374	2.299	2.123	2.025	1.824	1.548
1.267	2.186	2.118	1.955	1.865	1.680	1.426
1.367	2.026	1.963	1.812	1.729	1.557	1.322
1.467	1.888	1.829	1.688	1.611	1.451	1.232
1.567	1.768	1.712	1.581	1.508	1.359	1.153
1.667	1.662	1.609	1.486	1.418	1.277	1.084

HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS
In units of 'g' for BARH STPP

Period (Sec)	Damping Factor (as a percentage of critical damping)					
	0.80%	1%	1.60%	2%	3%	5%
1.767	1.568	1.518	1.402	1.337	1.205	1.023
1.867	1.484	1.437	1.327	1.266	1.140	0.968
1.967	1.408	1.364	1.259	1.201	1.082	0.919
2.067	1.340	1.298	1.198	1.143	1.030	0.874
2.167	1.278	1.238	1.143	1.090	0.982	0.834
2.267	1.222	1.184	1.093	1.042	0.939	0.797
2.367	1.170	1.134	1.046	0.998	0.899	0.763
2.467	1.123	1.088	1.004	0.958	0.863	0.732
2.567	1.079	1.045	0.965	0.921	0.829	0.704
2.667	1.039	1.006	0.929	0.886	0.798	0.678
2.767	1.001	0.970	0.895	0.854	0.769	0.653
2.867	0.966	0.936	0.864	0.824	0.743	0.630
2.967	0.934	0.904	0.835	0.796	0.718	0.609
3.067	0.903	0.875	0.808	0.770	0.694	0.589
3.167	0.875	0.847	0.782	0.746	0.672	0.571
3.267	0.848	0.821	0.758	0.723	0.652	0.553
3.367	0.823	0.797	0.736	0.702	0.632	0.537
3.467	0.799	0.774	0.714	0.682	0.614	0.521
3.544	0.782	0.757	0.699	0.667	0.601	0.510
3.559	0.778	0.754	0.696	0.664	0.596	0.508
3.666	0.756	0.732	0.676	0.645	0.561	0.479
3.765	0.736	0.713	0.658	0.611	0.532	0.454
3.865	0.717	0.694	0.624	0.580	0.505	0.431
3.965	0.699	0.677	0.593	0.551	0.480	0.409
4.017	0.690	0.668	0.578	0.537	0.468	0.399

6.00.00
CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. See Annexure – B for site specific information.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Welded steel structures	:	1.0%
b)	Bolted steel structures	:	2.0%
c)	Reinforced concrete structures	:	1.6%
d)	Steel stacks		As per IS:6533 & CICIND Model Code whichever is more critical.

ANNEXURE-B

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

a)	The basic wind speed " V_b " at tenmetres above the mean ground level	:	47 metres/second
b)	The risk coefficient " K_1 "	:	1.07
c)	Category of terrain	:	Category-2

7.00.00
SOIL DATA AND FOUNDATION SYSTEM

7.01.01

Employer has carried out geotechnical investigation in the areas near to this package. Logs of representative boreholes to be used for bidder's information in the vicinity of proposed area are enclosed with this Annexure-II. The bidder is required to carry out geotechnical investigation as per the clause no. 7.07.00 and ascertain the pile capacity and bearing capacity. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data is on the Bidder. Ground water table is encountered at a depth of about 0 to 1.0m below natural ground level (NGL) at the time of investigation. Fluctuation may occur in ground water table due to seasonal variation.

7.01.00

Finished Ground Level (FGL) generally corresponds to RL 46.20 within the plant area as shown in General Layout Plan (GLP). Controlled filling of thickness 3.5 to 4.0 m with soil has been done over Natural Ground Level (NGL) to achieve the FGL as indicated above.

7.02.00

For excavation depth upto 6.0 m from FGL, contractor shall make arrangements like shoring, strutting or any other method duly approved by the Engineer to retain the sides of excavated area. Contractor may also use sheet piling to protect the sides of excavated area if he so desires. For excavation 6 metres below FGL, sheet piling shall be provided. The design of the sheet pile shall be done by Contractor as per relevant IS codes. The Contractor shall submit the design of sheet piling for Engineers information.

7.03.00

The natural ground level is varying as per enclosed contour/spot level drawing.

- a) The foundation system to be adopted for different structures shall be as given in Table – 1 below

Table – 1: Net Allowable Bearing Pressure

STRUCTURE	TYPE OF FOUNDATION TO BE ADOPTED
FGD and related structures	Open/Piles

- b) During design the Allowable Bearing Pressure shall be as furnished in Table-2. Bidder is required to carry out geotechnical investigation in this area. The allowable bearing pressure shall be adopted after approval of geotechnical investigation report by owner. However, the maximum allowable bearing pressure shall be as per the approved geotechnical report and shall be limited to the values as furnished in Table-2.

Table – 2: Net Allowable Bearing Pressure

Structure	Founding Level in RL	1.02.00 Net Allowable Bearing Pressure 1.03.00 T/m ²		
		Isolated / Strip		Rafts (width > 6m) for 75mm settlement
		width upto 6 m for 25mm settlement	Width upto 6m for 40mm settlement	
FGD and related structures	1.5 m below NGL	5.0	5.5	7.0
	2.5 m below NGL	6.0	7.0	8.0

The net allowable bearing pressure higher than above mentioned values shall not be permitted. At intermediate levels the bearing capacity shall be same as the net allowable bearing pressure corresponding to the immediate shallower level mentioned above.

c) **Permissible Settlement of Foundations:**

For open foundations, the total permissible settlement and differential settlement shall be governed by IS: 1904 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following:

Isolated, Strip & Raft (Mill foundations/machine foundation)	25 mm
Isolated & Strip (Other than Mill foundations/machine foundation)	40 mm
Raft (widths greater than 6 m) (Other than Mill foundations/machine foundation)	75 mm

In case the total permissible settlement is to be restricted to less than as above specified from functional requirements, then the net allowable bearing pressure shall be reduced after review in consultation with Engineer.

- d) The diameter of pile, minimum length and maximum allowable capacity of piles shall be as given below:

Area/ Location	Pile Diameter (mm)	Minimum Length of Bored Pile Below Cut-off Level (m)	Safe Load Capacity in		
			Vertical Comp. (MT)	Pullout (MT)	Lateral (MT)
FGD and related structures	600	26.0	100.0	35.0	5.0
	600*	27.0*	100	35.0	5.0

Cut off Level (COL) is assumed at 3.0 m below FGL (RL (+) 46.2m). If the COL is shallower than the assumed COL, then the length of the pile shall be increased accordingly.

* Cut off Level (COL) is assumed at 1.5 m below FGL (RL (+) 46.2m). If the COL is shallower than the assumed COL, then the length of the pile shall be increased accordingly.

- e) The criteria for Pile Termination (founding level) shall be as given below:
The termination level of the pile shall be decided based on the following criterion

- Minimum length of the pile below COL (cut off level) shall be as specified above
- The minimum pile length for each group of piles shall be determined based on the nearest borelog. The SPT N value at pile termination level shall not be less than 40. For pile termination, SPT 'N' values shall be used from the nearby borelog data. The boreholes are in the bidder's scope and shall be conducted as per the enclosed scheme.
- However, in no case the length of pile shall be less than the minimum length determined as in (i) or (ii) above whichever is longer, for that pile group.

- f) Special Requirements:

- Chemicals in ground water and subsoil, as observed during investigation are:

CLAUSE NO.

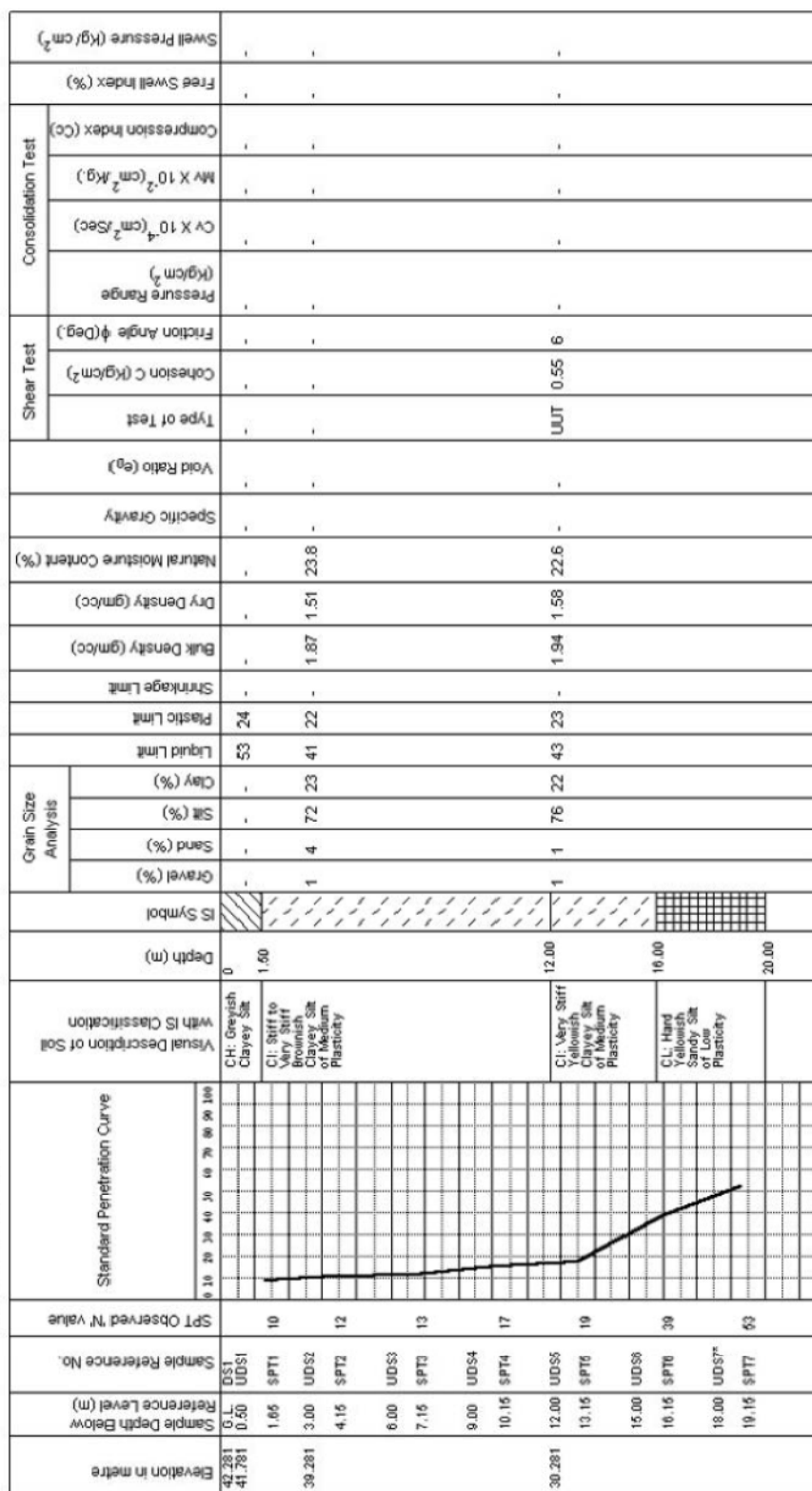
Project Information

Chemical	SO ₃	Chlorides	pH
Ground Water	20 - 56 ppm	34 – 368 ppm	6.8 - 7.2
Sub-soil	0.024 - 0.04 %	0.01 - 0.03 %	6.1 - 7.2

2) In view of the above, the following shall be adopted.

Cement Type	As specified elsewhere in the specifications
Concrete Grade	M25 for piles Minimum cement content for piles shall be 400 kg/cum of concrete. Concrete shall be dense and durable. Admixtures in concrete are not permitted
Type of Reinforcement	As specified elsewhere in the specifications
Cover to Reinforcement	As specified elsewhere in the specifications

BOHRING METHOD: Shell and Auger
NAME OF WORK : Detailed Geotechnical Investigation for Plant and Township Area for Barh Super Thermal Power Project in Bihar.



CLAUSE NO.

Project Information

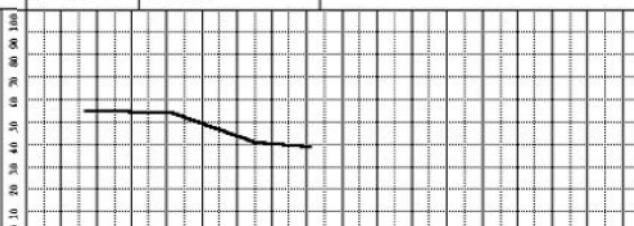
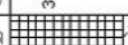


BORING METHOD: Shell and Auger

NAME OF WORK : Detailed Geotechnical Investigation for Plant and Township Area for Bath Super Thermal Power Project in Bilhal.

PROJECT NO : 2507
BORING SIZE : 150 MM
CO-ORDINATES : 900S, 430E
WATER TABLE : 0.75 M
RECORDED ON : 27/10/2002

TABLE NO : 253
BORE HOLE NO. : BH-127
TERMINATION DEPTH : 30.45 M
BORING START DATE : 24/10/2002
BORING FINISH DATE : 26/10/2002

Elevation in metre	Sample Depth Below Reference Level (m)	Sample Reference No.	SPT Observed 'N' value	Standard Penetration Curve		Visual Description of Soil with IS Classification	Depth (m)	IS Symbol	Grain Size Analysis					Liquid Limit	Plastic Limit	Shrinkage Limit	Bulk Density (gm/cc)	Dry Density (gm/cc)	Natural Moisture Content (%)	Specific Gravity	Void Ratio (eg)	Shear Test			Consolidation Test					Free Swell Index (%)	Swell Pressure (kg/cm ²)
									Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Type of Test									Cohesion C (kg/cm ²)	Friction Angle ϕ (Deg.)	Pressure Range (kg/cm ²)	CV X 10 ⁻⁴ (cm ² /Sec)	MV X 10 ⁻² (cm ² /Kg)	Compression Index (Cc)				
21.281	21.00	UDS8	66			CL: Hard Yellowish Sandy Silt of Low Plasticity	20.00		3	8	83	6	29	20	-	2.01	1.70	18.5	-	-	-	-	-	-	-	-	-	-	-	-	
	22.15	SP78					2		1	78	19	39	22	-	2.00	1.68	19.2	-	-	UCT	-	-	-	-	-	-	-	-	-	-	-
	24.00	UDS9*	55	24.00	2	1	78	19	39	22	-	2.00	1.68	19.2	-	-	UCT	-	-	-	-	-	-	-	-	-	-	-	-		
	25.15	SP79	42	27.00	UDS10	42	28.15	SP710	40	30.15	SP711	40																			

CLAUSE NO.

Project Information



BORING METHOD: Shell and Auger

NAME OF WORK : Detailed Geotechnical Investigation for Plant and Township Area for Bath Super Thermal Power Project in Bihar.

PROJECT NO : 2507
BORING SIZE : 150 MM
CO-ORDINATES : 900S, 520E
WATER TABLE : 0.0 M
RECORDED ON : 06/10/2002

TABLE NO : 254
BORE HOLE NO. : BH-128
TERMINATION DEPTH : 30.45 M
BORING START DATE : 03/10/2002
BORING FINISH DATE : 05/10/2002

Elevation in metre	Sample Depth Below Reference Level (m)	Sample Reference No.	SPT Observed 'N' Value	Standard Penetration Curve	Visual Description of Soil with IS Classification	Depth (m)	IS Symbol	Grain Size Analysis				Liquid Limit	Plastic Limit	Shrinkage Limit	Bulk Density (gm/cc)	Dry Density (gm/cc)	Natural Moisture Content (%)	Specific Gravity	Void Ratio (eg)	Shear Test			Consolidation Test				Free Swell Index (%)	Swell Pressure (Kg/ cm ²)				
								Gravel (%)	Sand (%)	Silt (%)	Clay (%)									Type of Test	Cohesion C (Kg/cm ²)	Friction Angle ϕ (Deg.)	Pressure Range (kg/cm ²)	Cv X 10 ⁻⁴ (cm ² /Sec)	Mv X 10 ⁻² (cm ² /Kg.)	Compression Index (Cc)						
42.295	0.00	DS1	10		CH: Stiff Greyish Clayey Silt	0						50	24																			
41.795	1.15	SPT1	9		CI: Medium to Stiff Brownish Clayey Silt of Medium Plasticity	2.00			4	73	20		22		1.86	1.49	24.7			UCT												
38.795	2.65	SPT2	8					3																								
	3.50	UDS2																														
	5.65	SPT3																														
	6.50	UDS3																														
	8.65	SPT4	11																													
	9.50	UDS4																														
	11.65	SPT5	44																													
	12.50	UDS5																														
	14.65	SPT6	10		CL: Stiff to Hard Yellowish Clayey Silt of Low Plasticity	9.00		3	6	76	15	33	20		1.95	1.64	19.1	2.66	0.625					0.5-1.0	9.69	1.36	0.090					
26.795	15.50	UDS6																						1.0-2.0	7.71	1.00						
	17.05	SPT7	31																					2.0-4.0	6.27	0.73						
	18.50	UDS7				10.00																		4.0-8.0	5.57	0.43						

 GEOTECH CONSULTANTS PVT. LTD. NEW DELHI			
BORING METHOD: Shell and Auger			
NAME OF WORK : Detailed Geotechnical Investigation for Plant and Township Area for Barh Super Thermal Power Project in Bihar.			
PROJECT NO	: 2507	TABLE NO	: 255
BORING SIZE	: 150 MM	BORE HOLE NO.	: BH-128
CO-ORDINATES	: 900S, 520E	TERMINATION DEPTH	: 30.45 M
WATER TABLE	: 0.0 M	BORING START DATE	: 03/10/2002
RECORDED ON	: 06/10/2002	BORING FINISH DATE	: 05/10/2002

[illegible]

COOLING WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	CaCO ₃	493
2.	Magnesium	CaCO ₃	212
3.	Sodium	CaCO ₃	250
4.	Potassium	CaCO ₃	28
5.	Total Cations	CaCO ₃	983
6.	Total Alkalinity	CaCO ₃	643
7.	P-Alkalinity	CaCO ₃	Nil
8.	Chloride	CaCO ₃	233
9.	Sulphate	CaCO ₃	107
9.	Total Anions	CaCO ₃	983
11.	Silica (Reactive)	SiO ₂	15
12.	Iron	Fe	1
13.	pH Value	-	8.6-9
14.	Turbidity	NTU	50

Note : The C.W system is expected to operate at about 2.5 Cycles of Concentration. As CW blow down water (Service Water) is tapped from discharge of CW pumps, the water quality of CW Blow down water shall be same as that above.

CLAUSE NO.

Project Information

**ANALYSIS OF DM WATER TO BE USED FOR
MAKE-UP WATER TO CONDENSER**

Sl.No.	Characteristics	Value
1.	Silica (Max.)	0.02 ppm as SiO_2
2.	Iron as Fe	Nil
3.	Total hardness	Nil
4.	pH value	6.8 -7.2
5.	Conductivity	Not more than 0.1 excluding the effects of free CO_2

CLAUSE NO.

Project Information



ANNEXURE-I



LOT-1A PROJECTS
 FLUE GAS DESULPHURISATION (FGD)
 PACKAGE

TECHNICAL SPECIFICATION
 SECTION-VI, PART-A
 BID DOC. NO.: CS-0011-109 (1A)-2

SUB SECTION II-A10
 PROJECT INFORMATION
 BARH STPP STAGE-I
 (3X660 MW)

PAGE 20 OF 30

अलगावी सारणी
CLIMATOLOGICAL TABLE

1831 से 1981 तक के औसत का आधार पर
BASED ON OBSERVATIONS FROM 1831 TO 1981

स्टेशन: रायचूर
STATION: Raichur
LAT 15°47' N LONG 75°10' E
ALTITUDE 100 M
DISTANCE FROM DELHI 100 KM

MONTH	TEMPERATURE										HUMIDITY				WIND				RAINFALL				TOTAL ANNUAL RAINFALL (mm)	NO. OF DAYS WITH RAIN	MAX. WIND SPEED (km/h)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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महाराष्ट्र सरकार
CLIMATOLOGICAL TABLE

STATION NAME
STATION Pains

STATION
LAT 23°37' N LONG 75°10' E
ALTITUDE 422 M S.L. 51 Meters

STATION
LAT 23°37' N LONG 75°10' E
ALTITUDE 422 M S.L. 51 Meters

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LAT 23°37' N LONG 75°10' E
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LAT 23°37' N LONG 75°10' E
ALTITUDE 422 M S.L. 51 Meters

STATION Pains												STATION Pains										STATION Pains											
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STATION Pains																																	

PAGE 23 OF 30

TABLE – 1

COAL CHARACTERISTICS

Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal	Range of Adequacy Coal
1	2	3	4	5	6	7
A. PROXIMATE ANALYSIS (As received basis)						
1.	Total Moisture	%	15.00	17.00	12.00	10 - 20
2.	Ash	%	40.00	42.00	34.00	30 - 46
3.	Volatile matter	%	19.00	18.00	22.00	24 - 16
4.	Fixed carbon	%	26.00	23.00	32.00	36 - 18
B. ULTIMATE ANALYSIS (As received basis)						
1.	Carbon	C%	31.37	28.93	40.08	46 - 24.75
2.	Hydrogen	H2%	3.40	2.40	3.50	3.6 - 2.2
3.	Nitrogen	N2%	1.5	1.45	1.78	1.8 - 0.4
4.	Oxygen (By difference)	O2%	7.75	7.26	8.03	8.1 - 5.5
5.	Sulphur	S%	0.40	0.5	0.36	0.30 - 0.5
6.	Carbonates	CO3%	0.3	0.26	0.15	0.10 - 0.35
7.	Phosphorous	P2%	0.28	0.20	0.10	0.1 - 0.3
8.	Total Moisture	H2O%	15.0	17.0	12.0	10 - 20
9.	Ash	%	40.0	42.0	34.0	30.0 - 46.0
10.	Total	%	100	100	100	
11.	Gross Calorific Value	KCal/Kg	3300	2800	4000	4500 - 2500
12.	Hard grove index		55	50	60	45 - 65

Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal	Range of Adequacy Coal
1	2	3	4	5	6	7

C. ASH ANALYSIS

1.	Silica	(SiO ₂)%	59.79	61.3	56.7	62.0 - 56.0
2.	Alumina	(Al ₂ O ₃)%	25.36	28.0	23.5	28.0 - 23.0
3.	Iron Oxide	(Fe ₂ O ₃)%	7.2	6.0	10.0	6.0 - 10.0
4.	Titania	(TiO ₂)%	1.2	1.0	1.5	1.0 - 1.7
5.	Phosphoric Anhydride	(P ₂ O ₅)%	2.6	1.5	3.0	1.0 - 3.0
6.	Lime	(CaO)%	0.88	0.5	1.5	0.5 - 1.7
7.	Magnesia	(MgO)%	0.55	0.4	1.0	0.4 - 1.1
8.	Sulphuric Anhydride	(SO ₃)%	1.2	0.5	1.4	0.5 - 1.7
9.	Alkalies (Na ₂ O+K ₂ O) (%) (by difference)		1.22	0.8	1.4	0.6 - 1.8

NOTE: Na₂O content in the above shall not be more than 0.1%

D. ASH FUSION RANGE
(Under reducing atmosphere)

a)	Initial Deformation Temperature (IDT) °C	1100	1100	1100	1100 - 1150
b)	Hemispherical temperature °C	1300	1250	1350	1250 - 1400
c)	Flow temperature °C	1400	1350	1400	1400 - 1450

TABLE-2
LIGHT DIESEL OIL CHARACTERISTICS
AS PER IS 1460-2000

Characteristics	LDO
1. Pour Point (max)	21 deg.C & 12°C for Summer and Winter respectively
2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15
3. Sediment percent by mass (max)	0.10
4. Total sulphur percent by mass (max)	1.5
5. Ash percentage by mass (max)	0.02
6. Carbon residue (Rans bottom) percent by pass (max.)	1.50
7. Acidity in organic	Nil
8. Flash point(Min.) - Pensky Martens	66 deg.C
9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2
10. Water content, % by volume(max)	0.25
11. GCV (Kcal/kg)	10,000

TABLE -3
FUEL OIL CHARACTERISTICS

Sl. No.	Characteristics	Heavy Furnace Oil IS-1593 1971 Grade HV	Low Sulphur Heavy Stock (LSHS)	Heavy Petroleum Stock (HPS)
1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.
2.	Gross calorific value (KCal/kg)	of the order of 11,000	of the order of 11,000	9,500 (min)
3.	Flash Point (Min)	66 deg C	75 deg C	75 deg C
4.	Water content by volume (Max)	1.0%	1.0%	1.0%
5.	Sediment by weight (Max)	0.25%	0.25%	0.25%
6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%
7.	Kinematic viscosity in Centistokes at - 50deg C (Max)	370	180	500
8.	Ash Content by weight (Max.)	0.1%	0.05%	0.1%
9.	Acidity (inorganic)	Nil	Nil	Nil
10.	Pour Point (Max.)	57 deg C	72 deg C	
11.	Sodium content	—	—	100 ppm
12.	Vanadium content	25 ppm	25 ppm	25 ppm
13.	Specific heat below pour point (KCal/Kg °C)		0.65	

Table-4

S.No	Constituent	As	mg/l (except pH & turbidity)
1.	Calcium	CaCO ₃	200.5
2.	Magnesium	CaCO ₃	92
3.	Sodium + Potassium	CaCO ₃	96
4.	Total Cations	CaCO ₃	388.50
5.	Chloride	CaCO ₃	106
6.	Sulphate	CaCO ₃	58.5
7.	Alkalinity	CaCO ₃	224
8.	Total Anions	CaCO ₃	388.50
9.	Iron(total)	Fe	0.3
10.	Silica	SiO ₂	10
11.	pH value	---	7.0-8.5
12.	Turbidity	NTU	10

Note: Clarified water is used for CW system as make up & the CW system is expected to operate at about 5.0 – 5.5 Cycles of Concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dosing. As CW blow down water is tapped from CW system, the water quality of CW blow down shall accordingly be arrived by the bidder.

Table-5

ANALYSIS OF DM WATER

Sl.No.	Characteristics	Value
1.	Silica (Max.)	0.02 ppm as SiO ₂
2.	Iron as Fe	Nil
3.	Total hardness	Nil
4.	pH value	6.8 to 7.2
5.	Conductivity	Not more than 0.1 µs/cm

Table-6
1.00.00
STEAM GENERATOR DATA

1.	Location	Outdoor
2.	Operation	Base load
3.	Type	Pulverised coal fired
4.	Maximum Continuous Rating	2225 Tonns/hr.
5.	Steam pressure at SH outlet	256 Kg/cm ² (a)
6.	Steam temperature at SH outlet	540°C
7.	Oil for start up and flame stabilisation	LDO/HFO
8.	Fuel oil system sizing	30% of Boiler MCR for HFO
9.	Pulverised coal size	Minimum 70% through 200 Mesh and 99% thru 50 mesh
10.	Type of pulveriser	Vertical spindle mills
11.	Type of oil burners	Air/Steam atomised for LDO/ HFO
12.	No. of air heaters	2 Nos PAPH, 2 Nos SAPH
13.	No. of ID Fans	Two (Axial Type, both working)

2.00.00
ESP DATA

1.	Location:	Downstream side of Air preheaters
2.	Operation:	Base load
3.	Type:	Rigid Discharge frame
4.	Rapping:	Intermittent

CLAUSE NO.

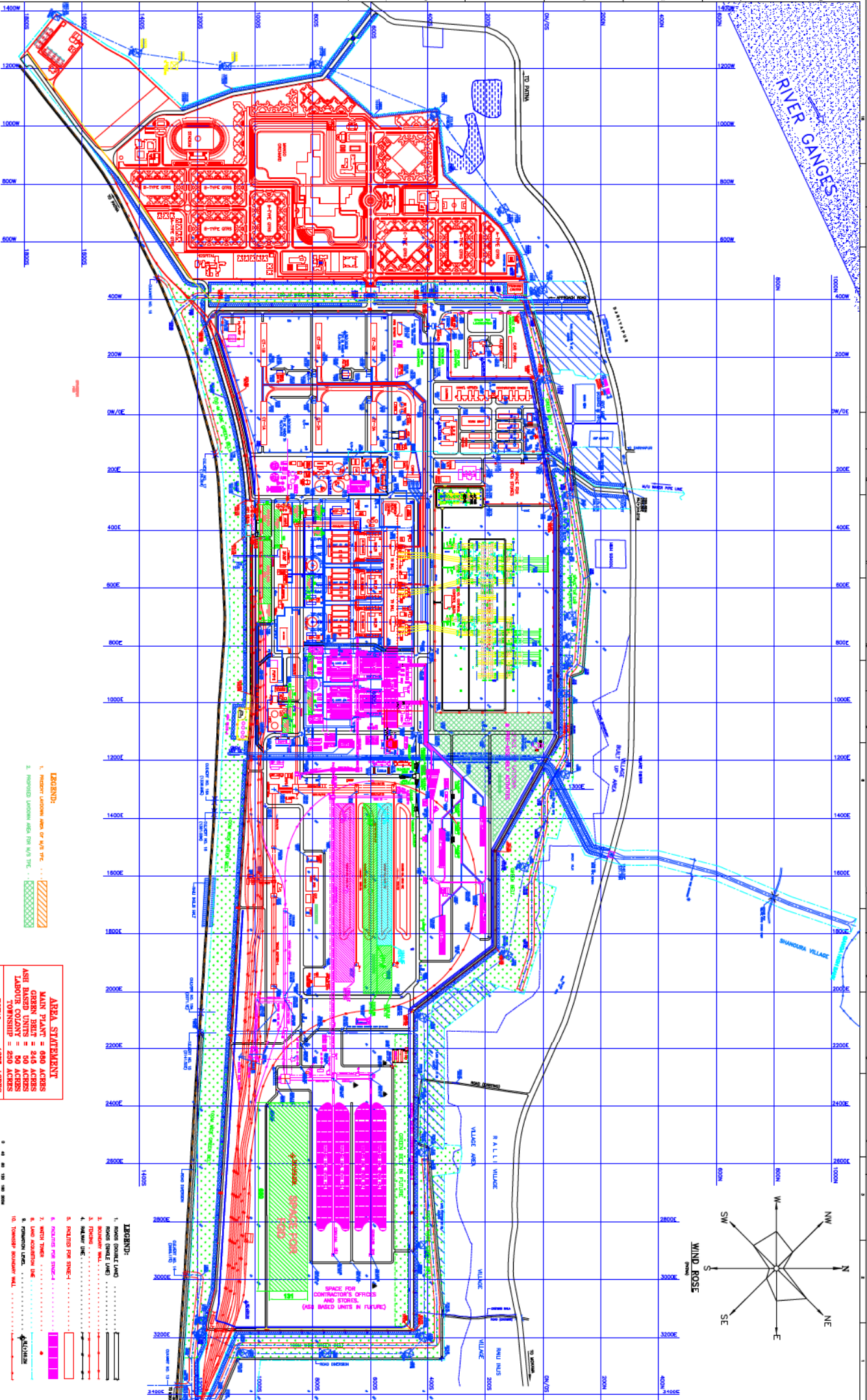
Project Information

List of Drawings placed below in this sub section:

Sl.no.	Drawing description	Drawing no.
1.	General Layout Plan	9562-999-POC-F-001
2.	Topographical Survey	9562-999-POC-F-002
3.	Equipment Layout Plan	9562-999-POM-A-001
4.	ID system-Elevation & Plan	(a) 9562-102-PVM-F-009 (b) 9562-102-PVM-F-008
5.	Chimney foundation	Refer details below

Chimney Details

Sl. No.	Project	Chimney shell outer diameter at ground level (m)	Chimney foundation outer diameter (m)	Type of foundation	Level of Top of foundation (m)	Level of Bottom of foundation (m)
1	Barh-I Unit#3	32	48.94	Raft supported on piles	RL(+) 45.70	RL(+) 41.45
2	Barh-I Unit#1 & 2	34.5	55.78	Raft supported on piles	RL(+) 45.70	RL(+) 40.95



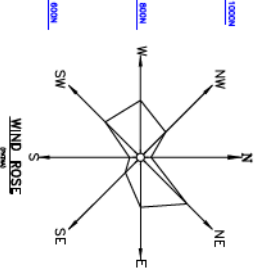
NOTES:

1. ALL CONSTRUCTIONS AND LAYOUTS ARE IN ACCORDANCE WITH THE GOVERNMENT OF INDIA, MINISTRY OF POWER, NEW DELHI.
2. THE SITE AREA IS 1275 ACRES.
3. THE SITE AREA IS 1275 ACRES.
4. THE SITE AREA IS 1275 ACRES.

LEGEND:

1. IMPROVED LAYOUT AREA FOR A/S P/T
2. IMPROVED LAYOUT AREA FOR A/S P/T

AREA STATEMENT
MAIN PLANT = 660 ACRES
ASH HANDLING = 245 ACRES
WATER TREATMENT = 80 ACRES
TOWNSHIP = 250 ACRES
TOTAL = 1275 ACRES



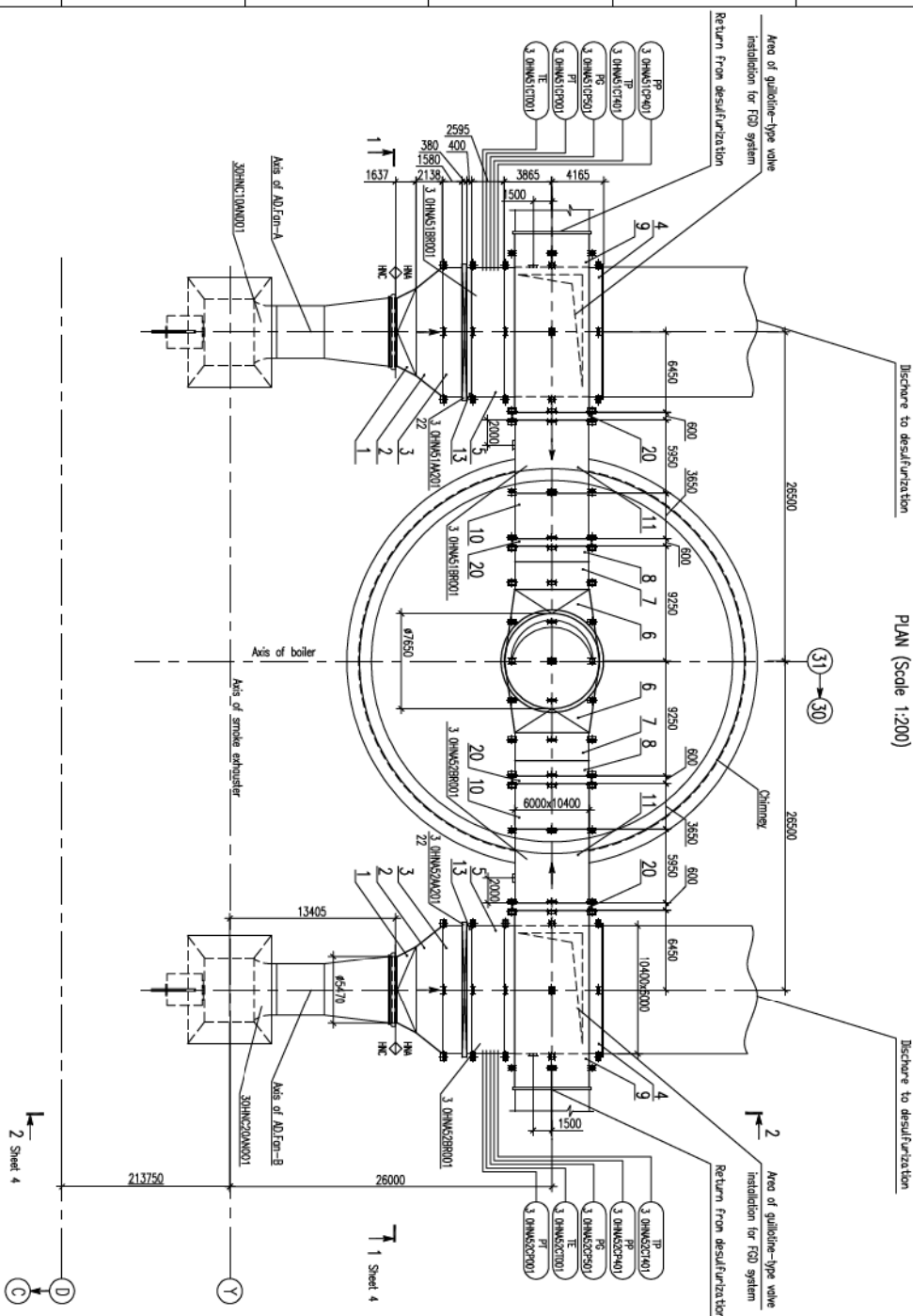
- LEGEND:**
1. ROAD (GRADE 1)
 2. ROAD (GRADE 2)
 3. ROAD (GRADE 3)
 4. ROAD (GRADE 4)
 5. ROAD (GRADE 5)
 6. ROAD (GRADE 6)
 7. ROAD (GRADE 7)
 8. ROAD (GRADE 8)
 9. ROAD (GRADE 9)
 10. ROAD (GRADE 10)

NTPC Limited
NEW DELHI

GENERAL LAYOUT PLAN

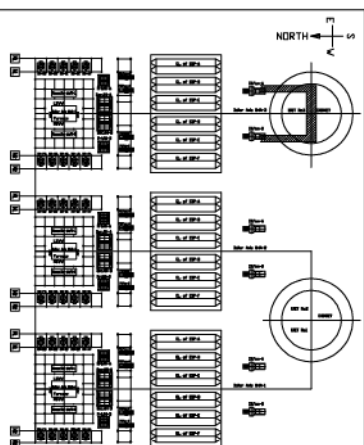
8-20

PLAN (Scale 1:200)



- Notes:
- 1 Refer general data to sheet 1.
 - 2 The floor level of the boiler bay in the area of boiler, ESPs and ID fans corresponds to 41.7200 m. Relative to 0.000 corresponds to house mill bay floor absolute at 46.7 m.
 - 3 This drawing is made on basis of P&ID diagrams BAH-0-SG-W-01-0001 (6538-102-P&W-L-002) and layout drawings BAH-0-SG-W-01-0002 (6538-102-P&W-F-002).
 - 4 This sheet is to be considered together with sheets 3, 4, 5.
 - 5 Refer Sections 1-1, 2-2 to sheet 3.
 - 6 Refer Section 3-3 to sheet 4.
 - 7 Refer Specification of details to sheet 5.

KEY PLAN



LEGEND

	Designing of duct
	Expansion joint
	Valve (gate, damper)
	Fixed support
	Guide support with guides movement specified
	Sliding support
	Boundary of designing
	Flow direction

DOCUMENT STATUS FOR INFORMATION

Rev.	Date	Description	Drawn	Check	Approved

Customer: **BAHI SUPER THERMAL POWER PROJECT (3 X 660 MW)**
MAIN PLANT PACKAGE (PART-A)
STEAM GENERATOR & AUXILIARIES

Contractor: **NTPC**
(A Government of India Enterprise)



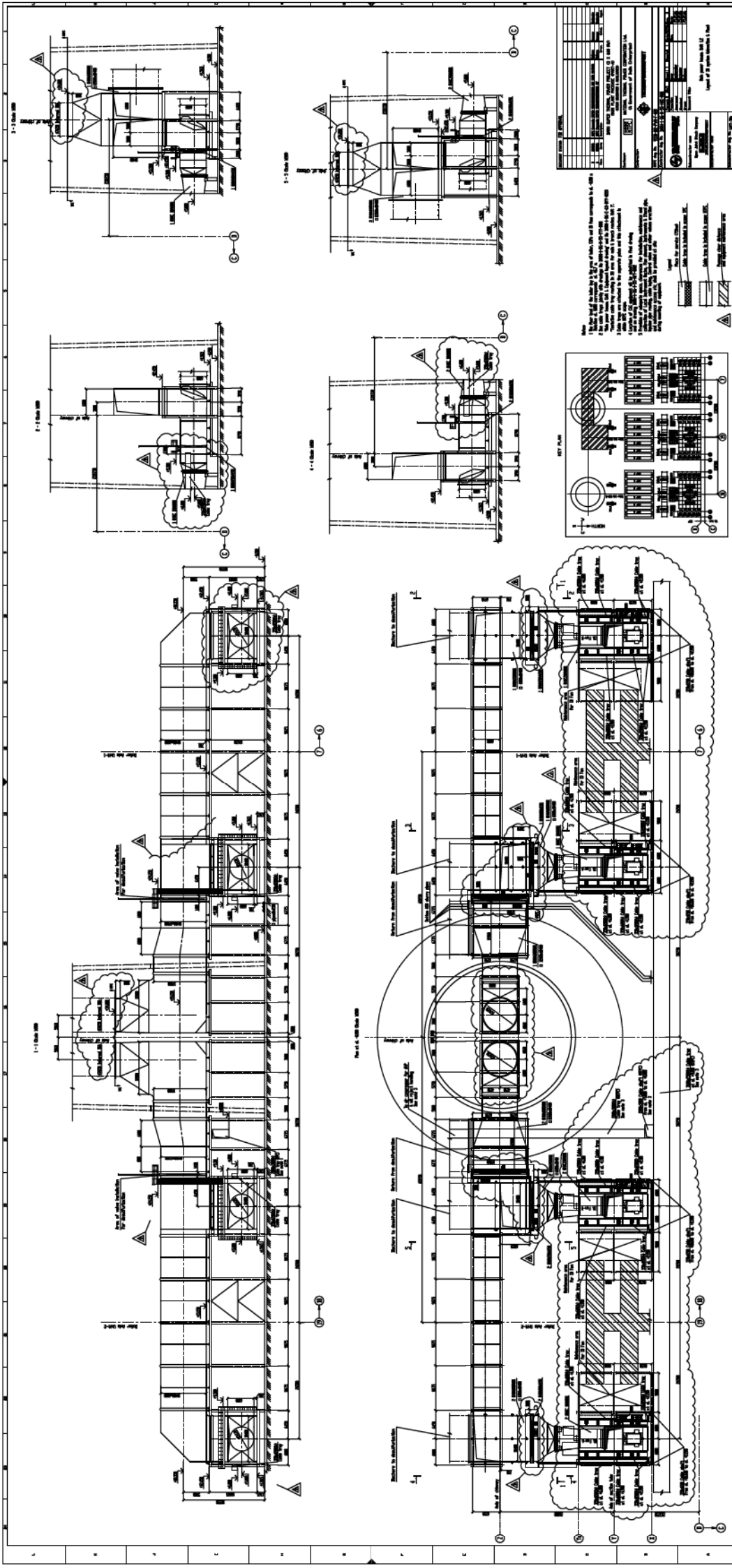
Contractor	Subcontractor	Design	Check	Approved
NTPC	BAHI-3-SG-W-01-0001			

Contractor	Subcontractor	Design	Check	Approved
NTPC	BAHI-3-SG-W-01-0001			

Contractor	Subcontractor	Design	Check	Approved
NTPC	BAHI-3-SG-W-01-0001			

Contractor	Subcontractor	Design	Check	Approved
NTPC	BAHI-3-SG-W-01-0001			

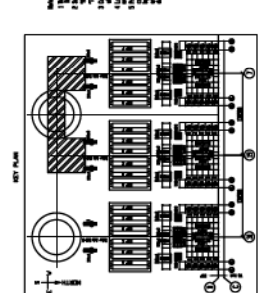
Contractor	Subcontractor	Design	Check	Approved
NTPC	BAHI-3-SG-W-01-0001			



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Date: [Blank]		Author: [Blank]	
Check: [Blank]		Approved: [Blank]	
Title: [Blank]		Notes: [Blank]	

Notes:

1. The building is a 10-story structure with a total height of 30.00m.
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9. The building is a 10-story structure with a total height of 30.00m.
10. The building is a 10-story structure with a total height of 30.00m.





Inspection and Test Plan

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

Contents

Phase	Description	Page
1	Inspection of jobsite and materials	2
2	Inspection of substrate	3
3	Inspection of surface preparation	4
4	Application of the Pennguard™ HP Epoxy Primer	5
5	Installation of the Pennguard™ Block Lining System	7
6	Final inspection	8
7	Log	8

Appendices

Protocol No. 1 : Acceptance of the steel substrate

Protocol No. 2 : Acceptance of the surface preparation

Protocol No. 3 : Acceptance of the primed surface

Protocol No. 4 : Acceptance of the lining

Daily report, Time sheet, Dust assessment

HPS1 : Application instructions

CES-150 : Installation Specification Pennguard™ HP Epoxy Primer

CE-314 : Product information Pennguard™ HP Epoxy Primer

CE-220 : Product information Pennguard™ Adhesive Membrane

CE-267 : Product information Pennguard™ Block 55

Procedure : Measuring of Dry Film Thickness (DFT) on Ferrous
Substrates

Storage instructions and shelf life

Operation and Maintenance Manual

Material Safety Data Sheets (MSDS)

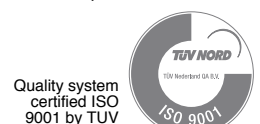
Page 1 / 9

Rev. No.	Date Revision	Document alterations	Author Date: Par.:	Authorized Date: Par.:
/	19-03-2019	Original	19-03-2019 CeV	19-03-2019 AdK

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/standard	Form of reporting	Inspection method
		Hadek	BHEL				
1	Phase 1 - Inspection of jobsite and materials						
1.1	Verify, that the installation of the Pennguard Block Lining System can take place under controlled conditions. Verify, that in case heating of the substrate is required, this is arranged in such a way, that the temperature of the substrate can be maintained for the required, substrate temperature related period after the lining is applied.	100% inspection	spot check	before start of lining project		daily report	visual
1.2	Verify, that all the equipment which is related to working at heights is installed in accordance with the safety requirements and safety standards which are applicable within the industry. Verify, that during the application of the Pennguard lining, the platform can be fixated in the centre of the chimney and, the distance between the edge of the platform and the wall can be maintained at approximately 200 mm. Verify, that the lighting is adequate.	100% inspection	witness	before start of lining project	HPS1	daily report	visual
1.3	Verify, that prior to installation, all Pennguard materials are stored according to attached "Storage instructions and shelf life".	100% inspection	witness	at arrival at site	CE-220 CE-314 CE-267	daily report	visual

Page 2 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

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Item:	Activity:	Verification by:		Inspection frequency	Reference/ standard	Form of reporting	Inspection method
		Hadek	BHEL				
1.4	Verify, that the contractor has implemented a system to control the consumption of the materials per shift and per section of the flues.	100% inspection		before installation		daily report	visual
1.5	Verify, that for mixing the membrane a Jiffler mixing tool is present.	100% inspection		before installation			
2	Phase 2 - Inspection of substrate.						
2.1	Steel substrate (all metal parts, such as carbon & alloy): Welds must be free of pinholes, undercutting, etc. Smooth ripple welds are acceptable. Weld spatter, slag and old anchor welds must be removed. Rustgrade A and B are acceptable, C is subject to agreement. Also pitting is subject to agreement.	100% inspection	witness	before blasting	ISO 8501-1: 1988 & HPS1/ CES-150	daily report	visual
2.2	Verify, that all leading edges of the Pennguard Block Lining System (e.g. at manholes, pipe stubs, expansion joints) are protected from undercutting by the gas stream through the use of properly designed "stop bars". The stop bars shall be fabricated of or protected by a corrosion resistant material. Stop bars must be installed using continuous welds.	100% inspection	witness	before blasting	HPS1	daily report	visual

Page 3 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/ standard	Form of reporting	Inspection method
		Hadek	BHEL				
2.3	Protocol 1 - Acceptance of the steel substrate -, attached hereto and incorporated herein, which applies to the specific area, will be signed by Hadek and BHEL. Note: gritblasting may uncover steel defects, which need to be addressed afterwards.					Protocol 1	
3	Phase 3 - Inspection of the surface preparation						
3.1	Examine abrasive for cleanliness and proper grade size.	spot check		after each delivery		daily report	visual
3.2	Verify cleanliness of the blasting air and the pressure developed at the nozzle.	spot check		1x daily during blasting		daily report	tissue/ MPa
3.3	Verify, that before blasting the substrate is free of oil, grease and other penetrating contaminants.	spot check		before blasting		daily report	visual
3.4	Verify, that the blast quality is in accordance with Sa 2.5 minimum for carbon steel. All metal parts, such as carbon steel and alloy steel the minimum surface profile (Rz) shall be 35 - 50 µm.	100% inspection	witness	after blasting and rough cleaning	ISO 8501-1: 1988	daily report	visual/ comparator

Page 4 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/standard	Form of reporting	Inspection method
		Hadek	BHEL				
3.5	Verify, that all abrasive and dust is carefully removed from the surface to be lined as well as from the scaffolding. Dust removal must be in accordance with class 2.	100% inspection	witness	after cleaning	ISO 8502-3: 1992	daily report	visual/ tape
3.6	Protocol 2 - Acceptance of surface preparation -, attached hereto and incorporated herein, which applies to the specific area, will be signed by Hadek and BHEL.					Protocol 2	
4	Phase 4 - Application of the Pennguard HP Epoxy Primer						
4.1	Verify and document the temperature of the substrate ($10^{\circ}\text{C} \leq T_{\text{subst.}} \leq 35^{\circ}\text{C}$), the air temperature and the Relative Humidity ($\text{R.H.} \leq 85\%$). The substrate temperature shall be at least 3°C higher than the dewpoint temperature.	100% inspection	spot check	before application	CE-314/ CES-150	daily report	DewCheck/ Elcometer
4.2	Verify and document the temperature of the Pennguard HP Epoxy Primer, $10^{\circ}\text{C} \leq T_{\text{primer}} \leq 35^{\circ}\text{C}$.			before application	CE-314/ CES-150	daily report	DewCheck/ Elcometer
4.3	Verify, that hoses, mixers and other equipment, which come into contact with the components or the mixed material are clean.	spot check		before application	CE-314/ CES-150		visual

Page 5 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/ standard	Form of reporting	Inspection method
		Hadek	BHEL				
4.4	Inspect the mixing of the Pennguard HP Epoxy Primer components and verify, that an induction time of 15 minutes is allowed for before starting the application procedure.	spot check		before application	CE-314/ CES-150		visual/ sec.
4.5	Verify, that prior to the spray application of the Pennguard HP Epoxy Primer, all welds, corners stopbars and other protuberances are being coated with a 10% diluted "stripe-coat" (paint brush only) of the Pennguard HP Epoxy Primer.	100% inspection		each application		daily report	visual
4.6	Verify, that the applicator is utilizing the right application technique. If spraying: single wet pass and 50% overlap. The wet film thickness, directly after application is between 75 and 150 µm.	spot check		each application	CE-314/ CES-150		visual/ wet film gauge
4.7	Record batch numbers of the Pennguard HP Epoxy Primer and the corresponding location.	100% inspection		each application	CE-314/ CES-150	daily report	
4.8	Verify the spray result after drying, the surface shows an even film, without holidays, drips or saggings.	100% inspection	witness	after application	CE-314/ CES-150	daily report	visual
4.9	Verify, that the DFT gauge to be used is calibrated according to the manufacturer's specifications and regularly calibrated depending on size of object, large amount of readings or gauge is dropped or readings are suspect. (Verify, that the appropriate setting is being used (ferrous or non-ferrous)).	100% inspection		before measurement		daily report	Elcometer 456T

Page 6 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/ standard	Form of reporting	Inspection method
		Hadek	BHEL				
4.10	Verify that the acceptable dry film thickness (DFT) ranges between 80% of the minimum specified DFT (38 μm) and 120% of the maximum specified DFT (75 μm) according to the Procedure; 'Measuring of Dry Film Thickness on Ferrous Substrates'.	100% inspection		after application	Procedure DFT	Elcometer 2.0 print out	Elcometer 456T
4.11	Protocol 3 - Acceptance of the primed substrate -, attached hereto and incorporated herein, which applies to the specific area, will be signed by Hadek and BHEL.					Protocol 3	
5	Phase 5 - Installation of the Pennguard Block Lining System						
5.1	Verify and document the temperature of the substrate ($10^{\circ}\text{C} \leq T_{\text{subst.}} \leq 32^{\circ}\text{C}$), the air temperature and the Relative Humidity. The substrate temperature shall be at least 3°C higher than the dewpoint temperature.	spot check	spot check	3 times each shift	CE-220	daily report	DewCheck/ Elcometer
5.2	Verify the temperature of the Pennguard Ahesive Membrane, $10^{\circ}\text{C} \leq T \leq 32^{\circ}\text{C}$.	spot check	spot check	3 times each shift	CE-220	daily report	DewCheck/ Elcometer
5.3	Verify, that mixers and tools are kept clean.	spot check		before installation			visual

Page 7 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/ standard	Form of reporting	Inspection method
		Hadek	BHEL				
5.4	Inspect the mixing method and the duration (at least 1 minute) of part A of the Pennguard Adhesive Membrane.	spot check		3 times each shift			visual/ sec.
5.5	Inspect the mixing method and duration (4 minutes at least) of components A and B of the Pennguard Adhesive Membrane	spot check		3 times each shift			visual/ sec.
5.6	Verify, that the right application technique (double buttering) is used for the Pennguard Adhesive Membrane and the Pennguard Blocks. The minimum thickness of the bed joint is 3 mm. The minimum thickness of the joints at the flue gas side is also 3 mm. All joints must be full.	100% inspection	spot check	during installation		daily report	visual/ gauge
5.7	Verify, that all blocks are well aligned, without offsets and with the joints struck smooth.	100% inspection	spot check	during installation	HPS 1		visual
5.8	Verify, that excess Pennguard Adhesive Membrane is removed from the surface of the blocks.	100% inspection	spot check	during installation	HPS 1		visual
5.9	Verify, that the Pennguard Adhesive Membrane cures well.	spot check		during installation		daily report	sample card
5.10	Record batch numbers of the Pennguard Adhesive Membrane and the Pennguard Blocks and their corresponding location.	100% inspection		each installation		daily report	

Page 8 / 9

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Inspection and Test Plan

Customer: BHEL

Ref. No.: 20191046.Pe

Revision: /

Project: Bahr I

Subject: Pennguard™ 55 - 1.5" on the interior of 2 steel flues



Item:	Activity:	Verification by:		Inspection frequency	Reference/standard	Form of reporting	Inspection method
		Hadek	BHEL				
5.11	Verify, that the Pennguard lining is free of defects and that the Pennguard Adhesive Membrane in the joints is without craters.	100% inspection	witness	after installation	HPS 1	daily report	visual
6	Phase 6 - Final inspection						
6.1	Verify, that after completion of the Pennguard lining, the lining on the total inside of the object is free from defects, mechanical damages and that the Pennguard Adhesive Membrane in the joints is without craters.	100% inspection	witness	after completion of the lining on the joints		daily report	visual
6.2	Protocol 4 - Acceptance of the lined substrate -, attached hereto and incorporated herein, which applies to the specific area, will be signed after completion of the flue by Hadek and BHEL.					Protocol 4	
7	Log						
7.1	The client will receive a final report containing all measurements taken during the surface preparation and the installation of the lining. Copies of the reports and the protocols will be handed over.					Manufacturing report	

Page 9 / 9

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Protocol 1 - Acceptance of the steel substrate

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

The undersigned declare, that the quality of the steel substrate of the internal surface of the above mentioned object is in accordance with the requirements which are described in chapter 1 of the Inspection and Test Plan.

This Protocol is subject to the terms and the conditions of the Inspection and Test Plan in its entirety.

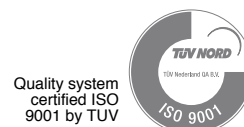
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Hadek Protective Systems b.v.		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Protocol 1 - Acceptance of the steel substrate

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

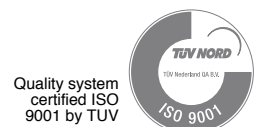
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Page 2 / 2

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Hadek Protective Systems b.v.		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Protocol 2 - Acceptance of the surface preparation

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

The undersigned declare, that the quality of the surface preparation of the steel substrate of the internal surface of the above mentioned object is in accordance with the requirements which are described in chapter 3 of the Inspection and Test Plan.

This Protocol is subject to the terms and the conditions of the Inspection and Test Plan in its entirety.

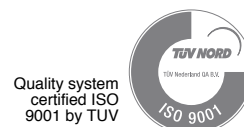
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Hadek Protective Systems b.v.		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Protocol 2 - Acceptance of the surface preparation

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

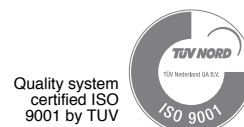
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Hadek Protective Systems b.v.		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Protocol 3 - Acceptance of the primed surface

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

The undersigned declare, that the quality of the primed surface of the internal surface of the above mentioned object is in accordance with the requirements which are described in chapter 4 of the Inspection and Test Plan.

This Protocol is subject to the terms and the conditions of the Inspection and Test Plan in its entirety.

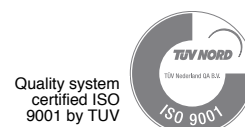
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Page 1 / 2

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Hadek Protective Systems b.v.		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Protocol 3 - Acceptance of the primed surface

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

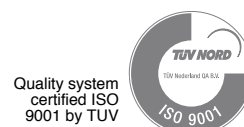
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Page 2 / 2

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Hadek Protective Systems b.v.		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Protocol 4 - Acceptance of the lining

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

The undersigned declare, that the quality of the lining on the internal surface of the above mentioned object is in accordance with the requirements which are described in chapter 5 & 6 of the Inspection and Test Plan.

This Protocol is subject to the terms and the conditions of the Inspection and Test Plan in its entirety.

Remarks:

Any and all damages caused to the Pennguard™ Block Lining System after inspection are excluded from this Protocol.

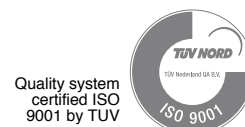
No hotworks should be done on the flue after installation of the Pennguard™ Block Lining System.

Page 1 / 2

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Hadek Protective Systems b.v.	BHEL	
Place:	Place:	
Date:	Date:	
Signature:	Signature:	

Protocol 4 - Acceptance of the lining

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

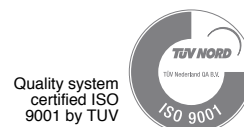
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Page 2 / 2

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Quality system
certified ISO
9001 by TUV

Hadek Protective Systems b.v.	BHEL	
Place:	Place:	
Date:	Date:	
Signature:	Signature:	

HADEK
PROTECTING POWER PLANT CHIMNEY

Subject : Pennguard™ 55 - 1.5" on the interior of 2 steel flues

Revision : /

Object:		Report No.:	
Object ID:		Insp. date:	
Lining system:	Pennguard™ Block Lining System	Supervisor:	
	55 - 1.5" / Penng.™ HP Epoxy Pri.		
Surface prep.:	Abrasive blasting to Sa 2.5	Client rep.:	
	Roughness 15-25µm		

Time	Ambient ° C	R.H. %	Substrate ° C	Dew point ° C	Outside ° C	Adhesive ° C	Primer ° C
Weather:							

[illegible]

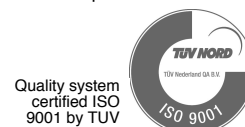
Batch No.:	
Consumption:	
DewCheck / Elcometer:	

Hadek Protective Systems		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

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Daily report

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

Object:		Report No.:	
Object ID:		Insp. date:	
Lining system:	Pennguard™ Block Lining System	Supervisor:	
	55 - 1.5" / Penng.™ HP Epoxy Pri.		
Surface prep.:	Abrasive blasting to Sa 2.5	Client rep.:	
	Roughness 15-25µm		

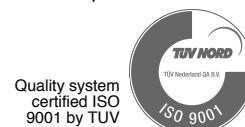
Observations:

Page 2 / 2

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Hadek Protective Systems		BHEL	
Place:		Place:	
Date:		Date:	
Signature:		Signature:	

Time sheet



Customer:	BHEL	Name Quality Inspector:	
Project:	Bahr I	First entry on site:	
Customer representative:		Project No.:	20191046.Pe

month	working hours (including breaks)		working hours (excluding breaks)	description of the executed work	initials q.inspector	initials customer
	year	from	till			
1						
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Realised by (name, date and signature):	Approved by (name, date and signature):
Hadek	Customer

Hadek Protective Systems b.v.

World Trade Center Rotterdam, P.O.Box 30139, NL-3001 DC Rotterdam, Tel. +31 (0)10 - 405 1461 - Telefax +31 (0)10 - 405 5011

Dust assessment in accordance with ISO 8502-3

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

Name : _____ Date : _____

Company : _____ Time : _____

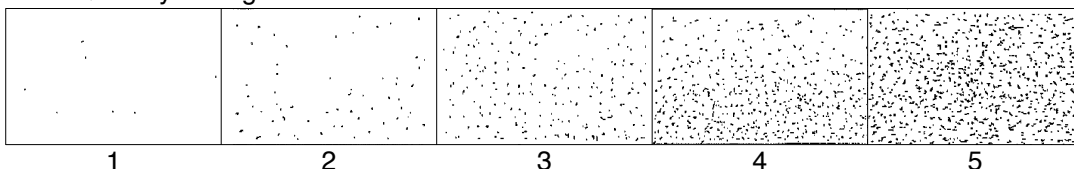
Location : _____

Dust Quantity Rating (Mean)

Test 1	
Test 2	
Test 3	
Test 4	
Test 5	

Dust Quantity Rating

Page 1 / 1



Surface identification : _____

Substrate backing used : _____

Nature of surface tested : _____

Adhesive tape used : _____

Hadek Protective Systems b.v.
P.O.Box 30139
3001 DC Rotterdam
The Netherlands

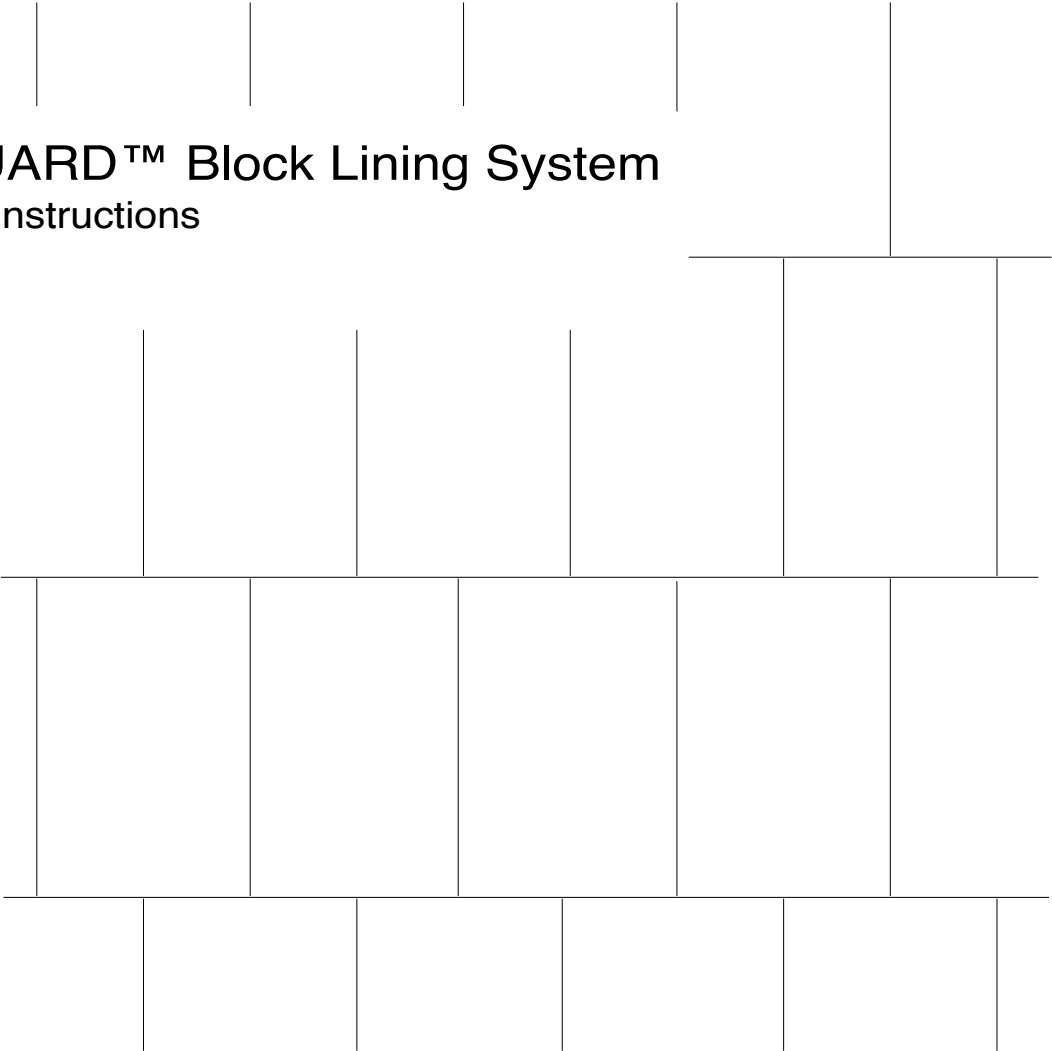
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Internet: http://www.hadek.com



PENNGUARD™ Block Lining System

Application instructions



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Application info	Pennguard™ Block Lining System	
HPS 1	Application instructions	Page 1 of 10
		Revision 16
NOTE: The PENNGUARD Block Lining System is a sophisticated lining and should only be installed by industrial contractors familiar with industrial lining practices.		
1. Scope / Use area 1.1 This specification covers the recommended installation, quality control, and inspection guidance for the successful installation of the Pennguard Block Lining System on metal, concrete, brick, and FRP surfaces. 1.2 At coal burning power plants, the Pennguard Block Lining System is used to protect carbon steel liners, breechings, heat recovery equipment, and inlet/outlet duct work of wet FGD scrubbers from condensate permeation and acid corrosion. It is used in flue gas conveying equipment such as stacks and ductwork serving the power, chemical, metallurgical, petrochemical, pulp & paper and municipal waste incineration/sludge burning industries, to protect the substrate structures from acid corrosion. 1.3 FRP-constructed stacks, ducts, and other equipment, when lined with the Pennguard Block Lining System, can operate at higher temperatures due to the insulation characteristics of this lining system. 1.4 The Pennguard Block Lining System offers an acid corrosion resistant, light-weight, highly insulative lining for steel and concrete tanks and vessels including the covers of molten sulfur pits, acid pickling tanks, and acid storage tanks. 1.5 The Pennguard Block Lining System may be used as a chemical resistant backup to refractories and chemically resistant masonry/monolithic linings in such areas as hot gas inlets to chemical vessels, petrochemical heaters and furnaces. 2. General 2.1 This specification is organized to first cover steps that are the same independent of the substrate type or design. The later sections provide information specific to a particular substrate design or component. 2.2 The Pennguard Block Lining System can be applied to many different surfaces. The system has been used successfully in power plant applications in flue gas ducts and chimneys that are constructed of many types of materials with varying designs. 2.3 Care in handling and storage of Pennguard Block must be followed since it is a glass material. The Block pieces are glass, and therefore can be susceptible to damage if care is not taken to prevent such damage during handling and installation. 2.4 The lining system when properly installed and cured is quite strong. However, excessive particulate loading, gas velocities exceeding 24-30 m/s per second and potential for mechanical damage during routine outages and inspections, must be designed for. Consult Hadek for specific applications if any doubt exists as to concerns. Although high velocities are not typically a problem when the lining is installed in a direction the same as the gas flow, areas such as turning vanes and sharp changes of direction may require special treatment. Also, note details in section 16.2.2 of this specification for specific concerns in some horizontal floor applications. 2.5 When construction and maintenance activities will take place near or on a lined surface, efforts shall be made to cover the surface to prevent mechanical damage.		

Application info	Pennguard™ Block Lining System	HADEK PROTECTING POWER PLANT CHIMNEYS
HPS 1	Application instructions	Page 2 of 10 Revision 16
Areas of known risk of mechanical damage such as near routine maintenance activities should be covered with a permanent layer to prevent damage to the liner. Coverings such as Tufchem Silicate Gunite, Tufchem Silicate Concrete Foundation Grade or Tufchem Silicate Concrete Trowel Grade have been used effectively for such areas. 2.6 When appropriate, the following sign shall be posted on the exterior of the structure during and after lining application. "Lined equipment, no welding or burning". 2.7 Do not impale the installed Pennguard Block Lining System with welding rods or other sharp or pointed devices as a convenient way to hang cords or wires for temporary lighting during outages or other maintenance activities. 3. Equipment / supplies 3.1 Heavy duty variable speed drills, having 16-18 mm chucks with sufficient torque to deliver a minimum speed of 230 rpm under load. For mixing, Hadek recommends the use of a Jiffler mix blade - Model DC312 with 2 x 165 mm propeller blades to mix the Adhesive Membrane. Blades shall be set with dimensions of 125 mm from the base of the bottom of the blade (sitting on a flat surface) to the top of the ferrule on the top blade. Jiffler mix blades with preset and welded propeller blades are available from Hadek.  Use of other mixing equipment may adversely affect mix results and product performance. Use of any other equipment shall only be authorized following consultation and written approval of Hadek. 3.2 Insulation saws and rasps, to cut and sculpt the Pennguard Block. 3.3 Masons' trowels of appropriate size to apply the Pennguard Adhesive Membrane. 3.4 Lanolin based waterless hand cleaner (for example: Boraxo or Go-Jo). 3.5 100 mm wide stiff bristled paint brushes, paper coveralls, Playtex dishwashing gloves, rags, wire brushes. 3.6 Use mineral spirits for cleaning and soaking trowels, etc., for loosening cured Pennguard™ Adhesive Membrane. 3.7 Set of installation specifications, and latest product information sheets for all lining materials of construction. 3.8 Sling psychrometer or dewpoint meter, calibrated electronic temperature meter, lights, surface thermometers, white (non-wax) marking chalk or white spray paint. 4. Temperatures 4.1 The product and substrate temperatures are critical. In cold winter conditions it is recommended that the product storage and construction area be heated to achieve and maintain the temperatures identified in sections 4.2 and 4.3. The heat source chosen shall not result in deposits on the surfaces to be coated.		

Application info	Pennguard™ Block Lining System	
HPS 1	Application instructions	Page 3 of 10 Revision 16
4.2 At the time of mixing and application the temperature of the component should be approximately 21°C. 4.3 The temperature of the prepared surface shall be at least 3°C above the moisture dew point and at a temperature between 10°C and 32°C at the time the Pennguard Block Lining System is applied. 4.4 Be aware of the temperature of the substrate to be sure that the Pennguard Adhesive Membrane does not set up too quickly and, hence, lose its wet tack. When properly mixed and applied Pennguard Adhesive Membrane will remain tacky for approximately four (4) hours at an ambient air temperature and substrate temperature of 21°C and no more than one hour at 32°C. Wet tack is if Membrane comes off onto the finger when touched. 4.5 Weather protection of the work site is necessary. The prepared substrate must be protected from the elements until the lining work is completed. 4.6 In addition to protecting the work area from the elements, the cartons of Pennguard Block and containers of Pennguard Adhesive Membrane and Primer, shall also be protected. 5. Mixing 5.1 Remove the lid from the Pennguard Adhesive Membrane can. Inspect for damage incurred during transit. 5.2 Insure that there are no leaks in the Component B container and that there is no water present on or in Component A. 5.2 Utilizing a drill, delivering sufficient torque to achieve a shaft rotation of a minimum 230 rpm, and the proper mixer blade as specified in section 3.1, premix Component A by itself for a minimum of one minute. If temperatures are below 18°C, mix component A for a minimum of 2 minutes. 5.2.1 A good manual mixing technique involves movement of the rotating blade within the pail. Move the blade around the base of the pail in a circular motion and also lift the blade from the base of the pail without bringing the blade above the surface of the compound and continue the circular motion around the side of the pail. During mixing also hold the mix blade occasionally at a 30 to 45 degree angle within the mixture, to insure all contents of the pail are thoroughly mixed, paying close attention to contact all surfaces of the sides of the pail with the mix blade. 5.2.2 Automated mixing machines specifically designed for this purpose can also be used to mix Pennguard Adhesive Membrane. Consult Hadek Protective Systems for more details. 5.3 Open Component B. Continue to mix Component A at the recommended speed. Begin pouring Component B into the vortex created by the mixer in Component A. Total elapsed time for the addition of the component B should be 15 to 20 seconds while mixing. 5.4 When the material temperature is 18°C or higher, mix for at least 3 minutes using a good mixing technique to yield an uniform mix. When the temperature of the components is 18°C or below, mix for at least 5 minutes using a good mixing technique to yield an uniform mix. 5.5 The Pennguard Adhesive Membrane is a thixotrope i.e. - it will thicken if allowed to sit after the components have been mixed together. Material is generally ready for use immediately after mixing.		

Application info	Pennguard™ Block Lining System	
HPS 1	Application instructions	Page 4 of 10
		Revision 16
5.6 Never allow moisture or other contaminants to come in contact with either membrane component or the wet mix. 5.7 Improper mix techniques and/or use of mixing equipment other than recommended in section 3.1 may adversely affect mix results and products performance. Use of any other equipment or mixing techniques shall only be authorized following consultation with and written approval of Hadek. Note carefully sections 5.2.1 and 5.2.2. 6. Installation 6.1 Before applying Block, the contractor shall check the flatness of the prepared substrate in any area which visually may indicate a seating problem. This shall be performed by taking a straight edge of the specified size of the Block to be installed and placing it dry against the prepared surface in an orientation similar to that which will be followed in the installation. If there are any gaps between the substrate and the back of the block greater than 3 mm or if the block does not sit firm against the surface, but rocks on a high point, properly mark the area. Either remove the imperfection in the substrate or cut the standard size block being used which, in turn, will minimize the effect of the substrate variation and allow a full bond of the block to the substrate surface using the Pennguard Adhesive Membrane. A comparable check shall also be applicable to lining curved surfaces. 6.2 Trowel apply a minimum 1.5 mm thickness of Pennguard Adhesive Membrane onto the substrate with a suitable trowel carrying the coverage to approximately 50 mm beyond the area the Pennguard Block will cover when it is placed in position. The size of the area to which the Pennguard Adhesive Membrane is applied at any one time shall be no greater than will allow the area to be lined with the Pennguard Block before the Pennguard Adhesive Membrane on the substrate loses its tackiness. Do not trowel to less than 1.5 mm thickness. The substrate must be fully lined. 6.3 Trowel a minimum of 1.5 mm thickness of the Pennguard Adhesive Membrane onto the back, and all sides of the Pennguard Block to be installed. In positioning the Pennguard Block against the Adhesive applied to the substrate surface, move the block back and forth at least 50 mm a couple of times as it is being slid into place against the adjacent block so as to remove voids between the block and the surface. Be sure to maintain a minimum of 3 mm thickness block to block, and block to substrate. Pennguard Adhesive Membrane shall totally fill side joints, and shall be seen to 'bead' along edges. Strike clean the surfaces of joints of Pennguard Adhesive Membrane squeezed out during placement of the block. Listen for the sound of block scraping against Block or the substrate. This is a sure indication of insufficiently filled side joints. 6.4 In placing successive Pennguard Blocks, it is acceptable to leave one or more sides without Pennguard Adhesive Membrane and subsequently apply the Adhesive Membrane to these sides when they are on the substrate prior to placing the next block up against this block edge. The intent is to utilize a double buttering technique. No block surface is to be put into final position without Adhesive Membrane applied with a trowel on that surface first. 6.5 It is very important that the Pennguard Block, coated with Pennguard Adhesive Membrane, has full contact with the Adhesive Membrane applied to the substrate surface, whether it be flat floors, side walls, overhead areas, curved		

Application info	Pennguard™ Block Lining System	
HPS 1	Application instructions	Page 5 of 10 Revision 16
surfaces, nozzles, etc. No voids shall be left between the block and the substrate. Cut the block and create an extra joint when necessary and/or increase thickness of the Pennguard Adhesive Membrane back joint. Side and back joints must be full joints, and shall not be less than 3 mm thick. 6.6 Installer shall exhibit care in the handling and placement of the blocks so as to minimize the presence of excess Adhesive Membrane on the face of the block. Side joints shall be struck clean after installation, with attention to removing excess material from the face of the block. Before moving to a new work area or at appropriate times such as shift changes or scaffold/platform movements, inspectors shall thoroughly inspect surface to detect presence of any excess Adhesive and direct that it is to be removed promptly. 6.7 If the applied Pennguard Adhesive Membrane is still tacky to the degree that when touched it blackens a gloved finger, additional Adhesive Membrane can be applied over it, to continue installing Pennguard Block. If however it has cured to the point of not staining a glove when touched, it must be removed. This can be accomplished by using scrapers to remove as much remaining Pennguard Adhesive Membrane as practical. Use care to confirm scraping does not damage the block. This procedure is critical since wet Pennguard Adhesive Membrane will not bond well to cured Pennguard Adhesive Membrane. 6.8 As noted in section 6.7, wet Pennguard Adhesive Membrane does not bond well to cured Pennguard Adhesive Membrane. The gloved finger tack test outlined in section 6.7 should be utilized to determine if work can carry on after a work stoppage without further treatment. Cured Adhesive Membrane that does not pass the gloved finger wet tack test must be abraded to roughen the surface and remove surface gloss. Dry remnants of cured Pennguard Adhesive Membrane remaining on a block surface at the end of a shift shall be dealt with by cutting back the block surface to expose a clean cell structure on the leading edge of the block. 6.9 When work stoppage is anticipated, remove as much of the Pennguard Adhesive Membrane as practical from the substrate and edges of the completed lining that will have additional lining when the stoppage ends. 6.10 Do not install blocks that are cracked, have gouges, or other imperfections in them. Also, do not install blocks with cracked corners, etc. 6.11 Staggered or broken bond construction is recommended to minimize four corners meeting and the possibility of a corner void. Running bond may be more desirable for gas flow purposes. Contact Hadek if this is a concern. 6.12 If partial Blocks are used, the minimum size shall be a one third piece of block. If the remaining gap is less than a half block, adjust the dimension of the final two blocks. 7. Abrasion resistant topcoat 7.1 Contact Hadek for details on specifying additional topcoats on the Block for abrasive service. 8. Stop bars 8.1 The Pennguard Block Lining System should not be finished to a free edge. It is recommended to install proper retaining (stopper) angles or flat bars to ensure		

Application info	Pennguard™ Block Lining System	
HPS 1	Application instructions	Page 6 of 10 Revision 16
proper installation. The height of the stopper should be the full lining thickness. The stop bar shall be of an alloy grade suitable for the anticipated service. Stop bars should be used if the Pennguard Block Lining System is to be installed immediate to man way openings, expansion joints, dampers, pipe stubs, sample ports, gunites, or castable linings. 9. Curing 9.1 Intended operating service conditions of the lined component may contribute to the cure of the system. 9.2 In general the lining may be placed into service after curing for 2 days at 32°C or for 72 hours at 21°C, or for 7 days at 10°C. 9.3 Pennguard Adhesive Membrane cures by chemical reaction. At a curing temperature of 21°C, the applied Pennguard Adhesive Membrane will develop full strength at 14 days at 21°C. 9.4 Contact Hadek for special cure schedules if down time does not allow sufficient curing of the lining as outlined in section 9.2 above. 9.5 Consult Hadek if initial start up temperatures may exceed 120°C. 10. Inspection / Qualification 10.1 The mixing, curing, and adhesion characteristics of Pennguard Adhesive Membrane shall be evaluated by applying it onto a test area of the same material and surface preparation of the production substrate. Work life and initial set time may be visually observed. Work life is the maximum time the Pennguard Adhesive Membrane remains trowelable. Initial set time is defined as the time between mixing Pennguard Adhesive Membrane and when it begins to exhibit cohesiveness, i.e. the time when the surface of the Pennguard Adhesive Membrane is no longer wet to the touch. Cure must be uniform. 10.2 The installation procedure of the lining system shall be verified by using Cure Verification Cards as supplied for the project. Cards should be retained throughout the duration of the project to insure cure of all applied batches. 10.3 Inspectors shall determine the frequency of random site checks to determine back joints have complete contact by pulling random Blocks while the Adhesive Membrane is still wet and visually verifying the back joint and side joints are completely full. 11. Records 11.1 Cure Verification Cards as outlined in section 10.2 should be retained throughout the duration of the project to insure cure of all applied batches. 11.2 Inspector shall sketch areas lined and which he inspected, and note his observations. 11.3 A photographic history of surface preparation, primer application, Adhesive Membrane application, and block installation is suggested. 12. Repair of mechanically damaged areas 12.1 Experience indicates that repair of an area smaller than a standard size block requires more effort than a larger area. 12.2 Cut out a minimum of a full block down to membrane on substrate. Remove remaining membrane on substrate as best as possible to expose underlying		

Application info	Pennguard™ Block Lining System		
HPS 1	Application instructions		Page 7 of 10
			Revision 16
substrate. Clean the Pennguard Adhesive Membrane per Section 6.8 and 6.9. Install block(s) per Section 6.2 and 6.3. 13. Specific substrate - metal, carbon steel, stainless steel, nickel alloys 13.1 Surface Preparation 13.1.1 All welds shall be continuous. Intermittent or spot welding shall not be permitted. 13.1.2 All weld spatter slag and old anchor welds shall be removed from the substrate, and the area ground flush with the parent metal. 13.1.3 Gross pinholes, pits, blind holes, porosity, undercutting, or similar depressions should not exist in the finished surface of the weld before or after blast cleaning. 13.1.4 All edges and fillets and similar abrupt contours shall be rounded off smoothly by grinding or machining. A 3 mm radius is preferable. Smooth ripple finished welds are acceptable. 13.1.5 Plates welded together shall be properly aligned; butt welded joints are preferred. 13.1.6 Lap welded joints should be avoided wherever possible. If lap-welded joints are used, they must be fully welded on the inside. 13.1.7 All connections to the equipment being lined shall be flanged. 13.1.8 Structural reinforcement members should be installed on the vessel exterior, if possible. However, if such members are installed internally, they should be fabricated of simple shapes such as smooth round bars or pipe for ease of applying the lining material. The use of angles, channels, I-beams, and other complex shapes should be avoided. If they must be installed internally, these members shall be fully seal welded and edges ground. 13.2 Surface Cleaning 13.2.1 Unless otherwise specified in writing by Hadek, a near white metal blast finish (as specified by most current revisions of ISO 8501-1 or SA 2.5) is required for preparing carbon steel surfaces to receive the lining. 13.3 Primer for carbon steel substrates - Pennguard HP Epoxy Primer 13.3.1 To prohibit the formation of re-rusting after blasting and rust bloom, carbon steel should be primed with Pennguard HP Epoxy Primer data sheet CE-314. 13.3.2 Mix and apply Pennguard HP Epoxy Primer in accordance with Hadek's specification CES-150. 13.4 For high nickel alloy and stainless steel substrates, consult Hadek Protective Systems to discuss specific project details. 13.5 The primer must dry hard before application of the Pennguard Block is allowed to begin.			

Application info	Pennguard™ Block Lining System	HADEK PROTECTING POWER PLANT CHIMNEYS
HPS 1	Application instructions	Page 8 of 10 Revision 16
14. Specific Substrate - Concrete & brick substrates 14.1 Surface Preparation 14.1.1 The surface condition of new and/or existing concrete and brick liners can vary greatly. The surface should be thoroughly inspected to identify the condition and suitability of the surface to accept the Pennguard Block Lining System. An assessment and evaluation of the suitability of the surface and the unique circumstances found for the specific concrete or brick lining should precede quotations, procurement, or mobilization of installation crews. Any buildup, deposits, carry over, or mortar on concrete or brick faces must be removed. 14.1.2 When forms have been used for placing the concrete, they should be designed so as to yield a smooth continuous concrete surface to which the lining will be applied. See also section 14.1.6. 14.1.3 Concrete floors should have a single pass trowelled finish with special care being taken to avoid bringing laitance to the surface. 14.1.4 New concrete shall reach a minimum compressive strength of 20 MPa and a surface tensile strength of 2.0 MPa before the lining is applied. Curing compounds must either be removed or tested for compatibility before proceeding. 14.1.5 Before acceptance for lining, all form marks and protrusions, such as prominent aggregate exposure, tie wires, reinforcing wire, stirrups, etc. must be cut off and ground flush with the surface. 14.1.6 All cavities, stone pockets, honeycombing, and bug holes greater than 6 mm depth shall be filled by repairing with appropriate materials. 14.1.7 Damage to the existing structure such as cracks or other structural damage is to be suitably repaired prior to the application of the Pennguard Block Lining System. 14.1.8 Existing concrete surfaces to be lined with the Pennguard Block Lining System shall be tested for suitable strength and verified to be structurally sound. 14.1.9 For installations onto brick liners, if the offset between adjacent bricks is greater than 3 mm, the nature and size of the surface irregularity will dictate the action to properly prepare the surface. For a corbeled area where individual brick courses are intentionally offset consult Hadek Protective Systems for specific details. 14.1.10 If mortar joints exist in brick substrates that are not completely filled, but brickwork is structurally sound and joints are not greater than 6 mm then Pennguard Adhesive Membrane can be used to fill those areas. Joints wider than 6 mm shall be appropriately addressed before proceeding. 14.1.11 Attachments to the brick substrate (i.e. liquid condensate collection (LC) systems and stop-bars) shall be installed without leaving any gaps in between the brick substrate and the attachment to be installed. A cementitious mortar shall be used to level the area behind attachments prior to final installation of such attachments. The leveled area behind LC systems shall have a vertical dimension greater than the width of the condensate collection plate to be bolted to the substrate.		

Application info	Pennguard™ Block Lining System	
HPS 1	Application instructions	Page 9 of 10
		Revision 16
14.2 Surface Cleaning 14.2.1 A brick liner surface to which the lining is to be applied shall be suitably high pressure water cleaned and abrasive blasted in order to clean the brick faces and mortar to provide a sound hard clean surface. Contaminants must be removed and the surface shall be pH neutral. Consult ASTM D4258 and D4262. The intent is to remove sufficient material to achieve a sound surface free of contaminants. 14.2.2 A concrete surface to which the lining is to be applied shall generally be prepared in accordance with ASTM D4259 (most current revision) Abrading Concrete”. The surface shall have a non-glazed appearance. The intent is to remove sufficient material in order to achieve a sound concrete surface free of laitance, glaze, efflorescence, and incompatible concrete curing agents or form release agents. 14.2.3 All surfaces must be dust, dirt, and grease-free. Any foreign material which will interfere with adhesion must be removed. All abrasives and dust must be removed from the substrate in accordance with the most recent revision of ISO 8502-3 prior to priming. The use of a power vacuum is recommended. 14.3 Primer for Concrete and Brick Substrates 14.3.1 Penntrowel Epoxy Primer is the recommended primer for all concrete and brick liner surfaces. It serves to seal and promote adhesion of Pennguard Adhesive Membrane. Consult Product Data Sheet CE-139 for complete product details. 15. Specific substrate - FRP substrate 15.1 Surface Preparation 15.1.1 Avoid or remove wax on surfaces to be lined. This may require grinding or sanding with a suitable grinding disc until a whitish surface has been achieved. Do not aggressively grind surface so as not to alter the surface profile. All remnants of dust from grinding or sanding shall be removed. 15.1.2 All edges and fillets and similar abrupt contours shall be rounded off smoothly by appropriate means. A 3 mm radius is preferable. 15.1.3 Panels joined together shall be properly aligned. Butt joints are preferred. 15.1.4 Lap joints should be avoided wherever possible. If lap joints are used, then they must be fully joined and sealed on the inside. 15.1.5 All connections to the equipment being lined shall be flanged. 15.2 Surface Cleaning 15.2.1 All surfaces must be dust, dirt, and free of grease. Any foreign material which will interfere with adhesion must be removed. Wax is sometimes found on the surface of FRP structures (used in fabrication process); this will need to be removed. 15.3 Primer for FRP 15.3.1 Primer for FRP is not normally required, check with Hadek for specific project requirements.		

Application info	Pennguard™ Block Lining System	HADEK PROTECTING POWER PLANT CHIMNEYS
HPS 1	Application instructions	Page 10 of 10
		Revision 16

16. Insulation and floor protection

16.1 Insulation

16.1.1 There is to be no external insulation on the structure being lined with Pennguard Block and Adhesive Membrane unless specifically authorized in writing by Hadek Protective Systems.

16.1.2 Thermal gradient calculations are to be performed to provide sufficient thickness of block material to maintain the temperature of the membrane substrate interface below the recommended levels.

16.2 Floors

16.2.1 Designs of horizontal ducting and chimney floors shall incorporate a sufficient number and size of drains so as to insure condensate is removed and that drains do not plug.

16.2.2 Pennguard Block installed in areas such as horizontal ductwork may be subjected to mechanical damage caused by maintenance procedures such as removal of fly ash carry over. If this type of condition is anticipated,

the floor area to be lined with the Pennguard Block Lining System may have a further protective layer installed over top of the Pennguard Block Lining System such as Tufchem Silicate Concrete to minimize mechanical damage. Contact Hadek Protective Systems for details.

17 Applicable material data sheets

17.1 Materials mentioned in this specification as part of, or associated with the Pennguard System. Please refer to or request the specific product information for further details.

Product name	Data sheet No.
Pennguard 55 Block	CE-267
Pennguard Adhesive Membrane	CE-220
Pennguard HP Epoxy Primer	CE-314
Pennguard Block Primer	CE-227
Penntrowel Epoxy Primer	CE-139
Tufchem Silicate Concrete FG	CE-252
Tufchem Silicate Concrete TG	CE-257

Safety precautions / Disclaimer

Mixes and applications of this product present a number of hazards. Read and follow the hazard information, precautions and first aid directions on the individual product labels and material safety data sheets before using. While all statements, technical information, and recommendations contained herein are based on information our company believes to be reliable, nothing contained herein shall constitute any warranty, express or implied, with respect to the products and/or services described herein and any such warranties are expressly disclaimed. We recommend that the prospective purchaser or user independently determine the suitability of our product(s) for their intended use. No statement, information or recommendation with respect to our products, whether contained herein or otherwise communicated, shall be legally binding upon us unless expressly set forth in a written agreement between us and the purchaser/user.

PENNGUARD™ HP Epoxy Primer
Installation specification

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Hadek Protective Systems b.v.

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Installation info	Pennguard™ HP Epoxy Primer	
CES-150	Installation specification	Page 1 of 4
		Revision 5
1. Scope 1.1 This specification shall cover the following materials: PENNGUARD HP Epoxy Primer as outlined on the most current version of data sheet CE-314. 1.2 Pennguard HP Epoxy Primer is an industrial lining system most typically used as one of the components of the Pennguard Block Lining System. Consult Hdek's document HPS-1 covering the installation of the Pennguard Block Lining System for further details on the installation of the other components of the system. 2. Surface preparation 2.1 All welds shall be continuous. Intermittent or spot welding shall not be permitted. 2.2 All weld spatter, slag and old anchor welds shall be removed from the substrate, and the area ground flush with the parent metal. 2.3 Gross pinholes, pits, blind holes, porosity, undercutting, or similar depressions should not exist in the finished surface of the weld before or after blast cleaning. 2.4 All edges and fillets and similar abrupt contours shall be rounded off smoothly by grinding or machining. A 3 mm radius is preferable. Smooth ripple finished welds are acceptable. 2.5 Plates welded together shall be properly aligned; butt welded joints are preferred. 2.6 Lap welded joints should be avoided wherever possible. If lap-welded joints are used, they must be fully welded on the inside. 2.7 All connections to the equipment being lined shall be flanged. 2.8 Structural reinforcement members should be installed on the substrate exterior, if possible. However, if such members are installed internally, they should be fabricated of simple shapes such as smooth round bars or pipe for ease of applying the lining material. The use of angles, channels, I-beams, and other complex shapes should be avoided. If they must be installed internally, these members shall be fully seal welded and edges ground. 2.9 Unless otherwise specified in writing by HADEK or its representative, a near-white metal finish (as specified by most current revisions of, ISO 8501-1 or SA 2.5) is required for preparing carbon steel surfaces to receive the lining. The resultant surface profile after grit blasting to achieve the near-white finish typically falls in the range of 38-50 µm, but this is not a hard and fast specification requirement. Variability with the size, shape, and composition of available local blast media may result in the achievement of the required cleanliness standard, while simultaneously producing a blast profile that may fall outside of this range. 2.10 New stainless steel, titanium, and nickel alloys (metal surfaces) must be abrasive blast cleaned to achieve a minimum profile of 35 µm and to remove any oxidation layer. Deteriorated, pitted, corroded stainless and nickel alloys must be cleaned and prepared to a sound base. All surfaces must be dust, dirt, and grease free. Any foreign material which will interfere with adhesion must be removed. 2.11 All abrasives and dust must be removed from the substrate in accordance with the most recent revision of ISO 8502-3 prior to priming. The use of a power vacuum is recommended.		

Installation info	Pennguard™ HP Epoxy Primer	HADEK PROTECTING POWER PLANT CHIMNEYS
CES-150	Installation specification	Page 2 of 4
		Revision 5
3. Mixing instructions 3.1 Mixing instructions: Pennguard HP Epoxy Primer is mixed in a normal ratio of 4.0 Parts "A" to 1.0 Part "B". It is packaged in pre measured containers. The Part "A" component is packaged in a 1.0 gallon pail and the "B" component is packaged in a separate smaller container for optimized shipping purposes. Both components should be emptied into a separate larger mixing vessel. 3.2 Thoroughly mix the contents of the Part "A" component to reconstitute any solids that may have settled during shipping and storage. Thoroughly mix the contents of the Part "B" component. 3.3 Pour the entire contents of the Part "A" container into the separate mixing container. Add the Part "B" component. Thoroughly mix the combined Part A/B mixture. 3.4 Allow mixed material to stand for an induction period of 15 minutes. 3.5 Thoroughly re-stir the mixture before starting application. 3.6 The primer has a pot-life of 4 - 6 hours at 24°C. Mix only enough primer that can be used during this period. 3.7 Spray application is preferred, although brush or roller application is acceptable. When installing by brush, use a nylon/ polyester or natural bristle. When applying by roller, use a 9.0 mm woven roller with a phenolic core. 4. Application 4.1 Application shall be performed within a temperature range of 10 - 35°C. Temperatures must be maintained at least 3°C above the moisture dew point, and relative humidity must be maintained below 85%. Work environment of the job site shall be controlled within this range. 4.2 Application should be accomplished in a single wet pass with a 50% overlap. 4.3 Hold the spray gun at right angles to the surface. 4.4 Primer can be applied at varying covering rates, varying from a rate of 175 µm Wet Film Thickness (WFT) to 75 µm WFT. For most applications where a 38-50 µm blast profile has been achieved, it is suggested primer be installed at a nominal thickness of 75-150 µm WFT. 4.4.1 The WFT/DFT thickness of the applied primer has a relationship to its performance and cost. Variables such as the profile of the prepared steel can be impacted by the blast media used, regardless of the cleanliness standard specified. All of these factors must be considered in advance of the commencement of work to establish agreed QA standards and methodologies. 4.5 WFT testing should be performed to monitor specified thicknesses as the job progresses. Film reduction during curing will reduce the DFT thicknesses of the cured lining when applied at the thicknesses above by a factor of approximately 50%. 4.6 Suggested spray equipment (or equivalent) as follows: Gun: DeVilbiss MBC-510 Fluid tip: E Pressure: 19 - 20 Mpa Hose: 6.0 mm ID Tip: 430 - 580 µm Filter: 60 mesh		

Installation info	Pennguard™ HP Epoxy Primer	
CES-150	Installation specification	Page 3 of 4 Revision 5
4.6.1 The above equipment specification is a suggested starting point only. Changes in pressure and tip sizes may be needed for proper atomization. 4.7 Pennguard HP Epoxy Primer is pre-thinned and further thinning is typically not required. If circumstances and the expertise of the painter deem that thinning may aid in the spraying of the material, Pennguard HP Epoxy Primer can be thinned up to 10 % by volume with MEK to assist in spraying if needed. Do not thin more than 10 %. 5. Curing and recoat 5.1 Pennguard HP Epoxy Primer typically cures dry to touch in ± 2 hours at temperatures of 24°C. High velocity air and good ventilation help to remove solvents and accelerate drying. High humidity slows curing. Primer will dry hard to allow handling in 2 to 4 hours depending on humidity and substrate temperature. Use a fingernail scratch test to insure Primer is cured hard before proceeding. 5.2 Recoat: Pennguard HP Epoxy Primer is designed to be installed in a single step to the desired thickness. In the event it becomes necessary to perform re-coating or touch-ups, Pennguard HP Epoxy Primer may require surface preparation before these operations can be completed. Material will reach approximately 80% of its full cure within 72 hours of application, with the remaining 20% attained over a period of 7-14 days. Recoating within the initial 72 hour period does not require any surface preparation. Once the initial 72 hour period has passed, the coated surface shall be sanded with a 150 - 200 grit sandpaper to roughen the coating surface; thus providing a “tooth” that will aid the adhesion of subsequent topcoats. 5.3 The Primer must dry hard to touch before commencing application of the Pennguard Block Lining System. Do not apply the Pennguard Block Lining System on wet or tacky Primer. 5.4 Primed components that remain exposed to the elements for excessive lengths of time require the resultant surface chalk to be removed before commencement of repriming or subsequent lining work. Wash affected components with clean water and allow to dry to touch before proceeding with installation of other components of the Pennguard Block Lining System. Pressure washing may be more efficient to achieve this for larger areas and is acceptable. 6. Sags and runs 6.1 Sags and runs can occasionally be encountered during the installation of Pennguard HP Epoxy Primer. While sags and runs are aesthetically unpleasing, they are not necessarily detrimental to the purpose of the Primer, which is to protect the steel from re-rusting before subsequent Block lining work. A sag/run however with a thickness > 200 µm could develop curing shrinkage stresses that minimizes bond in that area and shall be dealt with. 6.2 To assist in defining a standard for pass/fail for sags and runs the following is noted: 6.2.1 A sag is defined as having a width greater than its height and a height not exceeding 200 µm. A run is defined as singular bubble-shaped slumps of nominal 3 mm width or less and height of 200 µm or greater.		

PENNGUARD™ HP Epoxy Primer

An epoxy primer to protect blasted steel from rusting before installation of the Pennguard Block Lining System

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Hadek Protective Systems b.v.

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Product info	Pennguard™ HP Epoxy Primer	HADEK PROTECTING POWER PLANT CHIMNEYS
CE-314	An epoxy primer to protect blasted steel from rusting before installation of the Pennguard Block Lining System	Page 1 of 2 Revision 6

PENNGUARD HP Epoxy Primer is a high solids two component polyamide epoxy primer consisting of Pennguard HP Epoxy Primer - Part "A" and Pennguard HP Epoxy Primer Hardener Part "B". Spray application is recommended, but it can be brush or roller applied. Typical dry film thickness is 38-75 µm. Consult Hadek's specification CES-150 entitled "Specification for Installation for Pennguard HP Epoxy Primer" for complete installation details.

1. Areas of use

Pennguard HP Epoxy Primer is designed for application onto cleaned and blasted metal substrates to prevent rusting before installation of the Pennguard Block Lining System.

Pennguard HP Epoxy Primer is designed for priming carbon steel, some stainless steels & non-ferrous substrates in stacks, ducts, breaching and vessels. It is intended to prevent re-rusting of blasted steel during the period of time between completion of blasting and application of the Pennguard Block Lining System.

2. Outstanding features

- Prevents formation of flash rust on previously blasted steel surfaces.
- Greater film build offers longer term protection before installation of the Pennguard Block Lining System.
- Provides for maximum adhesion of the Pennguard Block Lining System.
- Easy to use with conventional spray equipment.
- Cures quickly at 24°C. Dries to touch in approximately 2 hours.
- VOC Compliant 0.42 kg/l.
- Lead and chromate free

3. Typical physical properties

Property	Part A	Part B	Mixed
Color	Grey	Clear/ Amber	Grey
Mix Ratio by volume	4.0	1.0	-
Viscosity cps			650 Cps, reacted
Density kg/l			1.5 kg/l
Pot Life @ 24°C	-	-	4 - 6 hours
Induction period before using	-	-	15 minutes
Dry time to touch 24°C			2 hours
Dry time to recoat 24°C			4 hours
Solids Content % by volume (ASTM D2369)			50 % ± 2 %
VOC kg/l (ASTM 3960)			0.4 kg/l
Shelf Life IF KEPT BELOW 21-27°C	1 year	1 year	-

Hadek Protective Systems b.v.

Product info	Pennguard™ HP Epoxy Primer	
CE-314	An epoxy primer to protect blasted steel from rusting before installation of the Pennguard Block Lining System	Page 2 of 2 Revision 6

4. Estimating / packaging *theoretical quantities - no overage allowance

Product	Code	Packaging	* Theoretical coverage
Pennguard HP Epoxy Primer Part A	29643	1.0 gallon can (= 3.785 l)	1 x 1.0 gallon can of PG HP Epoxy Primer Part A, combined with 1 qt gallon can of PG HP Epoxy Primer Part B will yield 1.25 gallons (4.7 l). Application thickness can range from 75-175 µm (3-7 mils WFT) per coat. A nominal 75-150 µm (3-6 mils WFT) coat is suggested for most applications.
Pennguard HP Epoxy Primer Part B	29651	1 qt gallon can (= 0.946 l)	A 1.25 gallon (4.7 l) unit will *theoretically cover 62 m² @ 75 µm thickness, 37.5 m² @ 125 µm, and 26.5 m² @ 175 µm. Film reduction during curing will reduce the DFT thickness by a factor of approximately 50%

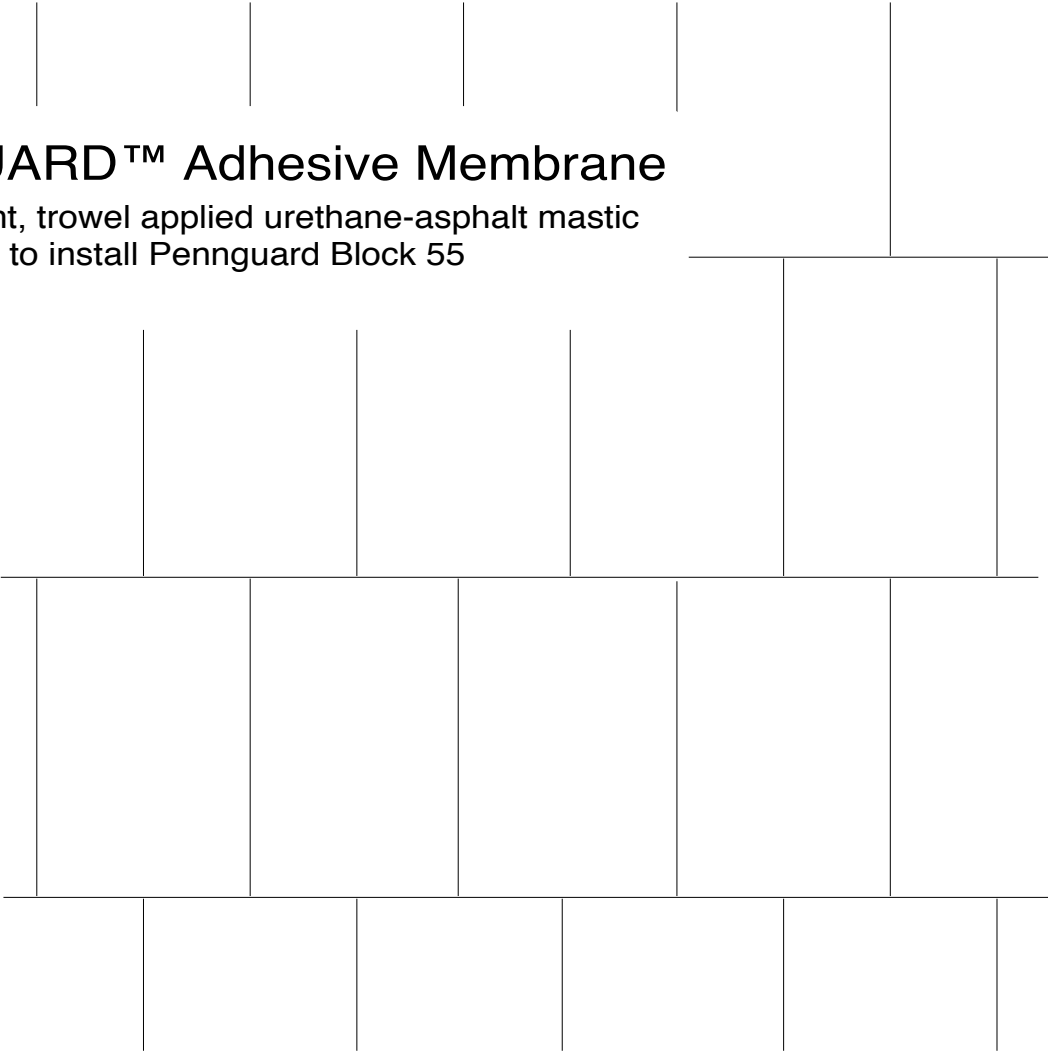
*Theoretical coverage is a calculation based on 100% yield assuming a perfectly flat surface which is not achievable. The Pennguard Block Lining System requires an SA 2.5 surface cleanliness. The blast media used to achieve this standard can vary, and this in turn may affect the resultant profile of the steel. A typical finish with a 38-50 µm profile will reduce primer practical coverage. Other variables affecting the amount of coverage reduction include loss during mixing, expertise of the applicator, overspray, spillage, and pail residual. Due to the potential for variability, coverages cannot be guaranteed.

Safety precautions / Disclaimer

Mixes and applications of this product present a number of hazards. Read and follow the hazard information, precautions and first aid directions on the individual product labels and material safety data sheets before using. While all statements, technical information, and recommendations contained herein are based on information our company believes to be reliable, nothing contained herein shall constitute any warranty, express or implied, with respect to the products and/or services described herein and any such warranties are expressly disclaimed. We recommend that the prospective purchaser or user independently determine the suitability of our product(s) for their intended use. No statement, information or recommendation with respect to our products, whether contained herein or otherwise communicated, shall be legally binding upon us unless expressly set forth in a written agreement between us and the purchaser/user.

PENNGUARD™ Adhesive Membrane

A 2-component, trowel applied urethane-asphalt mastic used primarily to install Pennguard Block 55



Product info	Pennguard™ Adhesive Membrane			
CE-220	A 2-component, trowel applied urethane-asphalt mastic used primarily to install Pennguard Block 55	Page 1 of 4		
		Revision 11		
As an adhesive, it serves to bond the Pennguard Block to a prepared substrate, and as a Membrane, it functions as an elastomeric, moisture and chemically-resistant barrier for that substrate.				
<table><tr><td> 1. Areas of use Although the Pennguard Adhesive Membrane is principally used as a part of our Pennguard Block Lining System, it may also be used as a trowel-applied protective Membrane under chemically-resistant masonry / monolithics, or even used by itself as an independent elastomeric lining. It should not be used where oil or organic solvents are present. Contact Hadek Protective Systems for specific recommendations. 2. Features and characteristics • Bonds well to concrete, carbon and alloy steels, FRP and to other organic linings. • Has excellent abrasion resistance. • Due to its elongation nature it has the capability of bridging hairline cracks which may occur in concrete substrates. • As a part of the Pennguard Block Lining System, it serves as a mechanical and thermal stress-relieving mechanism. • Resistant to moderate and dilute concentrations of mineral acids, also resistant to salt solutions. • Remains elastomeric to temperatures as low as -40°C. 3. Safety precautions The components of Pennguard Adhesive Membrane and mixes of them present a number of hazards. Before using, read the precautions and First Aid directions on the individual labels on the containers and on each product's material safety data sheet, and follow the noted hazard information. </td><td> 4. Surface preparation STEEL The carbon steel surfaces shall be prepared in accordance with Sa 2. Carbon Steel, Stainless Steel and Nickel Alloys should be coated with Pennguard Block Primer. CONCRETE The concrete surface shall be prepared in accordance with ASTM 4259 standard practice for abrading concrete. Contact Hadek Protective Systems for primer recommendations. 1. Concrete surface must be sound and free from grease, oil or other forms of contamination. 2. Any imperfections in the concrete, including blow holes, honeycombing, surface roughness or other imperfections, shall be suitably corrected. A good concrete patching compound shall be used as necessary in properly preparing the substrate prior to application of the Membrane. 3. Concrete surfaces must be clean and dry. OTHER SUBSTRATES For the preparation of organic coating-lined surfaces to which the Pennguard Adhesive Membrane is to be applied, contact Hadek Protective Systems. 5. Mixing 1. Utilizing a heavy duty electric drill, capable of delivering a minimum of 230 rpm under load and a Jiffler mix blade, Model DC-312 with 2 x 165 mm propeller blades, mix Component A by itself for a minimum of one minute. </td></tr></table>			1. Areas of use Although the Pennguard Adhesive Membrane is principally used as a part of our Pennguard Block Lining System, it may also be used as a trowel-applied protective Membrane under chemically-resistant masonry / monolithics, or even used by itself as an independent elastomeric lining. It should not be used where oil or organic solvents are present. Contact Hadek Protective Systems for specific recommendations. 2. Features and characteristics • Bonds well to concrete, carbon and alloy steels, FRP and to other organic linings. • Has excellent abrasion resistance. • Due to its elongation nature it has the capability of bridging hairline cracks which may occur in concrete substrates. • As a part of the Pennguard Block Lining System, it serves as a mechanical and thermal stress-relieving mechanism. • Resistant to moderate and dilute concentrations of mineral acids, also resistant to salt solutions. • Remains elastomeric to temperatures as low as -40°C. 3. Safety precautions The components of Pennguard Adhesive Membrane and mixes of them present a number of hazards. Before using, read the precautions and First Aid directions on the individual labels on the containers and on each product's material safety data sheet, and follow the noted hazard information.	4. Surface preparation STEEL The carbon steel surfaces shall be prepared in accordance with Sa 2. Carbon Steel, Stainless Steel and Nickel Alloys should be coated with Pennguard Block Primer. CONCRETE The concrete surface shall be prepared in accordance with ASTM 4259 standard practice for abrading concrete. Contact Hadek Protective Systems for primer recommendations. 1. Concrete surface must be sound and free from grease, oil or other forms of contamination. 2. Any imperfections in the concrete, including blow holes, honeycombing, surface roughness or other imperfections, shall be suitably corrected. A good concrete patching compound shall be used as necessary in properly preparing the substrate prior to application of the Membrane. 3. Concrete surfaces must be clean and dry. OTHER SUBSTRATES For the preparation of organic coating-lined surfaces to which the Pennguard Adhesive Membrane is to be applied, contact Hadek Protective Systems. 5. Mixing 1. Utilizing a heavy duty electric drill, capable of delivering a minimum of 230 rpm under load and a Jiffler mix blade, Model DC-312 with 2 x 165 mm propeller blades, mix Component A by itself for a minimum of one minute.
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Product info	Pennguard™ Adhesive Membrane	HADEK PROTECTING POWER PLANT CHIMNEYS															
CE-220	A 2-component, trowel applied urethane-asphalt mastic used primarily to install Pennguard Block 55	Page 2 of 4 Revision 11															
Shake well the container holding Component B, and add completely into Component A. When the temperature of the component is 21°C or higher, mix for at least three (3) minutes using a good mixing technique to yield an uniform mix. When the temperature of the components is 10°C, mix for at least ten (10) minutes using a good mixing technique to yield a uniform mix. 2. The mixed Pennguard Adhesive Membrane is a thixotrope. 3. Never allow moisture or other contaminants to come in contact with either Membrane component or the wet mix. 6. Instructions for installing 1. The prepared substrate surface must be dry, free of dust, dirt, grease, and oil or any other foreign material which will interfere with the adhesion, and shall be at least 3°C above the moisture dewpoint, and at a temperature between 10°C and 32°C at the time of the Pennguard Adhesive Membrane application. 2. When Pennguard Adhesive Membrane is used to install Pennguard Block, the lining system shall be installed as per our latest Data Specifications HPS-1, entitled "Pennguard Block Lining System - Application instructions". 3. When Pennguard Adhesive Membrane is used either as an independent lining or as a barrier under chemically-resistant masonry / monolithic construction, it shall be applied on the prepared substrate with a mason's trowel to a dry film thickness of no less than 3 mm or as specified by Hadek Protective Systems and in accordance with HPS-1, entitled "Pennguard Block Lining System - Application instructions". 7. Curing 1. When used as a Membrane under chemically-resistant masonry / monolithic construction, the Membrane can accept the application of such linings after 24 hours of curing at a 21°C temperature and relative humidity of 50%. The surface will exhibit a residual tackiness, and may require a dusting of silica flour to allow workers to walk on it. 2. Dependent upon the intended operating service conditions of Pennguard Adhesive Membrane, one may place such linings into service after curing for two days at 32°C or for 72 hours at 21°C, or for 7 days at 10°C. 3. Pennguard Adhesive Membrane cures by chemical reaction. At a curing temperature of 21°C, the applied product will develop approximately 45% of its physical properties within two days, approximately 80% within 7 days, and approximately 100% within 14 days. 8. Packaging Pennguard Adhesive Membrane is available in a 4 gallon unit. The 4 gallon unit is packed in a 4 gallon pail. Component B is packed separately. Freight Classification - Pipeline Coating, rust preventive asphalt. <table border="1"> <thead> <tr> <th>Product Code</th><th>Unit Size</th><th>Gross Weight</th></tr> </thead> <tbody> <tr> <td>19671 (domestic ground)</td><td>4 gallon</td><td>17.7 kg</td></tr> <tr> <td>19672 (sea shipment)</td><td>4 gallon</td><td>17.7 kg</td></tr> <tr> <td>19681 (air ship. UN pail)</td><td>4 gallon</td><td>17.7 kg</td></tr> <tr> <td>29488-341 (bottle)</td><td>341 gm</td><td>341 gm</td></tr> </tbody> </table>			Product Code	Unit Size	Gross Weight	19671 (domestic ground)	4 gallon	17.7 kg	19672 (sea shipment)	4 gallon	17.7 kg	19681 (air ship. UN pail)	4 gallon	17.7 kg	29488-341 (bottle)	341 gm	341 gm
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Product info	Pennguard™ Adhesive Membrane	HADEK PROTECTING POWER PLANT CHIMNEYS
CE-220	A 2-component, trowel applied urethane-asphalt mastic used primarily to install Pennguard Block 55	Page 3 of 4
		Revision 11
9. Estimating Application to smooth substrate (approximately 75µm profile) the net theoretical coverage is: 1.1 m² / gallon for a 3 mm thickness. Shrinkage is 5% maximum and, hence, the cured film will be approximately the same as the wet film thickness. Application estimates to concrete substrates or other surfaces shall take into account the roughness profile. Allow extra for wastage. 10. Storage - Shelf life Units of Pennguard Adhesive Membrane should be stored in dry areas. At the time of application, the temperature of the components should be at 21°C. Do not store near sources of heat or flame. Do not store at temperatures below -18°C. When stored in accordance with the above, unopened units of Pennguard Adhesive Membrane should be stable for up to one year from date of manufacture. 11. References For installation instructions, refer to our latest technical Data Specifications. HPS-1, entitled "Pennguard Block Lining System - Application instructions". For complete recommendations on the suitability of use, sizes and bonding system, contact Hadek Protective Systems.		

Product info	Pennguard™ Adhesive Membrane	
CE-220	A 2-component, trowel applied urethane-asphalt mastic used primarily to install Pennguard Block 55	Page 4 of 4
		Revision 11

12. Typical physical properties

Property	Pennguard Adhesive Membrane	
Service temperature behind Pennguard Block (at bond line behind block)	-40°C to 93°C *Note: Experience has indicated the service temperature of Pennguard Adhesive Membrane in side joints of a Pennguard Block Lining is significantly higher than values stated above. Consult Hadek Protective Systems for maximum service temperature limits for specific applications.	
Tensile strength at 23°C	>100 psi / 0.69 MPa	ASTM D-412
Elongation at 23°C	>100%	ASTM D-412
Fire resistance	FM (Factory Mutual) approved. Consult Hadek Protective Systems for details.	
Bond strength to carbon steel	135 psi / 0.93 MPa	ASTM D-4541
Mix ratio component A : component B	46 : 1 by weight. Mix full units only	
Wet mix weight	1.04 kg / liter	ASTM D-71
Pot life at 21°C (approximate)	45 to 55 minutes	
Color and appearance	Black elastomeric rubber	
Resistance to abrasion by sandblast	Excellent	FED-TT C-520

Safety precautions / Disclaimer

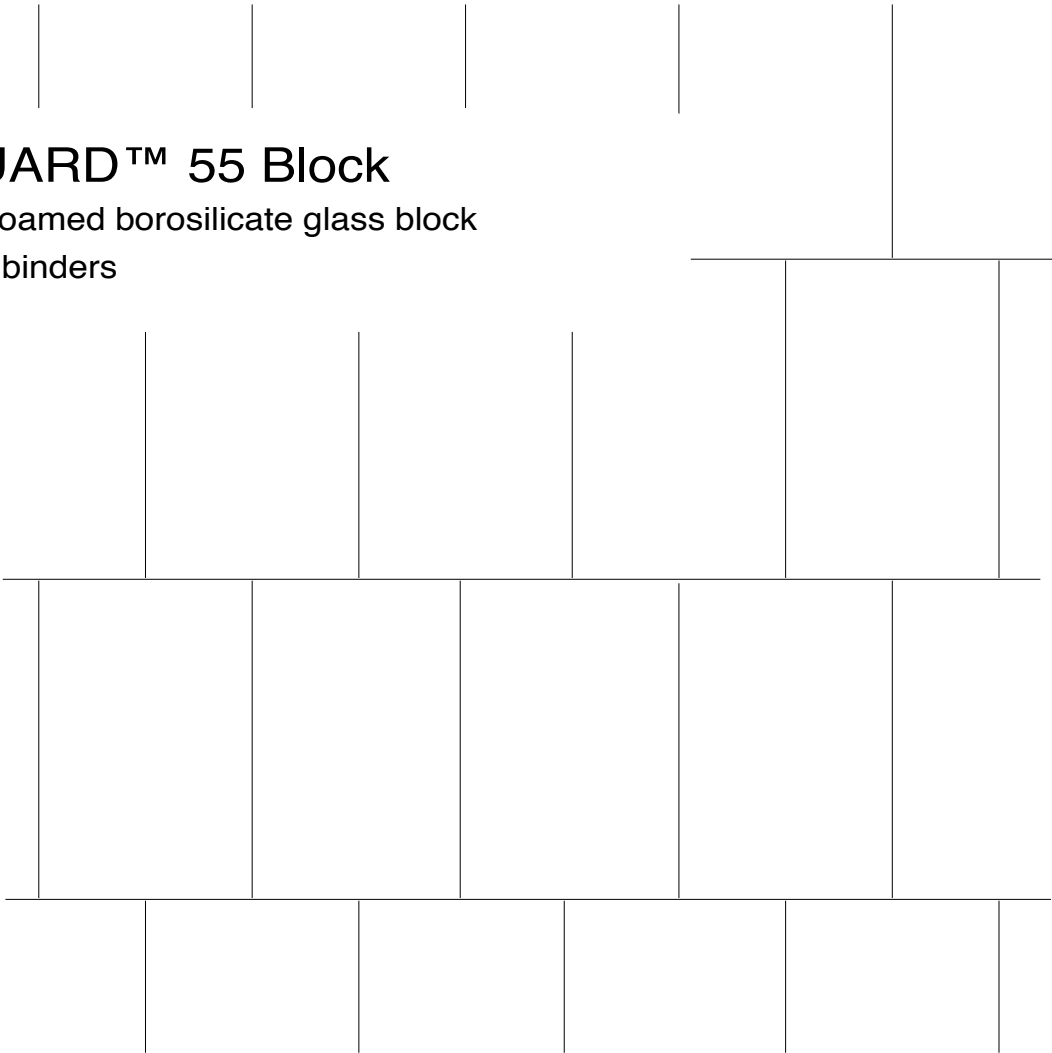
Mixes and applications of this product present a number of hazards. Read and follow the hazard information, precautions and first aid directions on the individual product labels and material safety data sheets before using. While all statements, technical information, and recommendations contained herein are based on information our company believes to be reliable, nothing contained herein shall constitute any warranty, express or implied, with respect to the products and/or services described herein and any such warranties are expressly disclaimed. We recommend that the prospective purchaser or user independently determine the suitability of our product(s) for their intended use. No statement, information or recommendation with respect to our products, whether contained herein or otherwise communicated, shall be legally binding upon us unless expressly set forth in a written agreement between us and the purchaser/user.

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PENNGUARD™ 55 Block

An inorganic foamed borosilicate glass block
containing no binders



Product info	Pennguard™ 55 Block	
CE-267	An inorganic foamed borosilicate glass block containing no binders	Page 1 of 4
		Revision 10
PENNGUARD 55 Block offers an approach to protecting metal, concrete, and FRP substrates from acid corrosion, while providing excellent thermal insulation and energy conservation.		
1. Description Pennguard 55 Block: • is an inorganic foamed borosilicate glass block containing no binders. • offers chemical resistance to most acids, solvents, and weak bases and can operate at temperatures up to 199°C. • is manufactured as a closed cellular foamed glass block, virtually impermeable to acidic liquids and gases. • is lightweight, and retains low thermal conductivity even when immersed in acid. Its low coefficient of thermal expansion provides excellent resistance to thermal shock. • does not support combustion, and may be used alone or in combination with refractories, acid brick, or acid resistant gunites & castables to provide a combination of corrosion protection and heat conservation. • is installed in a manner similar to chemically resistant masonry, utilizing Pennguard Pennguard Adhesive Membrane to bond the block to the substrate, and to form side joints between the faces of adjacent blocks. 2. Areas of use • The Pennguard Block Lining System consists of Pennguard Block type 55 that is applied to a substrate using Pennguard Adhesive Membrane, a flexible, acid resistant adhesive. • The Pennguard Block Lining System is primarily used for the internal protection of flue gas ducts and chimneys in power stations that fire coal, lignite, oil or other fossil fuels. It will form an acid and heat resistant barrier between the corrosive flue gas atmosphere and the substrate. • The Pennguard Block Lining System is suitable for application to mild steel, concrete and ceramic brick substrates as well as for application to stainless steel, alloys and fibre reinforced plastics (FRP) substrates. • The Pennguard Block Lining System is especially suitable for use in power stations with flue gas desulphurisation (FGD) plants. Pennguard Block Lining Systems are used successfully in hot, unscrubbed flue gases, in scrubbed flue gases (reheated or non reheated) as well as in mixed gas scrubbed/ unscrubbed flue gas streams. • The Pennguard Block Lining System can also be used in industries other than the power industry, such as the waste incineration, paper, cement and metallurgical industries. For specific recommendations on the use of Pennguard Block Lining Systems, please consult Hadek Protective Systems. 3. Features and characteristics The proprietary borosilicate glass composition of Pennguard 55 Block provides greater acid corrosion resistance, higher compressive strength, higher service temperature and significantly better thermal shock resistance than any other foamed glass composition.		

Product info	Pennguard™ 55 Block																																																																																																		
CE-267	An inorganic foamed borosilicate glass block containing no binders	Page 2 of 4																																																																																																	
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3.1 Chemical resistance <table><tr><td>Chemical:</td><td colspan="2">Resistant</td></tr><tr><td>1 Acid condensate solutions and gasses</td><td></td><td></td></tr><tr><td>1.1 *Sulfuric Acid</td><td>Yes</td><td></td></tr><tr><td>1.2 *Nitric Acid</td><td>Yes</td><td></td></tr><tr><td>1.3 *Hydrochloric Acid</td><td>Yes</td><td></td></tr><tr><td>1.4 *Phosphoric Acid</td><td>Yes</td><td></td></tr><tr><td>1.5 *Acetic Acid</td><td>Yes</td><td></td></tr><tr><td>1.6 *Hydrofluoric Acid</td><td></td><td>No</td></tr><tr><td>1.7 Steam impingement</td><td></td><td>No</td></tr><tr><td>* All concentrations, including gaseous forms</td><td></td><td></td></tr><tr><td>2 Base & Salt</td><td></td><td></td></tr><tr><td>2.1 Ammonium Hydroxide</td><td>Yes</td><td></td></tr><tr><td>2.2 Magnesium Hydroxide</td><td>Yes</td><td></td></tr><tr><td>2.3 Calcium Hydroxide</td><td></td><td>No</td></tr><tr><td>2.4 Potassium Hydroxide</td><td></td><td>No</td></tr><tr><td>2.5 Sodium Carbonate</td><td></td><td>No</td></tr><tr><td>2.6 Sodium Chloride</td><td>Yes</td><td></td></tr><tr><td>2.7 Sodium Sulfate</td><td>Yes</td><td></td></tr><tr><td>2.8 Sodium Sulfite</td><td></td><td>No</td></tr><tr><td>2.9 Ammonium Nitrate</td><td>Yes</td><td></td></tr><tr><td>3 Organics</td><td></td><td></td></tr><tr><td>3.1 Heptane</td><td>Yes</td><td></td></tr><tr><td>3.2 Kerosene</td><td>Yes</td><td></td></tr><tr><td>3.3 Benzene</td><td>Yes</td><td></td></tr><tr><td>3.4 Toluene</td><td>Yes</td><td></td></tr><tr><td>3.5 Carbon Tetrachloride</td><td>Yes</td><td></td></tr><tr><td>3.6 Methylene Chloride</td><td>Yes</td><td></td></tr><tr><td>3.7 Acetone</td><td>Yes</td><td></td></tr><tr><td>3.8 Methyl Ethyl Ketone</td><td>Yes</td><td></td></tr><tr><td>3.9 Methanol</td><td>Yes</td><td></td></tr><tr><td>3.10 Diethyl Ether</td><td>Yes</td><td></td></tr><tr><td>3.11 Ethyl Acetate</td><td>Yes</td><td></td></tr></table> 3.2 Physical properties 3.2.1 Pennguard's closed celled structure results in virtually zero permeability, capillarity, and absorption (surface wetting only). Pennguard 55 Block is non-combustible, totally inorganic. Having a density of only 192 kg/m³, an installed 51 mm thickness of the Pennguard Block Lining System adds only 14.4 kg/m² of lined area to the supporting structure, an important consideration for steel chimney liners and ductwork. The light weight increases design flexibility and lowers structural substrate costs. The Pennguard Block Lining System is suited for fabricator shop lining of ducts and stacks prior to transportation to the site and field erection. 3.2.2 The low coefficient of thermal expansion provides excellent resistance to upset or bypass operating temperatures. 3.2.3 Low thermal conductivity - provides 10 times more insulation than an equivalent thickness of acid-resistant brick, and more than 5 times the insulation of an equivalent thickness of dense monolithic lining construction. Eliminates the need to externally insulate process equipment, ductwork, etc, resulting in cooler equipment surfaces, less heat loss, and energy savings. The Pennguard Block Lining System performs under conditions of low temperature where acidic condensates and process acids are found, as well as at elevated temperatures where corrosive gases or concentrated acid condensates are found and where temperatures are above the service use limits of organic-based linings.				Chemical:	Resistant		1 Acid condensate solutions and gasses			1.1 *Sulfuric Acid	Yes		1.2 *Nitric Acid	Yes		1.3 *Hydrochloric Acid	Yes		1.4 *Phosphoric Acid	Yes		1.5 *Acetic Acid	Yes		1.6 *Hydrofluoric Acid		No	1.7 Steam impingement		No	* All concentrations, including gaseous forms			2 Base & Salt			2.1 Ammonium Hydroxide	Yes		2.2 Magnesium Hydroxide	Yes		2.3 Calcium Hydroxide		No	2.4 Potassium Hydroxide		No	2.5 Sodium Carbonate		No	2.6 Sodium Chloride	Yes		2.7 Sodium Sulfate	Yes		2.8 Sodium Sulfite		No	2.9 Ammonium Nitrate	Yes		3 Organics			3.1 Heptane	Yes		3.2 Kerosene	Yes		3.3 Benzene	Yes		3.4 Toluene	Yes		3.5 Carbon Tetrachloride	Yes		3.6 Methylene Chloride	Yes		3.7 Acetone	Yes		3.8 Methyl Ethyl Ketone	Yes		3.9 Methanol	Yes		3.10 Diethyl Ether	Yes		3.11 Ethyl Acetate	Yes	
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Product info	Pennguard™ 55 Block																
CE-267	An inorganic foamed borosilicate glass block containing no binders	Page 3 of 4															
		Revision 10															
Semi-refractory characteristics of the Pennguard 55 Block allow it to operate at hot face temperatures up to 199°C. 4. Application Pennguard 55 Block is engineered and marketed in nominal thicknesses of: 1" = 25 mm 1 1/2" = 38 mm 2" = 51 mm 2 1/2" = 64 mm The shape is rectangular with a nominal block size of: 9"x 6" = 229 mm x 152 mm If the substrate surface is irregular or curved, then the block size and shape can be shaped in the field accordingly. Pennguard 55 Block can also be fabricated into a variety of specialty shapes, such as T-sections, elbow sections, pipe lining segments, or other custom shapes. The block must be installed with: Pennguard Adhesive Membrane (Product Data sheet CE-220), a trowel applied urethane asphalt mastic. 5. Packaging In cartons, containing: <table><tr><th>Thickness in mm (inches)</th><th>Number of Blocks per carton</th><th>Coverage in m² / carton</th></tr><tr><td>25 (1.0)</td><td>90</td><td>3.14</td></tr><tr><td>38 (1.5)</td><td>60</td><td>2.09</td></tr><tr><td>51 (2.0)</td><td>48</td><td>1.67</td></tr><tr><td>64 (2.5)</td><td>36</td><td>1.25</td></tr></table> 6. Storage - Shelf Life The shelf life of Pennguard 55 Block is indefinite. Blocks are packaged in cartons which should be kept cool and dry. 7. References For installation instructions, refer to our latest technical Data Specifications: HPS 1, entitled "Pennguard Block Lining System - Application Instructions". For complete recommendations on the suitability of use, sizes and bonding system, contact Hadek Protective Systems in Rotterdam.			Thickness in mm (inches)	Number of Blocks per carton	Coverage in m² / carton	25 (1.0)	90	3.14	38 (1.5)	60	2.09	51 (2.0)	48	1.67	64 (2.5)	36	1.25
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Product info	Pennguard™ 55 Block	HADEK PROTECTING POWER PLANT CHIMNEYS
CE-267	An inorganic foamed borosilicate glass block containing no binders	Page 4 of 4 Revision 10

8. Typical physical properties

Property	Pennguard Block 55	
Composition	Borosilicate glass, inorganic, no binders	
Service Temperature Limit	199°C (390°F). Maximum service temperature values for foamed glass compositions are a function of thermal shock resistance, resistance to deformation (creep) under load, and consideration for a suitable engineering safety factor. In certain conditions, higher limits may apply. Consult Hadek Protective Systems for maximum service temperature limits for specific applications.	
Thermal conductivity at a mean temperature of:	38°C (100°F) 0.087 W / m °K 93°C (200°F) 0.098 W / m °K 149°C (300°F) 0.110 W / m °K	ASTM C-117 ASTM C-518
Specific heat	0.2 kcal / kg / °C	
Density	192 kg/m ³	ASTM C-303
Compressive strength	>200 psi / 1.38 MPa	ASTM C-165 (hot asphalt capping)
Flexural strength	>90 psi / 0.62 Mpa	ASTM C-203 ASTM C-240
Modulus of elasticity	180,000 psi / 1240 MPa	
Coefficient of linear thermal expansion	5.5 x 10 ⁻⁶ / °C	
Combustibility	None	
Capillarity	None	
Absorption of moisture	0.2 (surface wetting only)	ASTM C-240
Water vapor permeability	0.0	
Shelf life	Indefinite	

Safety precautions / Disclaimer

Mixes and applications of this product present a number of hazards. Read and follow the hazard information, precautions and first aid directions on the individual product labels and material safety data sheets before using. While all statements, technical information, and recommendations contained herein are based on information our company believes to be reliable, nothing contained herein shall constitute any warranty, express or implied, with respect to the products and/or services described herein and any such warranties are expressly disclaimed. We recommend that the prospective purchaser or user independently determine the suitability of our product(s) for their intended use. No statement, information or recommendation with respect to our products, whether contained herein or otherwise communicated, shall be legally binding upon us unless expressly set forth in a written agreement between us and the purchaser/user.

Hadek Protective Systems b.v.

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Procedure: Measuring of Dry Film Thickness (DFT) on Ferrous Substrates

Objective: This procedure describes the steps to be taken to successfully measure the DFT of coatings applied to ferrous substrates using electronic gages.

Revision: 1

Date: 1/1/2016



- 1 : Coating thickness is an important variable that plays a role in product quality, process control and cost control. Measurement of film thickness can be done with many different instruments. Understanding the equipment that is available for measuring the Dry Film Thickness (DFT), and how to successfully use it is useful to every coating operation. This particular procedure describes the use of electronic gauges; electronic circuitry converts reference signal to coating thickness.
- 2 : The following procedure shall be followed to measure the DFT in the field when coatings are applied within the manufacturer's specified DFT range (i.e. Pennguard HP Epoxy Primer):
 - DFT measurements shall be executed on sufficiently cured coatings only; measuring DFT too soon will show unreliable readings due to solvent entrapment.
 - The Electronic DFT gauge shall be calibrated (verifying accuracy using traceable standards) per manufacturer instructions at the beginning of each work shift as a minimum, and during if:
 - Obtaining a large no. of readings
 - Gauge is dropped or readings are suspect.
 - The DFT shall be measured according to the "grid" sample as described on page 2. Each circle (3.8 cm in diameter) consists of three (3) individual readings of which the 'mean' reading will be written on the substrate using a permanent marker (black). The readings on the substrate are helpful to determine if areas require touch-ups.
 - Depending on the specific DFT gauge used (i.e. Elcometer 465T), the SSPC-PA2 (2012) setting shall be selected.
 - Acceptable DFT shall range between 80% of the minimum specified DFT and 120% of the maximum specified DFT.
 - The following records shall be included/attached in Daily Reports:
 - Name, model, serial number, calibration date of electronic gauge, probe model and shims (foils of known thickness) used to verify/calibrate.
 - Location of DFT measurements taken
 - Object ID
 - No. of readings
 - Minimum DFT reading
 - Maximum DFT reading
 - Mean DFT reading
 - Standard Deviation
 - Elcometer 2.0 print out
- 3 : Relevant information:
 - CE-314 Pennguard HP Epoxy Primer
 - CES-150 Installation Specification for Pennguard HP Epoxy Primer
 - HPS-1 Pennguard Block Lining System - Application Instructions
 - Elcometer 456T: <http://www.youtube.com/watch?v=JwfmhmrVOfM>
 - Permanent marker: Edding, Sharpie or similar

Page 1 / 2

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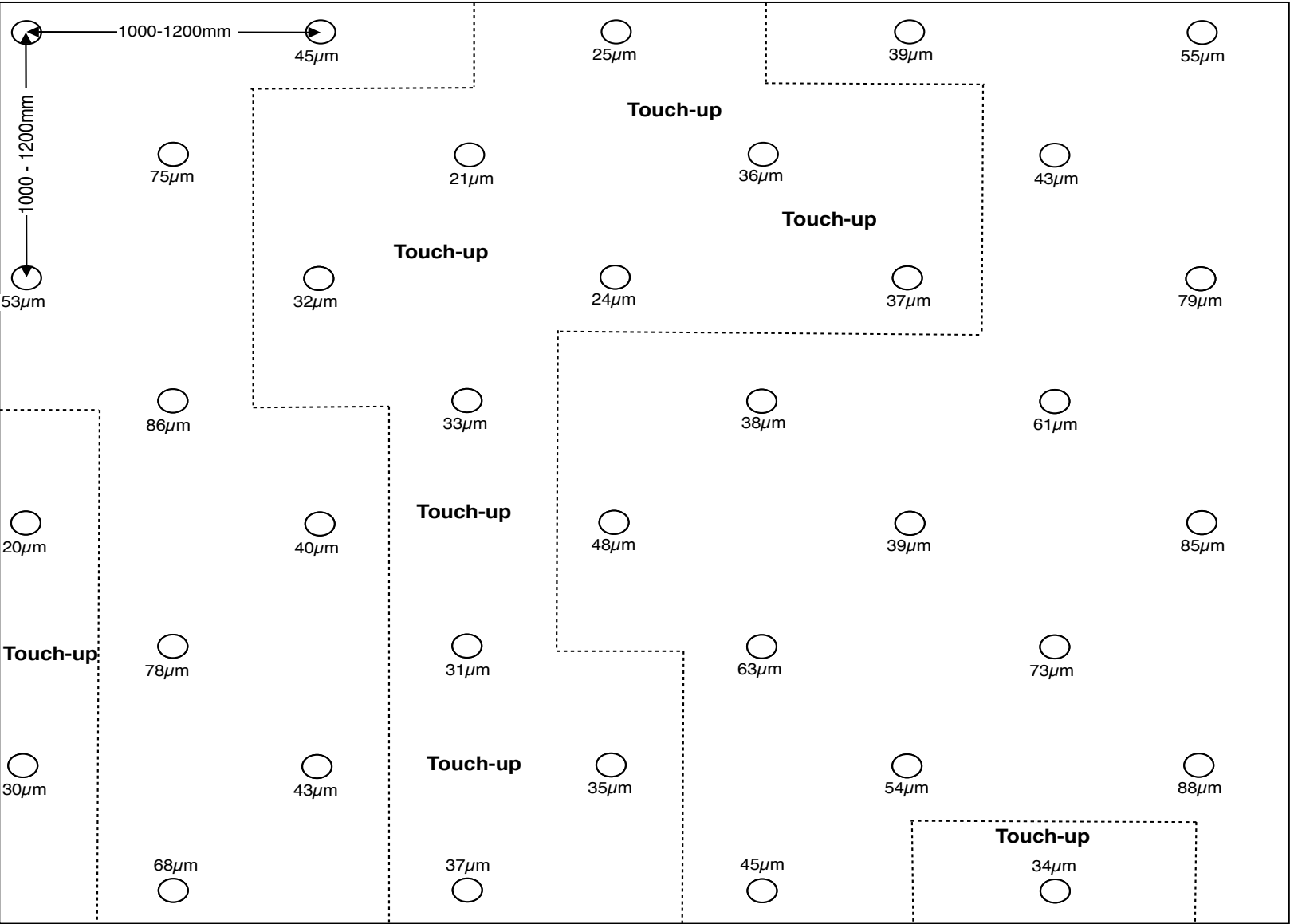
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Procedure: Measuring of Dry Film Thickness (DFT) on Ferrous Substrates

Objective: This procedure describes the steps to be taken to successfully measure the DFT of coatings applied to ferrous substrates using electronic gages.

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Storage instructions and shelf life

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

Storage instructions:

1	Pennguard Block	dry
2	Pennguard Adhesive Membrane part A	dry, protected from direct sunlight and at a well ventilated place Do not store at temperatures below -18°C.
3	Pennguard Adhesive Membrane part B (Urethane Asphalt Hardener)	dry, protected from direct sunlight and at a well ventilated, temperature controlled place (we recommend below 21°C). Part B is packed separately in cartons. It is important that this product is protected from high temperature fluctuations as this will influence the quality of the product.
4	Pennguard HP Epoxy Primer	dry, protected from direct sunlight and at a well ventilated place

Shelf life, if stored under recommended storage conditions:

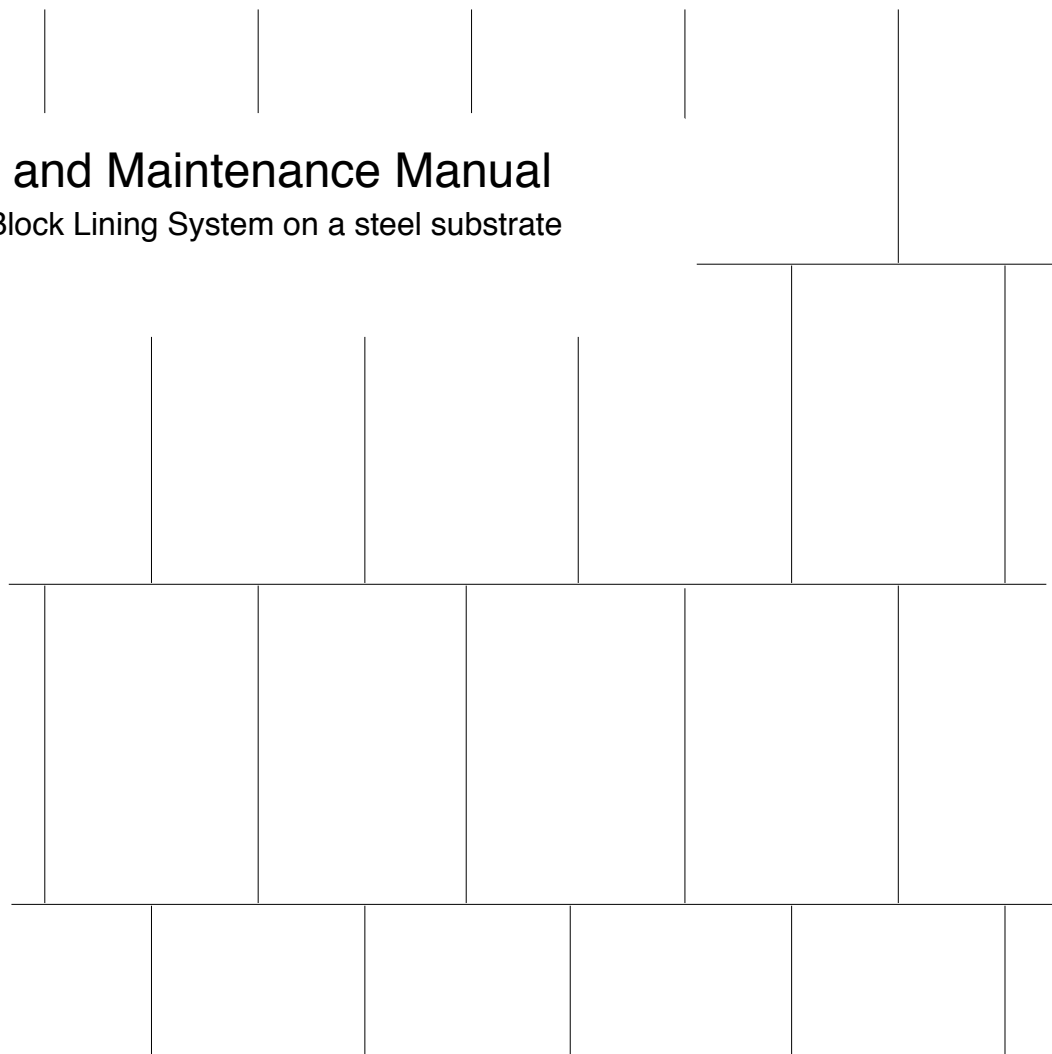
1	Pennguard Block	indefinite
2	Pennguard Adhesive Membrane part A	1 year*
3	Pennguard Adhesive Membrane part B (Urethane Asphalt Hardener)	1 year*
4	Pennguard HP Epoxy Primer	1 year*

* If stored under recommended storage conditions the shelf life can be longer than 1 year. We advise to have the materials tested in case of any doubts.

Operation and Maintenance Manual

Pennguard™ Block Lining System on a steel substrate

Bahr I, India



PENNGUARD™
BLOCK LINING SYSTEM



Hadek Protective Systems b.v.

World Trade Center Rotterdam - Postbus 30139, 3001 DC Rotterdam, Tel. (0)10 - 405 1461- Telefax (0)10 - 405 5011

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

Rev. No.:	Date Issue:	Reference:	By:			Approved by:		
			Initials:	Date:	Paraph:	Initials:	Date:	Paraph:
/	19-03-2019	O/M	CeV	19-03-2019		AdK	19-03-2019	

Contents:

Chptr.	Description:	Page no.:	Rev. no.:
1	Pennguard Block Lining System	3	/
	1.1 General precautions	3	/
2	Inspection frequency	4	/
	2.1 Planning	4	/
	2.2 Inspection methods of the Pennguard lining	4	/
3	Storage of materials	5	/
	3.1 Packaging	5	/
	3.2 Storage conditions	5	/
4	Repairs and modifications	7	/
	4.1 Repairs	7	/
	4.2 Modifications	8	/
	4.3 Skilled personnel	8	/
5	Safety	9	/
6	Technical information	10	/
	6.1 Use of the materials	10	/
	6.2 General characteristics	10	/
7	Applicable documents	11	/

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

1 Pennguard Block Lining System

1.1 General precautions

Precautions for the Pennguard Block Lining System during stops or revisions.

When entering a chimney / duct lined with the Pennguard Block Lining System some precautions are necessary.

Scaffolding or platform cannot be erected without special requirements to protect the lining. Care has to be taken, that the Pennguard lining on the bottom, walls and ceiling is not hit by platform, scaffolding pipes, timber boards, etc. as this might damage the Pennguard Blocks, making repairs necessary.

The Pennguard Adhesive Membrane in the joints is only flammable, when a sufficient heat source to sustain the fire, such as a torch or welding equipment, is present. Welding and cutting in the chimney / duct should preferably be avoided.

Care has to be taken when cleaning of the inside of the chimney / duct. Pressurised water will damage the blocks easily and should not be used. Workers entering the chimney / duct should be instructed, that when using shovels or other means for the removal of dirt, they have to be careful not to damage the blocks. Depending on build-up consistency/appearance, extensive low water pressure rinsing could be the solution. Careful use of scrapers or similar (preferably plastic tips) may be used in situations where build-up is extremely dense and hard, providing that the Pennguard lining shall not be damaged by these actions.

Smoking inside the chimney / duct should be prohibited permanently.

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

2 Inspection frequency

2.1 Planning

There is normally no need to inspect a Pennguard lining on a regular basis, i.e. at each outage.

If an inspection of the Pennguard lining is planned, Hadek requests to attend this inspection. The observations made during an inspection related to the operational conditions of installation - will enhance Hadek's knowledge on the performance of the Pennguard technology. Future customers and Pennguard applications will benefit from this experience.

2.2 Inspection methods of the Pennguard lining

The Pennguard lining is inspected visually. To make the inspection possible, the lining must have been cleaned to such an extent, that the surface of the lining is visible.

The following aspects are inspected:

1. Superficial damages: scratches, indents and similar superficial defects may have occurred during cleaning operations. If the depth of these defects is less than 50% of the original thickness of the block, the performance of the lining is not affected. If the defect is more than 50% of the block thickness, the subject block needs to be replaced.
2. Pennguard Adhesive Membrane: the Pennguard Adhesive Membrane in the joints between the blocks must have retained its flexibility. Due to high flue gas temperatures the Pennguard Adhesive Membrane may have hardened superficially. This might show as a loss of adhesion between the blocks and the Pennguard Adhesive Membrane in the joints. If the Pennguard Adhesive Membrane in the joints has hardened not more than to a depth of 10 mm, the performance of the Pennguard lining is not affected.

Pennguard Adhesive Membrane, that was applied on top of the Pennguard lining, may have hardened and started to detach or disappear. This does not affect the performance of the lining.

3. Cracking: hairline cracks do not affect the performance of the Pennguard lining.

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

3 Storage of materials

3.1 Packaging

The Pennguard Block Lining System materials are supplied in the following packagings:

Pennguard Block 55 - 1.5" : carton box containing 60 blocks
(weight per box: 43.0 lbs / 19.5 kg)

Pennguard Block 28 and 55 can be supplied in different thickness such as 1", 1.5", 2.0", 2.5" or 3.0".

Pennguard Adhesive Membrane

Part A : pail containing 4 gallons (= 15.14 liter)

Part B : bottle containing 341 gram

Pennguard HP Epoxy Primer

Part A : pail containing 1 US gallon
(= 3,785 liter)

Part B : can containing 1 qt US gallon
(= 0.946 liter)

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

3.2 Storage conditions

It is possible to keep small amounts of the materials on site for unexpected repairs.

The Pennguard Blocks can be stored for an unlimited time.

The Pennguard Adhesive Membrane Part A is not affected by the length of the storage time; the storage has to be dry. Storage near heat sources has to be avoided. Pennguard Adhesive Membrane Part B has a shelf life of 1 year, when stored below a temperature of 21°C.

The Pennguard HP Epoxy Primer part A and B has a shelf life of 1 year from Date of Manufacture when stored out of direct sunlight, in a dry location, and at a well ventilated place.

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

4 Repairs and modifications

4.1 Repairs

A repair of the Pennguard Block Lining System is necessary when a mechanical damage has reduced the block thickness by more than half. In these cases the damaged block has to be replaced by a new block.

The Pennguard Adhesive Membrane is used as an adhesive and to fill the joints.

The repair can only be done when the area to be repaired has a substrate temperature of at least 10°C. To maintain these conditions heat lamps can be used.

The repair is carried out in the following steps:

1. Cut away the damaged blocks and surrounding joints with a sharp knife, spatula, trowel or scraper;
2. Remove Pennguard Adhesive Membrane from the substrate with the right tools (for example a chisel, trowel or spatula);
3. Make sure that the sides of the blocks adjoining the area to be repaired are clean, i.e. free from Pennguard Adhesive Membrane;
4. Clean the steel substrate with solvent (MEK), not mineral spirit;
5. Ensure that the temperature of Pennguard Adhesive Membrane is at least 10°C during mixing and application;
6. Mix the Pennguard Adhesive Membrane in accordance with the manufacturer requirements:
 - mix component A for a minimum of 1 minute;
 - add component B, the hardener, while mixing continues;
 - mix component A and B for about 4 minutes at least, while presenting air entrapments;
 - cut the blocks to be installed to size; the joints must be at least 3 mm thick;
 - apply the Pennguard Adhesive Membrane to the substrate and the sides of the adjoining blocks;
 - apply sufficient Pennguard Adhesive Membrane to all sides and the underside of the block to be installed; after installation all joints must be full and at least 3 mm thick;

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

- install the Pennguard Blocks, making sure that all joints are at least 3 mm thick. It has to be made certain that the back joint and the side joints are completely filled with Pennguard Adhesive Membrane.
- strike clean the joints surrounding the newly installed Pennguard Blocks, leaving a smooth lining surface.

4.2 Modifications

When modifications to the object are required the lining can be removed and reinstalled as stated in the previous instructions (chapter 4.1).

In case welding is required, it must be ensured that the lining is removed sufficiently to avoid heat transfer into the remaining lining. Practice has shown that a distance between the weld and the lining of approximately 30 cm is sufficient.

4.3 Skilled personnel

The installation of the Pennguard materials, does not require special equipment or specialised personnel. In most cases professional brick layers will obtain a good result.

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

5 Safety

The power station has to ensure that all applicable safety measure are in place to ensure a safe working environment while doing the inspection and repairs. For a succesfull and safe inspection the following requirements apply:

- the surface of the lining must be sufficiently clean to enable a visual inspection - the guidelines for cleaning apply;
- suitable and safe means of access, in relation to the object to be inspected, must be present;
- adequate lighting must be provided for;
- the lining surface must be dry;
- the object must have been released for access by an authorized person.

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

6 Technical information

6.1 Use of the materials

The Pennguard lining can only be used in areas within the product specifications as included in the Inspection and Test Plan (see chapter 7).

6.2 General characteristics

The general characteristics of the Pennguard Block and Pennguard Adhesive Membrane lining components are listed below.

Technical information Pennguard Block lining materials			
No.:	Characteristic:	Block:	Adhesive:
1.	Appearance	Rectangular foamed block 9" x 6" x 1.5"	A two component thixotropic material in a 4 gallon pail. The second component is supplied separately in a small plastic container. Cured material appears as elastomeric rubber.
2.	Composition	Borosilicate glass	Urethane-asphalt mastic
3.	Colour	Black	Black
4.	Thickness	38 mm See chapter 3.1	3 mm after curing
5.	Density	0,19 kg / dm ³	wet mix = 1,07 kg / dm ³
6.	Resistance to abrasion by sandblast	low	excellent
7.	Adhesion	Not applicable	Bonds well to concrete*, brick, carbon* and alloy*, steels, FRP and other organic linings. *) Primer required

Operation and Maintenance Manual

Customer : BHEL

Subject : Pennguard™ 55 - 1.5" on the
interior of 2 steel flues

Project : Bahr I

Order No. : 20191046.Pe

Revision : /

7 Applicable documents

All applicable documents are included in the original Inspection and Test Plan (ITP), which was sent to the customer before the start of the project. To receive these documents again, please contact Hadek.

The ITP includes, among other documents:

- Material Safety Data Sheets;
- Product data sheets of the Pennguard HP Epoxy Primer, Pennguard Adhesive Membrane and Pennguard Block 55;
- Application Instructions (HPS 1).

SECTION 1: Identification of the substance/mixture and of the company/undertaking
1.1. Product identifier

Trade name or designation of the mixture Pennguard HP Epoxy Primer Part A
Registration number -
Synonyms None.
Issue date 26-July-2013
Version number 03
Revision date 07-January-2016
Supersedes date 22-June-2015

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Not available.
Uses advised against None known.

1.3. Details of the supplier of the safety data sheet

Company name ErgonArmor, a division of Ergon Asphalt & Emulsions, Inc.
Address 2829 Lakeland Drive
 Jackson, MS 39232
 USA
After hours telephone number 1-800-222-7122
Normal work hours telephone number 1-877-982-7667
Website www.ergonarmor.com
e-mail sds@ergon.com
Emergency 24-hour telephone number CHEMTREC: North America 1-800-424-9300 International 1-800-527-3887
Information on operation hours 8:00 a.m. to 5:00 p.m.

SECTION 2: Hazards identification
2.1. Classification of the substance or mixture

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification R10, Xn;R20, Xi;R41

Classification according to Regulation (EC) No 1272/2008 as amended

Physical hazards

Flammable liquids Category 2

H225 - Highly flammable liquid and vapour.

Health hazards

Serious eye damage/eye irritation Category 2

H319 - Causes serious eye irritation.

Reproductive toxicity Category 1B

H360 - May damage fertility by ingestion.
 H360 - May damage fertility or the unborn child.
 H360FD - May damage fertility. May damage the unborn child.

Specific target organ toxicity - single exposure Category 3 narcotic effects

H336 - May cause drowsiness or dizziness.

Hazard summary

Physical hazards Flammable.

Health hazards Harmful by inhalation. Risk of serious damage to eyes. Occupational exposure to the substance or mixture may cause adverse health effects.

Environmental hazards Not classified for hazards to the environment.

Specific hazards Causes burns.

Main symptoms	Not available.
2.2. Label elements	
Label according to Regulation (EC) No. 1272/2008 as amended	
Contains:	1-Butanol, Heptan-2-one
Hazard pictograms	
Signal word	Danger
Hazard statements	
H225	Highly flammable liquid and vapour.
H315 + H320	Causes skin and eye irritation
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H360	May damage fertility by ingestion.
H360	May damage fertility or the unborn child.
H360FD	May damage fertility. May damage the unborn child.
Precautionary statements	
Prevention	
P201	Use non-sparking tools and explosion-proof equipment.
P202	Obtain special instructions before use.
P210	Do not handle until all safety precautions have been read and understood.
P271	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233	Use only outdoors or in a well-ventilated area.
P240	Keep container tightly closed.
P241	Ground/bond container and receiving equipment.
P242	Use explosion-proof electrical/ventilating/lighting equipment.
P243	Use only non-sparking tools.
P261	Take precautionary measures against static discharge.
P264	Avoid breathing mist or vapour.
P264	Wash hands thoroughly after handling.
P280	Wash thoroughly after handling.
	Wear protective gloves/eye protection/face protection.
Response	
	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P370 + P378	In case of fire: Use appropriate media for extinction.
P301 + P330 + P331	IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P370 + P378	In case of fire: Use for extinction.
P308 + P313	IF exposed or concerned: Get medical advice/attention.
P312	Call a POISON CENTRE or doctor/physician if you feel unwell.
P337 + P313	If eye irritation persists: Get medical advice/attention.
Storage	
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P405	Store locked up.
Disposal	
P501	See section 13 of this SDS for disposal instructions.
	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.
Supplemental label information	None.
2.3. Other hazards	This product may contain the following ingredients; xylene, toluene, n-hexane, cyclohexane, naphthalene, benzene and ethyl benzene.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Heptan-2-one	5 - 25	110-43-0 203-767-1	-	606-024-00-3	#
Classification:	DSD: R10, Xn;R20/22				
	CLP: Flam. Liq. 3;H226, Acute Tox. 4;H302, Acute Tox. 4;H332, STOT SE 3;H336				
BENZENE, DIMETHYL	5 - 15	1330-20-7 215-535-7	-	601-022-00-9	#
Classification:	DSD: R10, Xn;R20/21, Xi;R38				C
	CLP: Flam. Liq. 3;H226, Acute Tox. 4;H312, Skin Irrit. 2;H315, Acute Tox. 4;H332, Aquatic Chronic 2;H411				C
1-Butanol	1 - 5	71-36-3 200-751-6	-	603-004-00-6	
Classification:	DSD: R10, Xn;R22, Xi;R37/38-41, R67				
	CLP: Flam. Liq. 3;H226, Acute Tox. 4;H302, Skin Irrit. 2;H315, Eye Dam. 1;H318, STOT SE 3;H335, STOT SE 3;H336, Aquatic Chronic 3;H412				

Other components below reportable levels 73,56

SECTION 4: First aid measures

General information Not available.

4.1. Description of first aid measures

Inhalation	Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.
Skin contact	Immediately remove contaminated clothing and shoes and wash skin with soap and plenty of water. If clothing sticks to the skin, do not remove. Wash contact areas with soap and water. If needed, seek medical attention.
Eye contact	Get medical attention if irritation develops and persists. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Ingestion	DO NOT induce vomiting. Get medical attention immediately. Rinse mouth.

4.2. Most important symptoms and effects, both acute and delayed Irritation of eyes and mucous membranes.

4.3. Indication of any immediate medical attention and special treatment needed Treat symptomatically. Symptoms may be delayed.

SECTION 5: Firefighting measures

General fire hazards Flammable liquid and vapour.

5.1. Extinguishing media

Suitable extinguishing media Water Spray, Fog, CO2, dry chemical, or Alcohol Resistant Foam

Unsuitable extinguishing media Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture Do not use forced stream as this could cause fire to spread.

5.3. Advice for firefighters

Special protective equipment for firefighters Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Structural firefighters protective clothing will only provide limited protection.

Special fire fighting procedures

In the event of fire, cool tanks with water spray. Do not release runoff from fire control methods to sewers or waterways.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures****For non-emergency personnel**

Eliminate all sources of ignition.

For emergency responders

Use personal protection recommended in Section 8 of the SDS. Keep unnecessary personnel away.

6.2. Environmental precautions

Do not allow the spilled product to enter public drainage systems or open watercourses.

6.3. Methods and material for containment and cleaning up

Remove sources of ignition. For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways. Dike far ahead of spill for later disposal. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Ventilate area and avoid breathing vapors or mist.

6.4. Reference to other sections

Not available.

SECTION 7: Handling and storage**7.1. Precautions for safe handling**

Avoid heat, sparks, open flames and other ignition sources. Avoid breathing mist or vapour. Avoid contact with eyes and prolonged or repeated contact with skin.

7.2. Conditions for safe storage, including any incompatibilities

Store in a well-ventilated place. Avoid heat, sparks, open flames and other ignition sources. Prevent electrostatic charge build-up by using common bonding and grounding techniques.

7.3. Specific end use(s)

Not available.

SECTION 8: Exposure controls/personal protection**8.1. Control parameters****Occupational exposure limits****Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001**

Components	Type	Value
1-Butanol (CAS 71-36-3)	MAK	150 mg/m3
		50 ppm
	STEL	600 mg/m3
BENZENE, DIMETHYL (CAS 1330-20-7)		200 ppm
	MAK	221 mg/m3
		50 ppm
	STEL	442 mg/m3
		100 ppm
Heptan-2-one (CAS 110-43-0)	MAK	237 mg/m3
		50 ppm
	STEL	473 mg/m3
		100 ppm

Belgium. Exposure Limit Values. Components

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	62 mg/m3
		20 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3
		100 ppm
	TWA	221 mg/m3
		50 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
		100 ppm
	TWA	238 mg/m3
		50 ppm

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

Components	Type	Value
BENZENE, DIMETHYL (CAS 1330-20-7)	TWA	100 mg/m3
	STEL	442 mg/m3
Heptan-2-one (CAS 110-43-0)	TWA	100 ppm
		221 mg/m3
	STEL	50 ppm
		475 mg/m3
	TWA	100 ppm
		238 mg/m3
		50 ppm

Croatia. Dangerous Substance Exposure Limit Values in the Workplace (ELVs), Annexes 1 and 2, Narodne Novine, 13/09

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	154 mg/m3 50 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	MAC	221 mg/m3
	STEL	50 ppm 442 mg/m3
Heptan-2-one (CAS 110-43-0)	MAC	100 ppm
		238 mg/m3
	STEL	50 ppm 475 mg/m3 100 ppm

Cyprus. OELs. Control of factory atmosphere and dangerous substances in factories regulation, PI 311/73, as amended.

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	150 mg/m3 50 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	TWA	435 mg/m3
		100 ppm

Czech Republic. OELs. Government Decree 361

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	600 mg/m3
	TWA	300 mg/m3
BENZENE, DIMETHYL (CAS 1330-20-7)	Ceiling	400 mg/m3
	TWA	200 mg/m3
Heptan-2-one (CAS 110-43-0)	Ceiling	300 mg/m3
	TWA	150 mg/m3

Denmark. Work Environment Authority. Exposure Limits for Substances & Materials, An. 2 & 3

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	150 mg/m3
		50 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	TLV	109 mg/m3
		25 ppm
Heptan-2-one (CAS 110-43-0)	TLV	238 mg/m3
		50 ppm

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	45 mg/m3
		15 ppm

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	450 mg/m3
	TWA	100 ppm 200 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Finland. Workplace Exposure Limits

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	230 mg/m3 75 ppm
	TWA	150 mg/m3 50 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	440 mg/m3
	TWA	100 ppm 220 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	STEL	360 mg/m3
	TWA	75 ppm 240 mg/m3 50 ppm

France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984

Components	Type	Value
1-Butanol (CAS 71-36-3)	VLE	150 mg/m3 50 ppm
	VME	442 mg/m3 100 ppm 221 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	VLE	475 mg/m3
	VME	100 ppm 238 mg/m3 50 ppm

Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG)

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	310 mg/m3 100 ppm
	TWA	440 mg/m3 100 ppm

Germany. TRGS 900, Limit Values in the Ambient Air at the Workplace

Components	Type	Value
1-Butanol (CAS 71-36-3)	AGW	310 mg/m3 100 ppm
	AGW	440 mg/m3
BENZENE, DIMETHYL (CAS 1330-20-7)	AGW	100 ppm
	AGW	238 mg/m3

Greece. OELs (Decree No. 90/1999, as amended)

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	300 mg/m3 100 ppm
	TWA	300 mg/m3 100 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	650 mg/m3 150 ppm
	TWA	435 mg/m3 100 ppm
Heptan-2-one (CAS 110-43-0)	STEL	465 mg/m3 100 ppm
	TWA	465 mg/m3 100 ppm

Hungary. OELs. Joint Decree on Chemical Safety of Workplaces

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	90 mg/m3
	TWA	45 mg/m3
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3
	TWA	221 mg/m3
Heptan-2-one (CAS 110-43-0)	STEL	476 mg/m3
	TWA	238 mg/m3

Iceland. OELs. Regulation 154/1999 on occupational exposure limits

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3 50 ppm
	TWA	80 mg/m3 25 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3 100 ppm
	TWA	109 mg/m3 25 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3 100 ppm
	TWA	238 mg/m3 50 ppm

Ireland. Occupational Exposure Limits

Components	Type	Value
1-Butanol (CAS 71-36-3) BENZENE, DIMETHYL (CAS 1330-20-7)	TWA	20 ppm
	STEL	442 mg/m3 100 ppm
Heptan-2-one (CAS 110-43-0)	TWA	221 mg/m3 50 ppm
	STEL	475 mg/m3 100 ppm
	TWA	238 mg/m3 50 ppm

Italy. Occupational Exposure Limits

Components	Type	Value
1-Butanol (CAS 71-36-3) BENZENE, DIMETHYL (CAS 1330-20-7)	TWA	20 ppm
	STEL	442 mg/m3 100 ppm
	TWA	221 mg/m3

Italy. Occupational Exposure Limits Components

Type	Value
STEL	50 ppm 475 mg/m3
TWA	100 ppm 238 mg/m3 50 ppm

Latvia. OELs. Occupational exposure limit values of chemical substances in work environment Components

Type	Value
TWA	10 mg/m3
STEL	442 mg/m3
TWA	100 ppm 221 mg/m3 50 ppm
STEL	475 mg/m3
TWA	100 ppm 238 mg/m3 50 ppm

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements Components

Type	Value
Ceiling	90 mg/m3 30 ppm
TWA	45 mg/m3 15 ppm
STEL	450 mg/m3
TWA	100 ppm 200 mg/m3 50 ppm
STEL	250 mg/m3
TWA	50 ppm 120 mg/m3 25 ppm

Luxembourg. Binding Occupational exposure limit values (Annex I), Memorial A Components

Type	Value
STEL	442 mg/m3
TWA	100 ppm 221 mg/m3 50 ppm
STEL	475 mg/m3
TWA	100 ppm 238 mg/m3 50 ppm

Malta. OELs. Occupational Exposure Limit Values (L.N. 227. of Occupational Health and Safety Authority Act (CAP. 424), Schedules I and V) Components

Type	Value
STEL	442 mg/m3
TWA	100 ppm 221 mg/m3 50 ppm
STEL	475 mg/m3
TWA	100 ppm 238 mg/m3 50 ppm

Netherlands. OELs (binding)

Components	Type	Value
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3
	TWA	210 mg/m3
Heptan-2-one (CAS 110-43-0)	TWA	233 mg/m3

Norway. Administrative Norms for Contaminants in the Workplace

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	75 mg/m3 25 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	TLV	108 mg/m3
		25 ppm
Heptan-2-one (CAS 110-43-0)	TLV	115 mg/m3 25 ppm

Poland. MACs. Minister of Labour and Social Policy Regarding Maximum Allowable Concentrations and Intensities in Working Environment

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3
	TWA	50 mg/m3
BENZENE, DIMETHYL (CAS 1330-20-7)	TWA	100 mg/m3
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	238 mg/m3

Portugal. OELs. Decree-Law n. 290/2001 (Journal of the Republic - 1 Series A, n.266)

Components	Type	Value
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3
	TWA	100 ppm 221 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796)

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	20 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm
Heptan-2-one (CAS 110-43-0)	TWA	50 ppm

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	200 mg/m3 66 ppm
	TWA	100 mg/m3 33 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3
	TWA	100 ppm 221 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

Components	Type	Value

50 ppm

Slovakia. OELs. Regulation No. 300/2007 concerning protection of health in work with chemical agents

Components	Type	Value

1-Butanol (CAS 71-36-3) TWA 310 mg/m3

100 ppm

BENZENE, DIMETHYL (CAS 1330-20-7) STEL 442 mg/m3

100 ppm

TWA 221 mg/m3

Heptan-2-one (CAS 110-43-0) STEL 50 ppm
475 mg/m3

100 ppm

TWA 238 mg/m3

50 ppm

Slovenia. OELs. Regulations concerning protection of workers against risks due to exposure to chemicals while working (Official Gazette of the Republic of Slovenia)

Components	Type	Value

1-Butanol (CAS 71-36-3) TWA 310 mg/m3

100 ppm

BENZENE, DIMETHYL (CAS 1330-20-7) TWA 221 mg/m3

50 ppm

Heptan-2-one (CAS 110-43-0) TWA 238 mg/m3

50 ppm

Spain. Occupational Exposure Limits

Components	Type	Value

1-Butanol (CAS 71-36-3) STEL 154 mg/m3

50 ppm

TWA 61 mg/m3

20 ppm

BENZENE, DIMETHYL (CAS 1330-20-7) STEL 442 mg/m3

100 ppm

TWA 221 mg/m3

50 ppm

Heptan-2-one (CAS 110-43-0) STEL 474 mg/m3

100 ppm

TWA 237 mg/m3

50 ppm

Sweden. Occupational Exposure Limit Values

Components	Type	Value

1-Butanol (CAS 71-36-3) Ceiling 90 mg/m3

30 ppm

TWA 45 mg/m3

15 ppm

BENZENE, DIMETHYL (CAS 1330-20-7) STEL 442 mg/m3

100 ppm

TWA 221 mg/m3

50 ppm

Heptan-2-one (CAS 110-43-0) STEL 250 mg/m3

50 ppm

TWA 120 mg/m3

25 ppm

Switzerland. SUVA Grenzwerte am Arbeitsplatz

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3 50 ppm
	TWA	150 mg/m3 50 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	870 mg/m3 200 ppm
	TWA	435 mg/m3 100 ppm
Heptan-2-one (CAS 110-43-0)	TWA	235 mg/m3 50 ppm

UK. EH40 Workplace Exposure Limits (WELs)

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	154 mg/m3 50 ppm
	TWA	441 mg/m3 100 ppm
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	220 mg/m3 50 ppm
	TWA	475 mg/m3 100 ppm
Heptan-2-one (CAS 110-43-0)	STEL	237 mg/m3 50 ppm
	TWA	475 mg/m3 100 ppm

EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU

Components	Type	Value
BENZENE, DIMETHYL (CAS 1330-20-7)	STEL	442 mg/m3 100 ppm
	TWA	221 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3 100 ppm
	TWA	238 mg/m3 50 ppm

Biological limit values**Finland. HTP-arvot, App 2., Biological Limit Values, (BRA/BGV) , Social Affairs and Ministry of Health**

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	5 mmol/l	Methylhippuric acids	Urine	*

* - For sampling details, please see the source document.

France. Biological indicators of exposure (IBE) (National Institute for Research and Security (INRS, ND 2065)

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	1500 mg/g	Acides méthylhippuriques	Creatinine in urine	*

* - For sampling details, please see the source document.

Germany. TRGS 903, BAT List (Biological Limit Values)

Components	Value	Determinant	Specimen	Sampling time
1-Butanol (CAS 71-36-3)	2 mg/g	1-Butanol (nach Hydrolyse)	Creatinine in urine	*
	10 mg/g	1-Butanol (nach Hydrolyse)	Creatinine in urine	*

Germany. TRGS 903, BAT List (Biological Limit Values)

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	2000 mg/l	Methylhippur-(Tolur-) säure (alle Isomere)	Urine	*
	1,5 mg/l	Xylol	Blood	*

* - For sampling details, please see the source document.

Hungary. Chemical Safety at Workplace Ordinance Joint Decree No. 25/2000 (Annex 2): Permissible limit values of biological exposure (effect) indices

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	1500 mg/g	methyl hippuric acids	Creatinine in urine	*
	860 µmol/mmol	methyl hippuric acids	Creatinine in urine	*

* - For sampling details, please see the source document.

Slovakia. BLVs (Biological Limit Value). Regulation no. 355/2006 concerning protection of workers exposed to chemical agents, Annex 2

Components	Value	Determinant	Specimen	Sampling time
1-Butanol (CAS 71-36-3)	2 mg/g	N-Butyl Alcohol	Creatinine in urine	*
	10 mg/g	N-Butyl Alcohol	Creatinine in urine	*
BENZENE, DIMETHYL (CAS 1330-20-7)	1334 mg/g	Methylhippuric acids	Creatinine in urine	*
	2000 mg/l	Methylhippuric acids	Urine	*
	1,5 mg/l	XYLENE	Blood	*

* - For sampling details, please see the source document.

Spain. Biological Limit Values (VLBs), Occupational Exposure Limits for Chemical Agents, Table 4

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	1,5 g/g	Ácidos metilhipúricos	Creatinine in urine	*

* - For sampling details, please see the source document.

Switzerland. BAT-Werte (Biological Limit Values in the Workplace as per SUVA)

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	1,5 g/g	Methyl-Hippurs äure	Creatinine in urine	*
	1,5 mg/l	Xylol	Blood	*

* - For sampling details, please see the source document.

UK. EH40 Biological Monitoring Guidance Values (BMGVs)

Components	Value	Determinant	Specimen	Sampling time
BENZENE, DIMETHYL (CAS 1330-20-7)	650 mmol/mol	Methyl hippuric acid	Creatinine in urine	*

* - For sampling details, please see the source document.

Recommended monitoring procedures Not available.

Derived no-effect level (DNEL) Not available.

Predicted no effect concentrations (PNECs) Not available.

Exposure guidelines**EU Exposure Limit Values: Skin designation**

BENZENE, DIMETHYL (CAS 1330-20-7)

Can be absorbed through the skin.

Heptan-2-one (CAS 110-43-0)

Can be absorbed through the skin.

8.2. Exposure controls

Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Explosion-proof general and local exhaust ventilation.
Individual protection measures, such as personal protective equipment	
General information	Not available.
Eye/face protection	Chemical goggles and face shield are recommended.
Skin protection	
- Hand protection	Use protective gloves.
- Other	Plastic or rubber gloves, apron and boots.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
Thermal hazards	Not available.
Hygiene measures	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.
Environmental exposure controls	Not available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance

Physical state	Liquid.
Form	Liquid.
Colour	Varies
Odour	Acetone-like.
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	26,7 °C (80,0 °F) Tag closed cup
Evaporation rate	1,8 BuAc
Flammability (solid, gas)	Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	1,1 % estimated
	1,4 %
Flammability limit - upper (%)	Not available.
Vapour pressure	Not available.
Vapour density	> 1
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Solubility (other)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	> 499 °C (> 930,2 °F)
Decomposition temperature	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidizing properties	Not available.

9.2. Other information

Specific gravity	11,54
VOC (Weight %)	3,31 lb/gal

SECTION 10: Stability and reactivity

10.1. Reactivity	Not available.
10.2. Chemical stability	Stable.
10.3. Possibility of hazardous reactions	Will not occur.
10.4. Conditions to avoid	Heat, sparks, flames.
10.5. Incompatible materials	Strong oxidising agents.
10.6. Hazardous decomposition products	Upon decomposition, this product emits oxides of sulfur, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

SECTION 11: Toxicological information

General information Not available.

Information on likely routes of exposure

Ingestion	May cause gastrointestinal discomfort if swallowed. Do not induce vomiting. Vomiting may increase risk of product aspiration.
Inhalation	Vapours have a narcotic effect and may cause headache, fatigue, dizziness and nausea.
Skin contact	Not available.
Eye contact	Causes serious eye irritation.

Symptoms Not available.

11.1. Information on toxicological effects

Components	Species	Test results
1-Butanol (CAS 71-36-3)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	3400 mg/kg
<i>Inhalation</i>		
LC50	Rat	8000 ppm, 4 Hours
<i>Oral</i>		
LD50	Rat	790 mg/kg
<i>Other</i>		
LD50	Mouse	377 mg/kg
	Rat	310 mg/kg
BENZENE, DIMETHYL (CAS 1330-20-7)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	> 43 g/kg
<i>Inhalation</i>		
LC50	Mouse	3907 mg/l, 6 Hours
	Rat	6350 mg/l, 4 Hours
<i>Oral</i>		
LD50	Mouse	1590 mg/kg
	Rat	3523 - 8600 mg/kg
<i>Other</i>		
LD50	Rat	3,8 mg/kg
Heptan-2-one (CAS 110-43-0)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	12600 mg/kg
<i>Oral</i>		
LD50	Mouse	730 mg/kg
	Rat	1,67 g/kg

Components	Species	Test results
<i>Other</i> LD50	Rat	800 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Not available. Irritating and may cause redness and pain.

Serious eye damage/eye irritation Causes eye irritation.

Respiratory sensitisation Not available.

Skin sensitisation Not available.

Germ cell mutagenicity Not available.

Carcinogenicity

IARC Monographs. Overall Evaluation of Carcinogenicity

BENZENE, DIMETHYL (CAS 1330-20-7)

3 Not classifiable as to carcinogenicity to humans.

Reproductive toxicity Components in this product have been shown to cause birth defects and reproductive disorders in laboratory animals.

Specific target organ toxicity - single exposure Narcotic effects.

Specific target organ toxicity - repeated exposure Not available.

Aspiration hazard Not available.

Mixture versus substance information Not available.

Other information Symptoms may be delayed.

SECTION 12: Ecological information

12.1. Toxicity Not expected to be harmful to aquatic organisms.

Components	Species	Test results
1-Butanol (CAS 71-36-3)		
Aquatic		
Crustacea	EC50	Water flea (Daphnia magna) 1897 - 2072 mg/l, 48 hours
Fish	LC50	Bluegill (Lepomis macrochirus) 100 - 500 mg/l, 96 hours
BENZENE, DIMETHYL (CAS 1330-20-7)		
Aquatic		
Fish	LC50	Bluegill (Lepomis macrochirus) 7,711 - 9,591 mg/l, 96 hours
Heptan-2-one (CAS 110-43-0)		
Aquatic		
Fish	LC50	Fathead minnow (Pimephales promelas) 126 - 137 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

12.2. Persistence and degradability No data is available on the degradability of this product.

12.3. Bioaccumulative potential Not available.

Partition coefficient n-octanol/water (log Kow)

1-Butanol	0,88
BENZENE, DIMETHYL	3,12 - 3,2
Heptan-2-one	1,98

Bioconcentration factor (BCF) Not available.

12.4. Mobility in soil Not available.

12.5. Results of PBT and vPvB assessment Not a PBT or vPvB substance or mixture.

12.6. Other adverse effects Not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste	Dispose of in accordance with local regulations.
Contaminated packaging	Residual vapours may explode on ignition; do not cut, drill, grind, or weld on or near this container. Recycle empty drums at an appropriate facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal. Ensure drums are tightly sealed.
EU waste code	The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Disposal methods/information	Dispose of contents/container in accordance with local/regional/national/international regulations.

SECTION 14: Transport information

ADR

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3
Hazard No. (ADR)	30
Tunnel restriction code	D/E
14.4. Packing group	II
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

RID

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3
14.4. Packing group	II
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

ADN

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3
14.4. Packing group	II
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

IATA

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Material
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	II
14.5. Environmental hazards	No.

ERG Code	3L
14.6. Special precautions for user	Not available.
Other information	
Passenger and cargo aircraft	Allowed.
Cargo aircraft only	Allowed.

IMDG

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	II
14.5. Environmental hazards	
Marine pollutant	No.
EmS	F-E, S-D
14.6. Special precautions for user	Not available.
14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

ADN; ADR; IATA; IMDG; RID



SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, Article 59(1). Candidate List

Not listed.

Authorisations

Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended

Not listed.

Restrictions on use

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use

Not regulated.

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Not listed.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

Not listed.

Other EU regulations**Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances**

Not listed.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

1-Butanol (CAS 71-36-3)

BENZENE, DIMETHYL (CAS 1330-20-7)

Heptan-2-one (CAS 110-43-0)

Directive 94/33/EC on the protection of young people at work

Not listed.

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws.
This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006.

National regulations

Not available.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out.

SECTION 16: Other information**International Inventories**

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

List of abbreviations

Not available.

References

Not available.

Information on evaluation method leading to the classification of mixture

Not available.

Full text of any statements or R-phrases and H-statements under Sections 2 to 15

R10 Flammable.
R20 Harmful by inhalation.
R20/21 Harmful by inhalation and in contact with skin.
R20/22 Harmful by inhalation and if swallowed.
R22 Harmful if swallowed.
R37/38 Irritating to respiratory system and skin.
R38 Irritating to skin.
R41 Risk of serious damage to eyes.
R67 Vapours may cause drowsiness and dizziness.
H226 Flammable liquid and vapour.
H302 Harmful if swallowed.

H312 Harmful in contact with skin.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H332 Harmful if inhaled.
H335 May cause respiratory irritation.
H336 May cause drowsiness or dizziness.
H411 Toxic to aquatic life with long lasting effects.
H412 Harmful to aquatic life with long lasting effects.

Revision information

Product and Company Identification: Product and Company Identification
Physical & Chemical Properties: Multiple Properties
Regulatory Information: United States

Training information

Not available.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SECTION 1: Identification of the substance/mixture and of the company/undertaking
1.1. Product identifier

Trade name or designation of the mixture Pennguard HP Epoxy Primer Part B
Registration number -
Synonyms None.
Issue date 26-July-2013
Version number 03
Revision date 07-January-2016
Supersedes date 22-June-2015

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Not available.
Uses advised against None known.

1.3. Details of the supplier of the safety data sheet

Company name ErgonArmor, a division of Ergon Asphalt & Emulsions, Inc.
Address 2829 Lakeland Drive
 Jackson, MS 39232
 USA
After hours telephone number 1-800-222-7122
Normal work hours telephone number 1-877-982-7667
Website www.ergonarmor.com
e-mail sds@ergon.com
Emergency 24-hour telephone number CHEMTREC: North America 1-800-424-9300 International 1-800-527-3887
Information on operation hours 8:00 a.m. to 5:00 p.m.

SECTION 2: Hazards identification
2.1. Classification of the substance or mixture

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification R10, Xn;R20/22, Xi;R36

Classification according to Regulation (EC) No 1272/2008 as amended

Physical hazards

Flammable liquids	Category 3	H226 - Flammable liquid and vapour.

Health hazards

Acute toxicity, oral	Category 4	H302 - Harmful if swallowed.
Acute toxicity, inhalation	Category 4	H332 - Harmful if inhaled.
Serious eye damage/eye irritation	Category 2	

Hazard summary

Physical hazards Flammable.
Health hazards Harmful by inhalation and if swallowed. Irritating to eyes. Occupational exposure to the substance or mixture may cause adverse health effects.
Environmental hazards Not classified for hazards to the environment.
Specific hazards Causes burns.
Main symptoms Not available.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains: 1-Butanol, Heptan-2-one

Hazard pictograms



Signal word

Danger

Hazard statements

H226 Flammable liquid and vapour.
H302 Harmful if swallowed.
H332 Harmful if inhaled.
H320 Causes eye irritation.

Precautionary statements

Prevention

P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P241 Use explosion-proof electrical/ventilating/lighting equipment.
P242 Use only non-sparking tools.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P243 Take precautionary measures against static discharge.
P240 Ground/bond container and receiving equipment.
P271 Use only outdoors or in a well-ventilated area.
P261 Avoid breathing mist or vapour.
P233 Keep container tightly closed.
P264 Wash thoroughly after handling.

Response

P301 + P330 + P331 If skin irritation occurs, seek medical advice/attention.
P303 + P361 + P353 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P370 + P378 In case of fire: Use appropriate media for extinction.
P312 Call a POISON CENTRE or doctor/physician if you feel unwell.
P301 + P312 IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell.

Storage

P410 + P403 Protect from sunlight. Store in a well-ventilated place.
P233 Keep container tightly closed.
P405 Store locked up.

Disposal

P501 See section 13 of this SDS for disposal instructions.
Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Supplemental label information

2.3. Other hazards

This product may contain the following ingredients; xylene, toluene, n-hexane, cyclohexane, naphthalene, benzene and ethyl benzene.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Heptan-2-one	30 - 50	110-43-0 203-767-1	-	606-024-00-3	#

Classification: DSD: R10, Xn;R20/22

CLP: Flam. Liq. 3;H226, Acute Tox. 4;H302, Acute Tox. 4;H332, STOT SE 3;H336

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
1-Butanol	1 - 10	71-36-3 200-751-6	-	603-004-00-6	
Classification:	DSD: R10, Xn;R22, Xi;R37/38-41, R67				
	CLP: Flam. Liq. 3;H226, Acute Tox. 4;H302, Skin Irrit. 2;H315, Eye Dam. 1;H318, STOT SE 3;H335, STOT SE 3;H336, Aquatic Chronic 3;H412				
Other components below reportable levels 34,4					
Composition comments	The full text for all R- and H-phrases is displayed in section 16.				
SECTION 4: First aid measures					
General information	Not available.				
4.1. Description of first aid measures					
Inhalation	Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.				
Skin contact	Immediately remove contaminated clothing and shoes and wash skin with soap and plenty of water. If clothing sticks to the skin, do not remove. Wash contact areas with soap and water. If needed, seek medical attention.				
Eye contact	Get medical attention if irritation develops and persists. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing.				
Ingestion	DO NOT induce vomiting. Get medical attention immediately. Rinse mouth.				
4.2. Most important symptoms and effects, both acute and delayed	Irritation of eyes and mucous membranes.				
4.3. Indication of any immediate medical attention and special treatment needed	Treat symptomatically. Symptoms may be delayed.				
SECTION 5: Firefighting measures					
General fire hazards	Flammable liquid and vapour.				
5.1. Extinguishing media					
Suitable extinguishing media	Water Spray, Fog, CO2, dry chemical, or Alcohol Resistant Foam				
Unsuitable extinguishing media	Do not use a solid water stream as it may scatter and spread fire.				
5.2. Special hazards arising from the substance or mixture	Do not use forced stream as this could cause fire to spread.				
5.3. Advice for firefighters					
Special protective equipment for firefighters	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Structural firefighters protective clothing will only provide limited protection.				
Special fire fighting procedures	In the event of fire, cool tanks with water spray. Do not release runoff from fire control methods to sewers or waterways.				
SECTION 6: Accidental release measures					
6.1. Personal precautions, protective equipment and emergency procedures					
For non-emergency personnel	Eliminate all sources of ignition.				
For emergency responders	Use personal protection recommended in Section 8 of the SDS. Keep unnecessary personnel away.				
6.2. Environmental precautions	Do not allow the spilled product to enter public drainage systems or open watercourses.				
6.3. Methods and material for containment and cleaning up	Remove sources of ignition. For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways. Dike far ahead of spill for later disposal. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Ventilate area and avoid breathing vapors or mist.				

6.4. Reference to other sections

Not available.

SECTION 7: Handling and storage**7.1. Precautions for safe handling**

Avoid heat, sparks, open flames and other ignition sources. Avoid breathing mist or vapour. Avoid contact with eyes and prolonged or repeated contact with skin.

7.2. Conditions for safe storage, including any incompatibilities

Store in a well-ventilated place. Avoid heat, sparks, open flames and other ignition sources. Prevent electrostatic charge build-up by using common bonding and grounding techniques.

7.3. Specific end use(s)

Not available.

SECTION 8: Exposure controls/personal protection**8.1. Control parameters****Occupational exposure limits****Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001**

Components	Type	Value
1-Butanol (CAS 71-36-3)	MAK	150 mg/m3
	STEL	50 ppm 600 mg/m3 200 ppm
Heptan-2-one (CAS 110-43-0)	MAK	237 mg/m3
	STEL	50 ppm 473 mg/m3 100 ppm

Belgium. Exposure Limit Values.

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	62 mg/m3 20 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3
	TWA	100 mg/m3
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Croatia. Dangerous Substance Exposure Limit Values in the Workplace (ELVs), Annexes 1 and 2, Narodne Novine, 13/09

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	154 mg/m3 50 ppm
Heptan-2-one (CAS 110-43-0)	MAC	238 mg/m3
	STEL	50 ppm 475 mg/m3 100 ppm

Cyprus. OELs. Control of factory atmosphere and dangerous substances in factories regulation, PI 311/73, as amended.

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	150 mg/m3 50 ppm

Czech Republic. OELs. Government Decree 361

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	600 mg/m3
	TWA	300 mg/m3
Heptan-2-one (CAS 110-43-0)	Ceiling	300 mg/m3
	TWA	150 mg/m3

Denmark. Work Environment Authority. Exposure Limits for Substances & Materials, An. 2 & 3

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	150 mg/m3
		50 ppm
Heptan-2-one (CAS 110-43-0)	TLV	238 mg/m3
		50 ppm

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	45 mg/m3
		15 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
		100 ppm
	TWA	238 mg/m3
		50 ppm

Finland. Workplace Exposure Limits

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	230 mg/m3
		75 ppm
	TWA	150 mg/m3
Heptan-2-one (CAS 110-43-0)		50 ppm
	STEL	360 mg/m3
		75 ppm
	TWA	240 mg/m3
		50 ppm

France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984

Components	Type	Value
1-Butanol (CAS 71-36-3)	VLE	150 mg/m3
		50 ppm
Heptan-2-one (CAS 110-43-0)	VLE	475 mg/m3
		100 ppm
	VME	238 mg/m3
		50 ppm

Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG)

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	310 mg/m3
		100 ppm

Germany. TRGS 900, Limit Values in the Ambient Air at the Workplace

Components	Type	Value
1-Butanol (CAS 71-36-3)	AGW	310 mg/m3
		100 ppm
Heptan-2-one (CAS 110-43-0)	AGW	238 mg/m3

Greece. OELs (Decree No. 90/1999, as amended)

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	300 mg/m3
		100 ppm
	TWA	300 mg/m3

Greece. OELs (Decree No. 90/1999, as amended)

Components	Type	Value
Heptan-2-one (CAS 110-43-0)	STEL	100 ppm
		465 mg/m3
	TWA	100 ppm 465 mg/m3 100 ppm

Hungary. OELs. Joint Decree on Chemical Safety of Workplaces

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	90 mg/m3
	TWA	45 mg/m3
Heptan-2-one (CAS 110-43-0)	STEL	476 mg/m3
	TWA	238 mg/m3

Iceland. OELs. Regulation 154/1999 on occupational exposure limits

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3 50 ppm
	TWA	80 mg/m3 25 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Ireland. Occupational Exposure Limits

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	20 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Italy. Occupational Exposure Limits

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	20 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Latvia. OELs. Occupational exposure limit values of chemical substances in work environment

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	10 mg/m3
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	90 mg/m3 30 ppm
	TWA	45 mg/m3 15 ppm
Heptan-2-one (CAS 110-43-0)	STEL	250 mg/m3
	TWA	50 ppm 120 mg/m3

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

Components	Type	Value

25 ppm

Luxembourg. Binding Occupational exposure limit values (Annex I), Memorial A

Components	Type	Value
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Malta. OELs. Occupational Exposure Limit Values (L.N. 227. of Occupational Health and Safety Authority Act (CAP. 424), Schedules I and V)

Components	Type	Value
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Netherlands. OELs (binding)

Components	Type	Value
Heptan-2-one (CAS 110-43-0)	TWA	233 mg/m3

Norway. Administrative Norms for Contaminants in the Workplace

Components	Type	Value
1-Butanol (CAS 71-36-3)	Ceiling	75 mg/m3 25 ppm
Heptan-2-one (CAS 110-43-0)	TLV	115 mg/m3 25 ppm

Poland. MACs. Minister of Labour and Social Policy Regarding Maximum Allowable Concentrations and Intensities in Working Environment

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	150 mg/m3
	TWA	50 mg/m3
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	238 mg/m3

Portugal. OELs. Decree-Law n. 290/2001 (Journal of the Republic - 1 Series A, n.266)

Components	Type	Value
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3 50 ppm

Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796)

Components	Type	Value
1-Butanol (CAS 71-36-3)	TWA	20 ppm
Heptan-2-one (CAS 110-43-0)	TWA	50 ppm

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

Components	Type	Value
1-Butanol (CAS 71-36-3)	STEL	200 mg/m3 66 ppm
	TWA	100 mg/m3 33 ppm
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm 238 mg/m3

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

Components	Type	Value

50 ppm

Slovakia. OELs. Regulation No. 300/2007 concerning protection of health in work with chemical agents

Components	Type	Value

1-Butanol (CAS 71-36-3) TWA 310 mg/m3

100 ppm

Heptan-2-one (CAS 110-43-0) STEL 475 mg/m3

100 ppm

TWA 238 mg/m3

50 ppm

Slovenia. OELs. Regulations concerning protection of workers against risks due to exposure to chemicals while working (Official Gazette of the Republic of Slovenia)

Components	Type	Value

1-Butanol (CAS 71-36-3) TWA 310 mg/m3

100 ppm

Heptan-2-one (CAS 110-43-0) TWA 238 mg/m3

50 ppm

Spain. Occupational Exposure Limits

Components	Type	Value

1-Butanol (CAS 71-36-3) STEL 154 mg/m3

50 ppm

TWA 61 mg/m3

20 ppm

Heptan-2-one (CAS 110-43-0) STEL 474 mg/m3

100 ppm

TWA 237 mg/m3

50 ppm

Sweden. Occupational Exposure Limit Values

Components	Type	Value

1-Butanol (CAS 71-36-3) Ceiling 90 mg/m3

30 ppm

TWA 45 mg/m3

15 ppm

Heptan-2-one (CAS 110-43-0) STEL 250 mg/m3

50 ppm

TWA 120 mg/m3

25 ppm

Switzerland. SUVA Grenzwerte am Arbeitsplatz

Components	Type	Value

1-Butanol (CAS 71-36-3) STEL 150 mg/m3

50 ppm

TWA 150 mg/m3

50 ppm

Heptan-2-one (CAS 110-43-0) TWA 235 mg/m3

50 ppm

UK. EH40 Workplace Exposure Limits (WELs)

Components	Type	Value

1-Butanol (CAS 71-36-3) STEL 154 mg/m3

50 ppm

Heptan-2-one (CAS 110-43-0) STEL 475 mg/m3

100 ppm

TWA 237 mg/m3

50 ppm

EU. Indicative Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU

Components	Type	Value
Heptan-2-one (CAS 110-43-0)	STEL	475 mg/m3
	TWA	100 ppm
		238 mg/m3 50 ppm

Biological limit values

Germany. TRGS 903, BAT List (Biological Limit Values)

Components	Value	Determinant	Specimen	Sampling time
1-Butanol (CAS 71-36-3)	2 mg/g	1-Butanol (nach Hydrolyse)	Creatinine in urine	*
	10 mg/g	1-Butanol (nach Hydrolyse)	Creatinine in urine	*

* - For sampling details, please see the source document.

Slovakia. BLVs (Biological Limit Value). Regulation no. 355/2006 concerning protection of workers exposed to chemical agents, Annex 2

Components	Value	Determinant	Specimen	Sampling time
1-Butanol (CAS 71-36-3)	2 mg/g	N-Butyl Alcohol	Creatinine in urine	*
	10 mg/g	N-Butyl Alcohol	Creatinine in urine	*

* - For sampling details, please see the source document.

Recommended monitoring procedures Not available.

Derived no-effect level (DNEL) Not available.

Predicted no effect concentrations (PNECs) Not available.

Exposure guidelines

EU Exposure Limit Values: Skin designation

Heptan-2-one (CAS 110-43-0)

Can be absorbed through the skin.

8.2. Exposure controls

Appropriate engineering controls Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.

Individual protection measures, such as personal protective equipment

General information Not available.

Eye/face protection Chemical goggles and face shield are recommended.

Skin protection

- Hand protection Use protective gloves.

- Other Plastic or rubber gloves, apron and boots.

Respiratory protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Thermal hazards Not available.

Hygiene measures Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

Environmental exposure controls Not available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance Clear.

Physical state Liquid.

Form Liquid.

Colour Amber.

Odour	Pungent ketone
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	38,9 °C (102,0 °F) Tag closed cup
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	1,4 %
Flammability limit - upper (%)	Not available.
Vapour pressure	Not available.
Vapour density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Solubility (other)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	> 499 °C (> 930,2 °F)
Decomposition temperature	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidizing properties	Not available.
9.2. Other information	
Specific gravity	0,91
VOC (Weight %)	4,22 lb/gal

SECTION 10: Stability and reactivity

10.1. Reactivity	Not available.
10.2. Chemical stability	Stable.
10.3. Possibility of hazardous reactions	Will not occur.
10.4. Conditions to avoid	Heat, sparks, flames.
10.5. Incompatible materials	Strong oxidising agents.
10.6. Hazardous decomposition products	Upon decomposition, this product emits oxides of sulfur, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.

SECTION 11: Toxicological information

General information	Not available.
Information on likely routes of exposure	
Ingestion	May be harmful if swallowed.
Inhalation	May be harmful if inhaled.
Skin contact	Not available.
Eye contact	Causes eye irritation.
Symptoms	Not available.
11.1. Information on toxicological effects	
Acute toxicity	Harmful if swallowed.

Components	Species	Test results
1-Butanol (CAS 71-36-3)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	3400 mg/kg
<i>Inhalation</i>		
LC50	Rat	8000 ppm, 4 Hours
<i>Oral</i>		
LD50	Rat	790 mg/kg
<i>Other</i>		
LD50	Mouse	377 mg/kg
	Rat	310 mg/kg
Heptan-2-one (CAS 110-43-0)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	12600 mg/kg
<i>Oral</i>		
LD50	Mouse	730 mg/kg
	Rat	1,67 g/kg
<i>Other</i>		
LD50	Rat	800 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes severe eye irritation.
Serious eye damage/eye irritation	Causes eye irritation.
Respiratory sensitisation	Not available.
Skin sensitisation	Not available.
Germ cell mutagenicity	Not available.
Carcinogenicity	Not available.
Reproductive toxicity	Not available.
Specific target organ toxicity - single exposure	Not available.
Specific target organ toxicity - repeated exposure	Not available.
Aspiration hazard	Not available.
Mixture versus substance information	Not available.
Other information	Symptoms may be delayed.

SECTION 12: Ecological information

12.1. Toxicity Not expected to be harmful to aquatic organisms.

Components	Species	Test results
1-Butanol (CAS 71-36-3)		
Aquatic		
Crustacea	EC50	Water flea (Daphnia magna) 1897 - 2072 mg/l, 48 hours
Fish	LC50	Bluegill (Lepomis macrochirus) 100 - 500 mg/l, 96 hours
Heptan-2-one (CAS 110-43-0)		
Aquatic		
Fish	LC50	Fathead minnow (Pimephales promelas) 126 - 137 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

12.2. Persistence and degradability No data is available on the degradability of this product.

12.3. Bioaccumulative potential	Not available.
Partition coefficient n-octanol/water (log Kow)	
1-Butanol	0,88
Heptan-2-one	1,98
Bioconcentration factor (BCF)	Not available.
12.4. Mobility in soil	Not available.
12.5. Results of PBT and vPvB assessment	Not a PBT or vPvB substance or mixture.
12.6. Other adverse effects	Not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste	Dispose of in accordance with local regulations.
Contaminated packaging	Residual vapours may explode on ignition; do not cut, drill, grind, or weld on or near this container. Recycle empty drums at an appropriate facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal. Ensure drums are tightly sealed.
EU waste code	The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Disposal methods/information	Dispose of contents/container in accordance with local/regional/national/international regulations.

SECTION 14: Transport information

ADR

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Hazard No. (ADR)	Not available.
Tunnel restriction code	D/E
14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

RID

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

ADN

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

IATA

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Material
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	No.
ERG Code	3L
14.6. Special precautions for user	Not available.
Other information	
Passenger and cargo aircraft	Allowed.
Cargo aircraft only	Allowed.

IMDG

14.1. UN number	UN1263
14.2. UN proper shipping name	Paint Related Materials
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	
Marine pollutant	No.
EmS	Not available.
14.6. Special precautions for user	Not available.
14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

ADN; ADR; IATA; IMDG; RID



SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, Article 59(1). Candidate List

Not listed.

Authorisations**Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended**

Not listed.

Restrictions on use**Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use**

Not regulated.

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Not listed.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

Not listed.

Other EU regulations**Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances**

Not listed.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

1-Butanol (CAS 71-36-3)

Heptan-2-one (CAS 110-43-0)

Directive 94/33/EC on the protection of young people at work

Not listed.

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws.
This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006.

National regulations

Not available.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out.

SECTION 16: Other information**International Inventories**

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

List of abbreviations

Not available.

References

Not available.

Information on evaluation method leading to the classification of mixture

Not available.

**Full text of any statements or
R-phrases and H-statements
under Sections 2 to 15**

R10 Flammable.
R20/22 Harmful by inhalation and if swallowed.
R22 Harmful if swallowed.
R36 Irritating to eyes.
R37/38 Irritating to respiratory system and skin.
R41 Risk of serious damage to eyes.
R67 Vapours may cause drowsiness and dizziness.
H226 Flammable liquid and vapour.
H302 Harmful if swallowed.
H315 Causes skin irritation.
H318 Causes serious eye damage.
H332 Harmful if inhaled.
H335 May cause respiratory irritation.
H336 May cause drowsiness or dizziness.
H412 Harmful to aquatic life with long lasting effects.

Revision information

Product and Company Identification: Product and Company Identification
Physical & Chemical Properties: Multiple Properties
GHS: Classification

Training information

Not available.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SECTION 1: Identification of the substance/mixture and of the company/undertaking
1.1. Product identifier

Trade name or designation of the mixture PENNGUARD ADHESIVE MEMBRANE PART A
Registration number -
Synonyms None.
Issue date 26-April-2016
Version number 01

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Not available.
Uses advised against None known.

1.3. Details of the supplier of the safety data sheet

Company name ErgonArmor, a division of Ergon Asphalt & Emulsions, Inc.
Address 2829 Lakeland Drive
 Jackson, MS 39232
 USA
After hours telephone number 1-800-222-7122
Normal work hours telephone number 1-877-982-7667
Website www.ergonarmor.com
e-mail sds@ergon.com
Emergency 24-hour telephone number CHEMTREC: North America 1-800-424-9300 International 1-800-527-3887
Information on operation hours 8:00 a.m. to 5:00 p.m.

SECTION 2: Hazards identification
2.1. Classification of the substance or mixture

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification R10, Carc. Cat. 2;R45, Muta. Cat. 2;R46

Classification according to Regulation (EC) No 1272/2008 as amended

Physical hazards

Flammable liquids	Category 3	H226 - Flammable liquid and vapour.

Health hazards

Acute toxicity, inhalation	Category 4	H332 - Harmful if inhaled.
Skin corrosion/irritation	Category 2	H315 - Causes skin irritation.
Serious eye damage/eye irritation	Category 2	
Specific target organ toxicity - single exposure	Category 3 narcotic effects	H336 - May cause drowsiness or dizziness.
Specific target organ toxicity - repeated exposure	Category 2	H373 - May cause damage to organs through prolonged or repeated exposure by inhalation.

Hazard summary

Physical hazards Flammable.
Health hazards May cause cancer. May cause heritable genetic damage. Occupational exposure to the substance or mixture may cause adverse health effects.
Environmental hazards Not classified for hazards to the environment.
Specific hazards Prolonged exposure may cause chronic effects.
Main symptoms Upper respiratory tract irritation. Irritation of eyes and mucous membranes.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended**Contains:** Asphalt, Quartz, Stoddard solvent**Hazard pictograms****Signal word**

None.

Hazard statements

H226 Flammable liquid and vapour.
H315 Causes skin irritation.
H320 Causes eye irritation.
H332 Harmful if inhaled.
H336 May cause drowsiness or dizziness.
H373 May cause damage to organs through prolonged or repeated exposure by inhalation.

Precautionary statements**Prevention**

P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P271 Use only outdoors or in a well-ventilated area.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ventilating/lighting equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P260 Do not breathe mist or vapour.
P261 Avoid breathing mist/vapours/spray.
P264 Wash thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/eye protection/face protection.

Response

P370 + P378 If skin irritation occurs, seek medical advice/attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P303 + P361 + P353 In case of fire: Use appropriate media for extinction.
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P308 + P313 IF exposed or concerned: Get medical advice/attention.
P312 Call a POISON CENTRE or doctor/physician if you feel unwell.
P337 + P313 If eye irritation persists: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.

Storage

P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.

Disposal

P501 See section 13 of this SDS for disposal instructions.
Dispose of contents/container in accordance with local/regional/national/international regulations.

Supplemental label information

% of the mixture consists of component(s) of unknown acute inhalation toxicity.

2.3. Other hazards

None known.

SECTION 3: Composition/information on ingredients**3.2. Mixtures****General information**

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Asphalt	10 - 30	8052-42-4 232-490-9	-	-	

Classification: **DSD:** -**CLP:** Flam. Liq. 2;H225

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Stoddard solvent	1 - 10	8052-41-3 232-489-3	-	649-345-00-4	
Classification:	DSD:	Carc. Cat. 2;R45, Muta. Cat. 2;R46, Xn;R65-48/20			P
	CLP:	Flam. Liq. 3;H226, Asp. Tox. 1;H304, Muta. 1B;H340, Carc. 1B;H350, STOT RE 1;H372			P
Propylene carbonate	1 - < 3	108-32-7 203-572-1	-	607-194-00-1	
Classification:	DSD:	Xi;R36			
	CLP:	Eye Irrit. 2;H319			
Quartz	< 1	14808-60-7 238-878-4	-	-	
Classification:	DSD:	-			
	CLP:	Carc. 1A;H350, STOT RE 1;H372			

Other components below reportable levels 70 - < 80

SECTION 4: First aid measures

General information IF exposed or concerned: Get medical advice/attention. Keep victim warm. Keep victim under observation.

4.1. Description of first aid measures

Inhalation For breathing difficulties, oxygen may be necessary. Get medical attention, if needed.

Skin contact For hot product, immediately immerse in or flush the affected area with large amounts of cold water to dissipate heat.

Eye contact Get medical attention if irritation develops and persists.

Ingestion Call a POISON CENTRE or doctor/physician. Do not induce vomiting without medical advice.

4.2. Most important symptoms and effects, both acute and delayed

Not available.

4.3. Indication of any immediate medical attention and special treatment needed

Keep victim warm. Keep victim under observation. Symptoms may be delayed.

SECTION 5: Firefighting measures

General fire hazards Not available.

5.1. Extinguishing media

Suitable extinguishing media Foam. Carbon dioxide (CO2). Water fog. Dry chemical powder.

Unsuitable extinguishing media Do not use water jet.

5.2. Special hazards arising from the substance or mixture Not available.

5.3. Advice for firefighters

Special protective equipment for firefighters Not available.

Special fire fighting procedures Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Do not get water inside container.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel Remove sources of ignition. Keep unnecessary personnel away. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

For emergency responders	Not available.
6.2. Environmental precautions	Prevent further leakage or spillage if safe to do so.
6.3. Methods and material for containment and cleaning up	Dike far ahead of spill for later disposal. Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimise spreading or contact with rain.
	Never return spills in original containers for re-use.
6.4. Reference to other sections	Not available.

SECTION 7: Handling and storage

7.1. Precautions for safe handling	Avoid heat, sparks, open flames and other ignition sources. Do not use in areas without adequate ventilation. Avoid prolonged exposure. Do not empty into drains. Trace amounts of hydrogen sulfide, a very highly toxic gas, may be present with this material. Keep face clear of tank and/or tank car openings.
7.2. Conditions for safe storage, including any incompatibilities	Store in a well-ventilated place. Keep container closed. Keep container dry. Keep away from food, drink and animal feeding stuffs. Keep out of reach of children. Use care in handling/storage.
7.3. Specific end use(s)	Not available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	MAK	0,15 mg/m3	Respirable dust.

Belgium. Exposure Limit Values.

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	5 mg/m3	Fume.
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable dust.
Stoddard solvent (CAS 8052-41-3)	TWA	533 mg/m3	
		100 ppm	

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	STEL	10 mg/m3	
	TWA	5 mg/m3	
Quartz (CAS 14808-60-7)	TWA	0,07 mg/m3	Respirable fraction.

Croatia. Dangerous Substance Exposure Limit Values in the Workplace (ELVs), Annexes 1 and 2, Narodne Novine, 13/09

Components	Type	Value	
Asphalt (CAS 8052-42-4)	MAC	5 mg/m3	
	STEL	10 mg/m3	
Quartz (CAS 14808-60-7)	MAC	0,1 mg/m3	

Cyprus. OELs. Control of factory atmosphere and dangerous substances in factories regulation, PI 311/73, as amended.

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	5 mg/m3	Fume.

Czech Republic. OELs. Government Decree 361

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable dust.

Denmark. Work Environment Authority. Exposure Limits for Substances & Materials, An. 2 & 3

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TLV	1 mg/m3	Dust.
Quartz (CAS 14808-60-7)	TLV	0,3 mg/m3	Total
		0,1 mg/m3	Respirable.
Stoddard solvent (CAS 8052-41-3)	TLV	145 mg/m3	
		25 ppm	

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	5 mg/m3	Vapor.
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable dust.
Stoddard solvent (CAS 8052-41-3)	STEL	600 mg/m3	
	TWA	100 ppm 300 mg/m3 50 ppm	

Finland. Workplace Exposure Limits

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0,05 mg/m3	Respirable.

France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	VME	0,1 mg/m3	Respirable fraction.

Greece. OELs (Decree No. 90/1999, as amended)

Components	Type	Value	
Asphalt (CAS 8052-42-4)	TWA	5 mg/m3	
Stoddard solvent (CAS 8052-41-3)	STEL	720 mg/m3	
	TWA	125 ppm 575 mg/m3 100 ppm	

Hungary. OELs. Joint Decree on Chemical Safety of Workplaces

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0,15 mg/m3	Respirable.

Iceland. OELs. Regulation 154/1999 on occupational exposure limits

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	5 mg/m3	Fume.
Quartz (CAS 14808-60-7)	TWA	0,3 mg/m3	Total dust.
		0,1 mg/m3	Respirable dust.
Stoddard solvent (CAS 8052-41-3)	TWA	145 mg/m3	
		25 ppm	

Ireland. Occupational Exposure Limits

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	STEL	10 mg/m3	Fume.
	TWA	0,5 mg/m3	Fume.
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable dust.
Stoddard solvent (CAS 8052-41-3)	TWA	573 mg/m3	
		100 ppm	

Italy. Occupational Exposure Limits

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	0,5 mg/m3	Inhalable fraction.
Quartz (CAS 14808-60-7)	TWA	0,025 mg/m3	Respirable fraction.
Stoddard solvent (CAS 8052-41-3)	TWA	100 ppm	

Latvia. OELs. Occupational exposure limit values of chemical substances in work environment

Components	Type	Value	
Propylene carbonate (CAS 108-32-7)	TWA	2 mg/m3	

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

Components	Type	Value	Form
Propylene carbonate (CAS 108-32-7)	TWA	7 mg/m3	
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable fraction.

Netherlands. OELs (binding)

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0,075 mg/m3	Respirable dust.

Norway. Administrative Norms for Contaminants in the Workplace

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TLV	5 mg/m3	Fume.
Quartz (CAS 14808-60-7)	TLV	0,3 mg/m3	Total dust.
		0,1 mg/m3	Respirable dust.

Poland. MACs. Minister of Labour and Social Policy Regarding Maximum Allowable Concentrations and Intensities in Working Environment

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	STEL	10 mg/m3	Fume.
	TWA	5 mg/m3	Fume.
Quartz (CAS 14808-60-7)	TWA	2 mg/m3	Total dust.
		0,3 mg/m3	Respirable dust.
Stoddard solvent (CAS 8052-41-3)	STEL	900 mg/m3	
	TWA	300 mg/m3	

Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796)

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	0,5 mg/m3	Inhalable fume.
Quartz (CAS 14808-60-7)	TWA	0,025 mg/m3	Respirable fraction.
Stoddard solvent (CAS 8052-41-3)	TWA	100 ppm	

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	5 mg/m3	Fume.
Stoddard solvent (CAS 8052-41-3)	STEL	1000 mg/m3	
	TWA	700 mg/m3	

Slovakia. OELs for carcinogens and mutagens. Regulation No. 46/2002 on carcinogenic and mutagenic substances

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable fraction.

Slovakia. OELs. Regulation No. 300/2007 concerning protection of health in work with chemical agents

Components	Type	Value	
Stoddard solvent (CAS 8052-41-3)	STEL	600 mg/m3	
	TWA	100 ppm	
		300 mg/m3	
		50 ppm	

Slovenia. OELs. Regulations concerning protection of workers against risks due to exposure to chemicals while working (Official Gazette of the Republic of Slovenia)

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	10 ppm	Vapor and aerosol.
Quartz (CAS 14808-60-7)	TWA	0,15 mg/m3	Respirable fraction.

Spain. Occupational Exposure Limits

Components	Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	0,5 mg/m3	Aerosol
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable fraction.

Sweden. Occupational Exposure Limit Values

Components	Type	Value	Form
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m3	Respirable dust.
Stoddard solvent (CAS 8052-41-3)	STEL	300 mg/m3	
	TWA	50 ppm	
		150 mg/m3	
		25 ppm	

**Switzerland. SUVA Grenzwerte am Arbeitsplatz
Components**

Type	Value	Form
Asphalt (CAS 8052-42-4)	TWA	10 mg/m ³
Quartz (CAS 14808-60-7)	TWA	0,15 mg/m ³

**UK. EH40 Workplace Exposure Limits (WELs)
Components**

Type	Value	Form
Asphalt (CAS 8052-42-4)	STEL	10 mg/m ³
	TWA	5 mg/m ³
Quartz (CAS 14808-60-7)	TWA	0,1 mg/m ³

Biological limit values No biological exposure limits noted for the ingredient(s).

Recommended monitoring procedures Not available.

Derived no-effect level (DNEL) Not available.

Predicted no effect concentrations (PNECs) Not available.

8.2. Exposure controls

Appropriate engineering controls Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.

Individual protection measures, such as personal protective equipment

General information Use personal protective equipment as required. Keep working clothes separately.

Eye/face protection Not available.

Skin protection

- Hand protection Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

- Other Not available.

Respiratory protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Thermal hazards Not available.

Hygiene measures When using, do not eat, drink or smoke. Handle in accordance with good industrial hygiene and safety practices.

Environmental exposure controls Not available.

SECTION 9: Physical and chemical properties**9.1. Information on basic physical and chemical properties**

Appearance	Black liquid
Physical state	Liquid.
Form	Semi-solid at ambient temperature
Colour	Black
Odour	Not available.
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	148,89 - 182,22 °C (300 - 360 °F)
Flash point	37,8 - 60,0 °C (100,0 - 140,0 °F)
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Vapour pressure	Not available.
Vapour density	Not available.

Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Solubility (other)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidizing properties	Not available.
9.2. Other information	
Specific gravity	1 - 1,05
VOC (Weight %)	1,23 lb/gal

SECTION 10: Stability and reactivity

10.1. Reactivity	Not available.
10.2. Chemical stability	Stable under normal temperature conditions.
10.3. Possibility of hazardous reactions	Not available.
10.4. Conditions to avoid	Not available.
10.5. Incompatible materials	Strong oxidising agents.
10.6. Hazardous decomposition products	Irritants. Toxic gas.

SECTION 11: Toxicological information

General information	Not available.
Information on likely routes of exposure	
Ingestion	May cause discomfort if swallowed. However, ingestion is not likely to be a primary route of occupational exposure.
Inhalation	Vapours have a narcotic effect and may cause headache, fatigue, dizziness and nausea
Skin contact	Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis.
Eye contact	May be irritating to eyes.
Symptoms	Not available.

11.1. Information on toxicological effects

Acute toxicity	Not classified.

Components	Species	Test results
Propylene carbonate (CAS 108-32-7)		
Acute		
<i>Oral</i>		
LD50	Rabbit	> 20 ml/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes eye irritation.
Respiratory sensitisation	Not available.
Skin sensitisation	Not a skin sensitiser.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product contains crystalline silica. Silica is a known carcinogen; however in this encapsulated form the normal routes of exposure are unavailable.

IARC Monographs. Overall Evaluation of Carcinogenicity

Asphalt (CAS 8052-42-4)	2B Possibly carcinogenic to humans.
Quartz (CAS 14808-60-7)	1 Carcinogenic to humans.
Stoddard solvent (CAS 8052-41-3)	3 Not classifiable as to carcinogenicity to humans.

Reproductive toxicity	Not classified.
Specific target organ toxicity - single exposure	Central nervous system.
Specific target organ toxicity - repeated exposure	May cause damage to organs through prolonged or repeated exposure by inhalation.
Aspiration hazard	Not classified.
Mixture versus substance information	Not available.
Other information	Not available.

SECTION 12: Ecological information

12.1. Toxicity	Not expected to be harmful to aquatic organisms.
12.2. Persistence and degradability	Not available.
12.3. Bioaccumulative potential	Not available.
Partition coefficient n-octanol/water (log Kow)	
Propylene carbonate	-0,41
Stoddard solvent	3,16 - 7,15
Bioconcentration factor (BCF)	Not available.
12.4. Mobility in soil	Not available.
12.5. Results of PBT and vPvB assessment	Not a PBT or vPvB substance or mixture.
12.6. Other adverse effects	Not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste	Dispose of in accordance with local regulations.
Contaminated packaging	Offer rinsed packaging material to local recycling facilities.
EU waste code	Waste codes should be assigned by the user based on the application for which the product was used. The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Disposal methods/information	Dispose in accordance with all applicable regulations.

SECTION 14: Transport information

ADR

14.1. UN number	UN1999
14.2. UN proper shipping name	TARS, LIQUID, including road asphalt and oils, bitumen and cut backs
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3
Hazard No. (ADR)	30
Tunnel restriction code	D/E
14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

RID

14.1. UN number	UN1999
14.2. UN proper shipping name	TARS, LIQUID, including road asphalt and oils, bitumen and cut backs
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3

14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

ADN

14.1. UN number	UN1999
14.2. UN proper shipping name	Tars, Liquid, [including road asphalt and oils, bitumen and cut backs]
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
Label(s)	3
14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.

IATA

14.1. UN number	UN1999
14.2. UN proper shipping name	Tars, liquid including road asphalt and oils, bitumen and cut backs
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	No.
ERG Code	3L
14.6. Special precautions for user	Not available.
Other information	
Passenger and cargo aircraft	Allowed.
Cargo aircraft only	Allowed.

IMDG

14.1. UN number	UN1999
14.2. UN proper shipping name	TARS, LIQUID including road oils, and cutback bitumens
14.3. Transport hazard class(es)	
Class	3
Subsidiary risk	-
14.4. Packing group	III
14.5. Environmental hazards	
Marine pollutant	No.
EmS	F-E, S-E
14.6. Special precautions for user	Not available.
14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

ADN; ADR; IATA; IMDG; RID



Further information

If shipped by ground in quantities LESS than 119 gallons (450 L): Not regulated as a hazardous material. If shipped by vessel in individual containers that are less than 7.9 gallons (30 L) each, then IMDG 2.3.2.5 exception applies: Not regulated as a hazardous material.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, Article 59(1). Candidate List

Not listed.

Authorisations

Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended

Not listed.

Restrictions on use

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use

Not regulated.

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Stoddard solvent (CAS 8052-41-3)

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

Stoddard solvent (CAS 8052-41-3)

Other EU regulations

Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances

Not listed.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

Propylene carbonate (CAS 108-32-7)

Stoddard solvent (CAS 8052-41-3)

Directive 94/33/EC on the protection of young people at work

Stoddard solvent (CAS 8052-41-3)

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006.

National regulations

Reacts violently with water.

15.2. Chemical safety assessment

Not available.

SECTION 16: Other information

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes
*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s) A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).		
List of abbreviations	Not available.	
References	Not available.	
Information on evaluation method leading to the classification of mixture	Not available.	
Full text of any statements or R-phrases and H-statements under Sections 2 to 15	R10 Flammable. R36 Irritating to eyes. R45 May cause cancer. R46 May cause heritable genetic damage. R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation. R65 Harmful: may cause lung damage if swallowed. H225 Highly flammable liquid and vapour. H226 Flammable liquid and vapour. H304 May be fatal if swallowed and enters airways. H319 Causes serious eye irritation. H340 May cause genetic defects. H350 May cause cancer. H372 Causes damage to organs through prolonged or repeated exposure. H372 Causes damage to organs through prolonged or repeated exposure by inhalation.	
Revision information	Product and Company Identification: Product and Company Identification Transport Information: Product Shipping Name/Packing Group GHS: Classification	
Training information	Not available.	
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.	

SECTION 1: Identification of the substance/mixture and of the company/undertaking
1.1. Product identifier

Trade name or designation of the mixture Urethane Asphalt Hardener
Registration number -
Synonyms Pennguard Adhesive Membrane - Part B
Issue date 29-June-2015
Version number 02
Revision date 26-April-2016
Supersedes date 29-June-2015

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Asphalt Hardener
Uses advised against None known.

1.3. Details of the supplier of the safety data sheet

Company name ErgonArmor, a division of Ergon Asphalt & Emulsions, Inc.
Address 2829 Lakeland Drive
 Jackson, MS 39232
 USA
After hours telephone number 1-800-222-7122
Normal work hours telephone number 1-877-982-7667
Website www.ergonarmor.com
e-mail sds@ergon.com
Emergency 24-hour telephone number CHEMTREC: North America 1-800-424-9300 International 1-800-527-3887
Information on operation hours 8:00 a.m. to 5:00 p.m.

SECTION 2: Hazards identification
2.1. Classification of the substance or mixture

The mixture has been assessed and/or tested for its physical, health and environmental hazards and the following classification applies.

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification Xn;R20-48/20, Xi;R36/37/38

The full text for all R-phrases is displayed in section 16.

Classification according to Regulation (EC) No 1272/2008 as amended
Health hazards

Skin corrosion/irritation	Category 2	H315 - Causes skin irritation.
Serious eye damage/eye irritation	Category 2	H319 - Causes serious eye irritation.
Respiratory sensitisation	Category 1	H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin sensitisation	Category 1	H317 - May cause an allergic skin reaction.
Specific target organ toxicity - single exposure	Category 3 respiratory tract irritation	H335 - May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	Category 2	H373 - May cause damage to organs through prolonged or repeated exposure.

Hazard summary

Physical hazards Not classified for physical hazards.

Health hazards	Harmful by inhalation. Irritating to eyes, respiratory system and skin. Harmful: danger of serious damage to health by prolonged exposure through inhalation. Occupational exposure to the substance or mixture may cause adverse health effects.
Environmental hazards	Not classified for hazards to the environment.
Specific hazards	Material reacts with water.
Main symptoms	Irritation of eyes and mucous membranes. Prolonged exposure may cause chronic effects.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains: MDI, METHYLENEDIPHENYL DIISOCYANATE

Hazard pictograms



Signal word

Danger

Hazard statements

H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H335	May cause respiratory irritation.
H373	May cause damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention

P271	Use only outdoors or in a well-ventilated area.
P260	Do not breathe mist or vapour.
P261	Avoid breathing mist/vapours/spray.
P264	Wash thoroughly after handling.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves.
P280	Wear eye/face protection.
P285	In case of inadequate ventilation wear respiratory protection.

Response

P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312	Call a POISON CENTRE or doctor/physician if you feel unwell.
P333 + P313	If skin irritation or rash occurs: Get medical advice/attention.
P337 + P313	If eye irritation persists: Get medical advice/attention.
P342 + P311	If experiencing respiratory symptoms: Call a POISON CENTRE or doctor/physician.
P362	Take off contaminated clothing and wash before reuse.

Storage

P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.

Disposal

P501	Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Supplemental label information

None.

2.3. Other hazards

None known.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes

METHYLENEDIPHENYL DIISOCYANATE	45 - 55	26447-40-5 247-714-0	-	615-005-00-9	

Classification:	DSD: Carc. Cat. 3;R40, Xn;R20-48/20, Xi;R36/37/38, R42/43	C,2
	CLP: Skin Irrit. 2;H315, Skin Sens. 1;H317, Eye Irrit. 2;H319, Acute Tox. 4;H332, Resp. Sens. 1;H334, STOT SE 3;H335, Carc. 2;H351, STOT RE 2;H373	2,C

MDI	< 45	101-68-8 202-966-0	-	615-005-00-9	

Classification:	DSD: Carc. Cat. 3;R40, Xn;R20-48/20, Xi;R36/37/38, R42/43	C,2
	CLP: Skin Irrit. 2;H315, Skin Sens. 1;H317, Eye Irrit. 2;H319, Acute Tox. 4;H332, Resp. Sens. 1;H334, STOT SE 3;H335, Carc. 2;H351, STOT RE 2;H373	2,C

Other components below reportable levels 27,5

SECTION 4: First aid measures

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. IF exposed or concerned: Get medical advice/attention.

4.1. Description of first aid measures

Inhalation If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. If experiencing respiratory symptoms: Call a POISON CENTRE or doctor/physician.

Skin contact Remove contaminated clothing. For minor skin contact, avoid spreading material on unaffected skin. If skin irritation occurs: Get medical advice/attention.

Eye contact Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.

Ingestion Not available.

4.2. Most important symptoms and effects, both acute and delayed Irritation of eyes and mucous membranes. Prolonged exposure may cause chronic effects. Irritant effects. May cause allergic respiratory reaction. May cause allergic skin reaction.

4.3. Indication of any immediate medical attention and special treatment needed Keep victim under observation. Symptoms may be delayed.

SECTION 5: Firefighting measures

General fire hazards Not available.

5.1. Extinguishing media

Suitable extinguishing media Extinguish with alcohol-resistant foam, carbon dioxide, dry powder or water fog. Water spray mist or foam.

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture Use a water spray to cool fire-exposed containers.

5.3. Advice for firefighters

Special protective equipment for firefighters Wear suitable protective equipment. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Special fire fighting procedures Do not get water inside container.

SECTION 6: Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures**

For non-emergency personnel Keep unnecessary personnel away. Wear appropriate protective equipment and clothing during clean-up. Do not touch or walk through spilled material. Ensure adequate ventilation. Avoid inhalation of vapours or mists.

For emergency responders	Keep unnecessary personnel away. Use personal protection recommended in Section 8 of the SDS.
6.2. Environmental precautions	No special environmental precautions required.
6.3. Methods and material for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimise spreading or contact with rain. Do not get water on spilled substance or inside containers. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills in original containers for re-use.
6.4. Reference to other sections	For personal protection, see section 8. For waste disposal, see section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling	Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wash hands thoroughly after handling.
7.2. Conditions for safe storage, including any incompatibilities	Store locked up. Store in a well-ventilated place. Keep container tightly closed.
7.3. Specific end use(s)	Not available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Austria. MAK List, OEL Ordinance (GwV), BGBl. II, no. 184/2001

Components	Type	Value
MDI (CAS 101-68-8)	Ceiling	0,1 mg/m ³
	MAK	0,01 ppm 0,05 mg/m ³ 0,005 ppm

Belgium. Exposure Limit Values.

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,052 mg/m ³ 0,005 ppm

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,07 mg/m ³
	TWA	0,05 mg/m ³

Cyprus. OELs. Control of factory atmosphere and dangerous substances in factories regulation, PI 311/73, as amended.

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,2 mg/m ³ 0,02 ppm

Czech Republic. OELs. Government Decree 361

Components	Type	Value
MDI (CAS 101-68-8)	Ceiling	0,1 mg/m ³
	TWA	0,05 mg/m ³

Denmark. Work Environment Authority. Exposure Limits for Substances & Materials, An. 2 & 3

Components	Type	Value
MDI (CAS 101-68-8)	TLV	0,05 mg/m ³ 0,005 ppm

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,05 mg/m ³ 0,005 ppm

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	TWA	0,005 ppm

Finland. Workplace Exposure Limits

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,035 mg/m ³
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	STEL	0,035 mg/m ³

France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984

Components	Type	Value
MDI (CAS 101-68-8)	VLE	0,2 mg/m ³ 0,02 ppm
	VME	0,1 mg/m ³ 0,01 ppm

Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG)

Components	Type	Value	Form
MDI (CAS 101-68-8)	TWA	0,05 mg/m ³	Inhalable fraction.

Germany. TRGS 900, Limit Values in the Ambient Air at the Workplace

Components	Type	Value	Form
MDI (CAS 101-68-8)	AGW	0,05 mg/m ³	Inhalable fraction.

Greece. OELs (Decree No. 90/1999, as amended)

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,2 mg/m ³ 0,02 ppm
	TWA	0,2 mg/m ³ 0,02 ppm

Hungary. OELs. Joint Decree on Chemical Safety of Workplaces

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,05 mg/m ³
	TWA	0,05 mg/m ³

Iceland. OELs. Regulation 154/1999 on occupational exposure limits

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,1 mg/m ³ 0,01 ppm
	TWA	0,05 mg/m ³ 0,005 ppm

Ireland. Occupational Exposure Limits

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,07 mg/m ³
	TWA	0,02 mg/m ³
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	STEL	0,07 mg/m ³
	TWA	0,02 mg/m ³

Italy. Occupational Exposure Limits

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,005 ppm

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

Components	Type	Value
MDI (CAS 101-68-8)	Ceiling	0,1 mg/m ³ 0,01 ppm
	TWA	0,05 mg/m ³

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

Components	Type	Value
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	Ceiling	0,005 ppm 0,01 ppm
	TWA	0,005 ppm

Norway. Administrative Norms for Contaminants in the Workplace

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,01 ppm
	TLV	0,05 mg/m3 0,005 ppm
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	STEL	0,01 ppm
	TLV	0,005 ppm

Poland. MACs. Minister of Labour and Social Policy Regarding Maximum Allowable Concentrations and Intensities in Working Environment

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,09 mg/m3
	TWA	0,03 mg/m3
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	STEL	0,09 mg/m3
	TWA	0,03 mg/m3

Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796)

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,005 ppm

Romania. OELs. Protection of workers from exposure to chemical agents at the workplace

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,15 mg/m3
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	STEL	0,2 mg/m3

Slovakia. OELs. Regulation No. 300/2007 concerning protection of health in work with chemical agents

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,03 mg/m3 0,002 ppm

Slovenia. OELs. Regulations concerning protection of workers against risks due to exposure to chemicals while working (Official Gazette of the Republic of Slovenia)

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,05 mg/m3

Spain. Occupational Exposure Limits

Components	Type	Value
MDI (CAS 101-68-8)	TWA	0,052 mg/m3 0,005 ppm

Sweden. Occupational Exposure Limit Values

Components	Type	Value
MDI (CAS 101-68-8)	Ceiling	0,05 mg/m3 0,005 ppm
	TWA	0,03 mg/m3 0,002 ppm
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	Ceiling	0,005 ppm
	TWA	0,002 ppm

Switzerland. SUVA Grenzwerte am Arbeitsplatz

Components	Type	Value
MDI (CAS 101-68-8)	STEL	0,02 mg/m3

Switzerland. SUVA Grenzwerte am Arbeitsplatz
Components **Type** **Value**

METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	TWA	0,02 mg/m3
	STEL	0,02 mg/m3
	TWA	0,02 mg/m3

UK. EH40 Workplace Exposure Limits (WELs)
Components **Type** **Value**

MDI (CAS 101-68-8)	STEL	0,07 mg/m3
	TWA	0,02 mg/m3
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	STEL	0,07 mg/m3
	TWA	0,02 mg/m3

Biological limit values

Switzerland. BAT-Werte (Biological Limit Values in the Workplace as per SUVA)

Components	Value	Determinant	Specimen	Sampling time
MDI (CAS 101-68-8)	10 µg/g	4,4'-Diaminodiphenylmethane	Creatinine in urine	*

* - For sampling details, please see the source document.

Recommended monitoring procedures Follow standard monitoring procedures.

Derived no-effect level (DNEL) Not available.

Predicted no effect concentrations (PNECs) Not available.

8.2. Exposure controls

Appropriate engineering controls Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.

Individual protection measures, such as personal protective equipment

General information Use personal protective equipment as required. Eye wash fountain is recommended.

Eye/face protection Not available.

Skin protection

- Hand protection Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

- Other Wear suitable protective clothing.

Respiratory protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

Thermal hazards Not available.

Hygiene measures Keep away from food and drink. Contaminated work clothing should not be allowed out of the workplace. Handle in accordance with good industrial hygiene and safety practices.

Environmental exposure controls Not available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Brown Liquid
Physical state	Liquid.
Form	Liquid.
Colour	Brown.
Odour	Musty.
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	> 300 °C (> 572 °F)
Flash point	> 250,0 °C (> 482,0 °F)

Material name: Urethane Asphalt Hardener

5377 Version No.: 02 Revision date: 26-April-2016 Issue date: 29-June-2015

Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Vapour pressure	1 hPa @ 20 deg C
Vapour density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Solubility (other)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidizing properties	Not available.

9.2. Other information

Density	1,24 g/cm3

SECTION 10: Stability and reactivity

10.1. Reactivity	Alcohols. Water, moisture.
10.2. Chemical stability	Not available.
10.3. Possibility of hazardous reactions	This product will autopolymerize at very high temperatures. (>200 deg C)
10.4. Conditions to avoid	Not available.
10.5. Incompatible materials	Alcohols. Amines.
10.6. Hazardous decomposition products	Carbon dioxide. Nitrogen oxides (NOx). Sulphur oxides.

SECTION 11: Toxicological information

General information	Not available.
Information on likely routes of exposure	
Ingestion	May cause discomfort if swallowed.
Inhalation	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin contact	Not available.
Eye contact	Causes serious eye irritation.
Symptoms	Irritant effects.

11.1. Information on toxicological effects

Acute toxicity	Not applicable.

Components	Species	Test results
MDI (CAS 101-68-8)		
Acute		
<i>Inhalation</i>		
LC50	Rat	0,369 mg/l, 4 Hours

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Not available.
Serious eye damage/eye irritation	Causes serious eye irritation.
Respiratory sensitisation	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin sensitisation	May cause an allergic skin reaction.
Germ cell mutagenicity	Not available.

Carcinogenicity

IARC Monographs. Overall Evaluation of Carcinogenicity

MDI (CAS 101-68-8)	3 Not classifiable as to carcinogenicity to humans.
METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)	3 Not classifiable as to carcinogenicity to humans.

Reproductive toxicity	Not available.
Specific target organ toxicity - single exposure	Respiratory tract irritation.
Specific target organ toxicity - repeated exposure	Respiratory system.
Aspiration hazard	Not available.
Mixture versus substance information	Not available.
Other information	Not available.

SECTION 12: Ecological information

12.1. Toxicity	Not expected to be harmful to aquatic organisms.
12.2. Persistence and degradability	No data is available on the degradability of this product.
12.3. Bioaccumulative potential	Not available.
Partition coefficient n-octanol/water (log Kow)	Not available.
Bioconcentration factor (BCF)	Not available.
12.4. Mobility in soil	Not available.
12.5. Results of PBT and vPvB assessment	Not a PBT or vPvB substance or mixture.
12.6. Other adverse effects	Not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.
EU waste code	The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Disposal methods/information	Dispose of contents/container in accordance with local/regional/national/international regulations.

SECTION 14: Transport information

General ADR	If shipped below RQ, this product is not subject to hazardous materials regulations.
14.1. UN number	UN2206
14.2. UN proper shipping name	ISOCYANATES, TOXIC, N.O.S. or ISOCYANATE SOLUTION, TOXIC, N.O.S. (METHYLENEDIPHENYL DIISOCYANATE, MDI)
14.3. Transport hazard class(es)	
Class	6.1(PGIII)
Subsidiary risk	-
Label(s)	6.1
Hazard No. (ADR)	60
Tunnel restriction code	E
14.4. Packing group	III
14.5. Environmental hazards	No.
14.6. Special precautions for user	Not available.
RID	
14.1. UN number	UN2206

14.2. UN proper shipping name ISOCYANATES, TOXIC, N.O.S. or ISOCYANATE SOLUTION, TOXIC, N.O.S. (METHYLENEDIPHENYL DIISOCYANATE, MDI)

14.3. Transport hazard class(es)

Class 6.1(PGIII)

Subsidiary risk -

Label(s) 6.1

14.4. Packing group III

14.5. Environmental hazards No.

14.6. Special precautions for user Not available.

ADN

14.1. UN number UN2206

14.2. UN proper shipping name Isocyanates, Toxic, [or isocyanate solution, toxic, n.o.s.] (METHYLENEDIPHENYL DIISOCYANATE, MDI)

14.3. Transport hazard class(es)

Class 6.1(PGIII)

Subsidiary risk -

Label(s) 6.1

14.4. Packing group III

14.5. Environmental hazards No.

14.6. Special precautions for user Not available.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not available.

ADN; ADR; RID



Further information

If shipped below RQ, this product is not subject to hazardous materials regulations.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, Article 59(1). Candidate List

Not listed.

Authorisations**Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended**

Not listed.

Restrictions on use**Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use**

MDI (CAS 101-68-8)

METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Not listed.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

MDI (CAS 101-68-8)

METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)

Other EU regulations**Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances**

Not listed.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

MDI (CAS 101-68-8)

METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)

Directive 94/33/EC on the protection of young people at work

MDI (CAS 101-68-8)

METHYLENEDIPHENYL DIISOCYANATE (CAS 26447-40-5)

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006. Pregnant women should not work with the product, if there is the least risk of exposure.

National regulations

Young people under 18 years old are not allowed to work with this product according to the EU Directive 94/33/EC on the protection of young people at work.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out.

SECTION 16: Other information**International Inventories**

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

List of abbreviations

Not available.

References

Not available.

Information on evaluation method leading to the classification of mixture	Not available.
Full text of any statements or R-phrases and H-statements under Sections 2 to 15	R20 Harmful by inhalation. R36/37/38 Irritating to eyes, respiratory system and skin. R40 Limited evidence of a carcinogenic effect. R42/43 May cause sensitisation by inhalation and skin contact. R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H319 Causes serious eye irritation. H332 Harmful if inhaled. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H335 May cause respiratory irritation. H351 Suspected of causing cancer. H373 May cause damage to organs through prolonged or repeated exposure.
Revision information	Product and Company Identification: Synonyms SECTION 3: Composition/information on ingredients: <INDENT> Transport Information: Product Shipping Name/Packing Group Regulatory Information: Risk Phrases - Labeling HazReg Data: North America GHS: Classification
Training information	Not available.
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SECTION 1: Identification of the substance/mixture and of the company/undertaking
1.1. Product identifier

Trade name or designation of the mixture PENNGUARD BLOCK 55/28
Registration number -
Synonyms None.
Issue date 29-June-2015
Version number 02
Revision date 13-June-2016
Supersedes date 29-June-2015

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Not available.
Uses advised against None known.

1.3. Details of the supplier of the safety data sheet

Company name ErgonArmor, a division of Ergon Asphalt & Emulsions, Inc.
Address 2829 Lakeland Drive
 Jackson, MS 39232
 USA
After hours telephone number 1-800-222-7122
Normal work hours telephone number 1-877-982-7667
Website www.ergonarmor.com
e-mail sds@ergon.com
Emergency 24-hour telephone number CHEMTREC: North America 1-800-424-9300 International 1-800-527-3887
Information on operation hours 8:00 a.m. to 5:00 p.m.

SECTION 2: Hazards identification
2.1. Classification of the substance or mixture

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification Carc. Cat. 3;R40

Classification according to Regulation (EC) No 1272/2008 as amended

Health hazards

Acute toxicity, oral	Category 4
Acute toxicity, inhalation	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2

H315 - Causes skin irritation.

H319 - Causes serious eye irritation.

Hazard summary

Physical hazards Not classified for physical hazards.
Health hazards Limited evidence of a carcinogenic effect.
Environmental hazards Not classified for hazards to the environment.
Specific hazards Not available.
Main symptoms Not available.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains: Glass Dust

Hazard pictograms



Signal word

Danger

Hazard statements

H302 + H332

H315

H319

Harmful if swallowed or if inhaled

Causes skin irritation.

Causes serious eye irritation.

Precautionary statements

Prevention

P271

Use only outdoors or in a well-ventilated area.

P260

Do not breathe dust/fume/gas/mist/vapors/spray.

P261

Avoid breathing dust/fume.

P264

Wash thoroughly after handling.

P270

Do not eat, drink or smoke when using this product.

P280

Wear protective gloves.

P280

Wear eye/face protection.

P285

In case of inadequate ventilation wear respiratory protection.

Response

P301 + P312

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P302 + P352

IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell.

P321

IF ON SKIN: Wash with plenty of soap and water.

P304 + P340

Specific treatment see Section 4 of this SDS.

P305 + P351 + P338

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P312

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P321

Call a POISON CENTRE or doctor/physician if you feel unwell.

P330

Specific treatment (see this label).

P332 + P313

Rinse mouth.

P337 + P313

If skin irritation occurs: Get medical advice/attention.

P362

If eye irritation persists: Get medical advice/attention.

Take off contaminated clothing and wash before reuse.

Storage

P405

Store locked up.

Disposal

P501

Dispose of contents/container in accordance with local/regional/national/international regulations.

Supplemental label information

None.

2.3. Other hazards

None known.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Glass Dust	Varies	N/A 266-046-0	-	650-016-00-2	
Classification:	DSD: Carc. Cat. 3;R40				A,Q,R
	CLP: Carc. 2;H351				A,Q,R

SECTION 4: First aid measures

General information

IF exposed or concerned: Get medical advice/attention. Wash contaminated clothing before reuse.

4.1. Description of first aid measures

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call a POISON CENTRE or doctor/physician if you feel unwell.

Skin contact	Take off immediately all contaminated clothing. Wash off with soap and plenty of water. For minor skin contact, avoid spreading material on unaffected skin.
Eye contact	Remove contact lenses, if present and easy to do. Continue rinsing.
Ingestion	Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell. Do not use mouth-to-mouth method if victim ingested the substance.

4.2. Most important symptoms and effects, both acute and delayed

Mild skin irritation.

4.3. Indication of any immediate medical attention and special treatment needed

In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.

SECTION 5: Firefighting measures

General fire hazards Not available.

5.1. Extinguishing media

Suitable extinguishing media Water fog. Foam. Carbon dioxide (CO2). Powder.

Unsuitable extinguishing media Not available.

5.2. Special hazards arising from the substance or mixture Not a fire hazard. No unusual fire or explosion hazards noted.

5.3. Advice for firefighters

Special protective equipment for firefighters Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

Special fire fighting procedures Not available.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel Avoid generation and spreading of dust. Good personal hygiene is necessary. Wash hands and contaminated areas with water and soap before leaving the work site.

For emergency responders Use personal protection recommended in Section 8 of the SDS.

6.2. Environmental precautions Not available.

6.3. Methods and material for containment and cleaning up Not available.

6.4. Reference to other sections Not available.

SECTION 7: Handling and storage

7.1. Precautions for safe handling Avoid breathing vapour. Use personal protective equipment as required. Avoid prolonged exposure. When using, do not eat, drink or smoke. Wash hands thoroughly after handling.

7.2. Conditions for safe storage, including any incompatibilities Store in a well-ventilated place.

7.3. Specific end use(s) Not available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Belgium. Exposure Limit Values. Components

Type	Value	Form
Glass Dust (CAS N/A)	1000000 fibers/m3	Fiber.
	100000 fibers/m3	Respirable fibers.
	10 mg/m3	Fiber or dust.

Bulgaria. OELs. Regulation No 13 on protection of workers against risks of exposure to chemical agents at work

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³ 6 mg/m ³	Respirable fraction. Inhalable fraction.

Cyprus. OELs. Control of factory atmosphere and dangerous substances in factories regulation, PI 311/73, as amended.

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	10 mg/m ³	Fiber or dust.

Czech Republic. OELs. Government Decree 361

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³ 5 mg/m ³ 4 mg/m ³	Respirable fibers. Dust.

Estonia. OELs. Occupational Exposure Limits of Hazardous Substances. (Annex of Regulation No. 293 of 18 September 2001)

Components	Type	Value
Glass Dust (CAS N/A)	TWA	1 fibers/mL

Finland. Workplace Exposure Limits

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³ 5 mg/m ³	Respirable. Total dust.

Hungary. OELs. Joint Decree on Chemical Safety of Workplaces

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³	Fiber.

Iceland. OELs. Regulation 154/1999 on occupational exposure limits

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³	Fiber.

Ireland. Occupational Exposure Limits

Components	Type	Value
Glass Dust (CAS N/A)	TWA	2 fibers/cm ³ 5 mg/m ³

Italy. Occupational Exposure Limits

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³ 5 mg/m ³	Fiber. Inhalable fraction.

Lithuania. OELs. Limit Values for Chemical Substances, General Requirements

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	0,2 fibers/cm ³	Fiber.

Norway. Administrative Norms for Contaminants in the Workplace

Components	Type	Value	Form
Glass Dust (CAS N/A)	TLV	0,1 fibers/cm ³ 5 mg/m ³	Fiber. Total dust.

Poland. MACs. Minister of Labour and Social Policy Regarding Maximum Allowable Concentrations and Intensities in Working Environment

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm ³ 0,5 fibers/cm ³ 1 mg/m ³	Respirable fibers. Respirable dust. Total dust.

Portugal. VLEs. Norm on occupational exposure to chemical agents (NP 1796)

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	0,2 fibers/cm ³ 5 mg/m ³	Fiber. Inhalable fraction.

Slovakia. OELs. Regulation No. 300/2007 concerning protection of health in work with chemical agents

Components	Type	Value
Glass Dust (CAS N/A)	TWA	2 fibers/cm ³

Slovenia. OELs. Regulations concerning protection of workers against risks due to exposure to chemicals while working (Official Gazette of the Republic of Slovenia)

Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	500000 fibers/cm3	Dust.
Spain. Carcinogens and Mutagens with Limit Values (Table 2)			
Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	0,5 fibers/cm3	Fiber.
Spain. Occupational Exposure Limits			
Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/cm3	Fiber.
Sweden. Occupational Exposure Limit Values			
Components	Type	Value	
Glass Dust (CAS N/A)	TWA	1 fibers/mL	
Switzerland. SUVA Grenzwerte am Arbeitsplatz			
Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	0,5 fibers/mL	Fiber.
UK. EH40 Workplace Exposure Limits (WELs)			
Components	Type	Value	Form
Glass Dust (CAS N/A)	TWA	1 fibers/mL	Fiber.
		5 mg/m3	Fiber.

Biological limit values	No biological exposure limits noted for the ingredient(s).
Recommended monitoring procedures	Follow standard monitoring procedures.
Derived no-effect level (DNEL)	Not available.
Predicted no effect concentrations (PNECs)	Not available.
8.2. Exposure controls	
Appropriate engineering controls	Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.
Individual protection measures, such as personal protective equipment	
General information	Wear chemical protective equipment that is specifically recommended by the manufacturer.
Eye/face protection	Wear approved safety goggles.
Skin protection	
- Hand protection	Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.
- Other	Wear appropriate chemical resistant clothing.
Respiratory protection	Not available.
Thermal hazards	Not available.
Hygiene measures	Avoid contact with eyes. Avoid contact with skin. Avoid contact with clothing. Wash hands before breaks and immediately after handling the product.
Environmental exposure controls	Not available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Black Solid
Physical state	Solid.
Form	Solid.
Colour	Black.
Odour	Odourless.
Odour threshold	Not available.
pH	Not available.
Melting point/freezing point	820 °C (1508 °F)
Initial boiling point and boiling range	Not available.

Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Vapour pressure	Not available.
Vapour density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	insoluble
Solubility (other)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidizing properties	Not available.
9.2. Other information	
Specific gravity	0,11 - 0,22

SECTION 10: Stability and reactivity

10.1. Reactivity	Strong acids. Strong alkalis. Amines.
10.2. Chemical stability	Material is stable under normal conditions.
10.3. Possibility of hazardous reactions	Will not occur.
10.4. Conditions to avoid	Avoid conditions which create dust.
10.5. Incompatible materials	None known.
10.6. Hazardous decomposition products	None known.

SECTION 11: Toxicological information

General information	Not available.
Information on likely routes of exposure	
Ingestion	Causes digestive tract burns. However, ingestion is not likely to be a primary route of occupational exposure.
Inhalation	Inhalation of vapours/fumes generated by heating this product may cause respiratory irritation with throat discomfort, coughing or difficulty breathing.
Skin contact	Causes skin irritation.
Eye contact	Causes eye irritation.
Symptoms	Not available.
11.1. Information on toxicological effects	
Acute toxicity	Not applicable.
Skin corrosion/irritation	Not available.
Serious eye damage/eye irritation	May be irritating to eyes.
Respiratory sensitisation	Not available.
Skin sensitisation	May cause an allergic skin reaction.
Germ cell mutagenicity	Not classified.
Carcinogenicity	This product contains a substance that is reasonably anticipated to be a human carcinogen, however, the route of exposure is unavailable in this product as provided.
IARC Monographs. Overall Evaluation of Carcinogenicity	
Glass Dust (CAS N/A)	2B Possibly carcinogenic to humans. 3 Not classifiable as to carcinogenicity to humans.
Reproductive toxicity	Not classified.
Specific target organ toxicity - single exposure	Not classified.

Specific target organ toxicity - repeated exposure	Not applicable.
Aspiration hazard	Not classified.
Mixture versus substance information	Not available.
Other information	Not available.

SECTION 12: Ecological information

12.1. Toxicity	The product contains a substance which is harmful to aquatic organisms.
12.2. Persistence and degradability	No data is available on the degradability of this product.
12.3. Bioaccumulative potential	Not available.
Partition coefficient n-octanol/water (log K_{ow})	Not available.
Bioconcentration factor (BCF)	Not available.
12.4. Mobility in soil	Not available.
12.5. Results of PBT and vPvB assessment	Not applicable. Not applicable. Not applicable.
12.6. Other adverse effects	Not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal.
EU waste code	Waste codes should be assigned by the user based on the application for which the product was used.
Disposal methods/information	Dispose of contents/container in accordance with local/regional/national/international regulations. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

SECTION 14: Transport information

ADR

Not regulated as dangerous goods.

ADN

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, Article 59(1). Candidate List

Not listed.

Authorisations

Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorization, as amended

Not listed.

Restrictions on use

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use

Not regulated.

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Not listed.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

Glass Dust (CAS N/A)

Other EU regulations

Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances

Not listed.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

Glass Dust (CAS N/A)

Directive 94/33/EC on the protection of young people at work

Glass Dust (CAS N/A)

Other regulations

The product is classified and labelled in accordance with EC directives or respective national laws. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006. Pregnant women should not work with the product, if there is the least risk of exposure.

National regulations

Young people under 18 years old are not allowed to work with this product according to the EU Directive 94/33/EC on the protection of young people at work.

15.2. Chemical safety assessment

No Chemical Safety Assessment has been carried out.

SECTION 16: Other information

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

List of abbreviations	Not available.
References	Not available.
Information on evaluation method leading to the classification of mixture	Not available.
Full text of any statements or R-phrases and H-statements under Sections 2 to 15	R40 Limited evidence of a carcinogenic effect. H351 Suspected of causing cancer.
Revision information	Product and Company Identification: Product and Company Identification Physical & Chemical Properties: Multiple Properties GHS: Classification
Training information	Not available.
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

	TITLE: - 3X660 MW BARH-I STPP FGD SYSTEM PACKAGE. SPECIFICATIONS FOR SINGLE FLUE RCC CHIMNEY	SPECIFICATION NO. PE-TS-442-620-C002
		VOLUME :
		SECTION :
		REV.NO. 00
		SHEET :

3X660 MW BARH-STAGE-I STPP **FGD SYSTEM PACKAGE**

VOLUME II-B

CIVIL, STRUCTURAL AND ARCHITECTURAL WORKS

SECTION – D

GENERAL TECHNICAL SPECIFICATION (CHIMNEY FLUE LINER)

PE-TS-442-620-C002



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301

	TITLE: - 3X660 MW BARH-I STPP FGD SYSTEM PACKAGE. SPECIFICATIONS FOR SINGLE FLUE RCC CHIMNEY	SPECIFICATION NO. PE-TS-442-620-C002
		VOLUME :
		SECTION :
		REV.NO. 00
		SHEET :

PREAMBLE

Standard technical details as indicated in specification shall be agreed upon between BHEL & Bidder.

Technical requirements are stipulated in this Volume which comprises of

Section C : This section indicates the technical requirements specific to the contract related to chimney.

Section D : This section comprises of technical specification(s)

The requirements mentioned in the Section C shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the Section D in the specification. In case on any conflict between technical specification and BOQ, BOQ shall prevail.

	TITLE: - 3X660 MW BARH-I STPP FGD SYSTEM PACKAGE. SPECIFICATIONS FOR SINGLE FLUE RCC CHIMNEY	SPECIFICATION NO. PE-TS-442-620-C002
		VOLUME :
		SECTION :
		REV.NO. 00
		SHEET :

INDEX

SECTION

DESCRIPTION

Section-C

SPECIFIC TECHNICAL REQUIREMENTS

- i) CIVIL
- ii) MECHANICAL

Section-D

SPECIFICATION FOR CIVIL, STRUCTURAL AND ARCHITECTURAL WORKS

Sub-section D17: Fabrication of structural steelwork

Sub-section D18: Erection of structural steelwork

Sub-section D24: Quality Assurance & Inspection

Sub-section D25: RCC stack

Sub-section D26: Borosilicate glass block lining system(13 page) &stack flow model study(12 pg)



TITLE:

**TECHNICAL SPECIFICATION FOR
FABRICATION OF STRUCTURAL
STEEL WORK**

SPECIFICATION NO. PE-TS-442-600-C017

VOLUME - II B

SECTION - D

SUBSECTION -D17

REV.NO. 0

DATE 19/11/2018

SHEET 1

OF

40

VOLUME: II B

SECTION - D (PART I)

SUB-SECTION – D 17

SPECIFICATION NO. PE-TS-442-600-C017

FABRICATION OF STRUCTURAL STEEL WORK



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301

 Maharatna Company		TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		TENDER NO. PSER/SC/1BAR-C/1907/19		SPECIFICATION NO. PE-TS-442-600-C017																						
				VOLUME - II B																								
				SECTION - D		SUBSECTION -D17																						
				REV.NO. 0		DATE 19/11/2018																						
				SHEET 2		OF 40																						
C O N T E N T <table><tr><th>CLAUSE NO.</th><th>DESCRIPTION</th><th>SHEET NO.</th></tr><tr><td>1.00.00</td><td>SCOPE</td><td>3</td></tr><tr><td>2.00.00</td><td>GENERAL</td><td>3</td></tr><tr><td>3.00.00</td><td>W ORKMANSHIP</td><td>19</td></tr><tr><td>4.00.00</td><td>INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY</td><td>29</td></tr><tr><td>5.00.00</td><td>INFORMATION TO BE SUBMITTED</td><td>33</td></tr><tr><td>6.00.00</td><td>RATES AND MEASUREMENTS</td><td>34</td></tr></table>								CLAUSE NO.	DESCRIPTION	SHEET NO.	1.00.00	SCOPE	3	2.00.00	GENERAL	3	3.00.00	W ORKMANSHIP	19	4.00.00	INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY	29	5.00.00	INFORMATION TO BE SUBMITTED	33	6.00.00	RATES AND MEASUREMENTS	34
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5.00.00	INFORMATION TO BE SUBMITTED	33																										
6.00.00	RATES AND MEASUREMENTS	34																										

	TITLE:		SPECIFICATION NO. PE-TS-442-600-C017	
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		VOLUME - II B	
			SECTION - D SUBSECTION -D17	
			REV.NO. 0	DATE 19/11/2018
			SHEET 3	OF 40

SUB-SECTION – D XVII**FABRICATION OF STRUCTURAL STEEL WORK****1.00.00 SCOPE**

This specification covers supply, fabrication, testing, painting and delivery to site of structural steelwork including supply of all consumable stores and rivets, bolts, nuts, washers, electrodes and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the contract.

2.00.00 GENERAL**2.01.00 Work to be provided for by the Contractor**

The work to be provided for by the Contractor, unless otherwise specified elsewhere in the contract, shall include, but not be limited to the following

- a) Preparation of complete detailed fabrication drawings and erection marking drawings required for all the structures covered under the scope of the contract based on the approved design drawings. As decided by the Engineer, some or all of these detailed drawings will have to be submitted for approval.
- b) To submit revised design with calculations and detailed fabrication drawings in case any substitution of the designed sections are to be made.
- c) To submit design calculations for joints and connections developed by the contractor along with detailed fabrication drawings.
- d) Furnish all materials, labour, tools and plant and all consumables required for fabrication and supply, all necessary rivets, bolts, nuts, washers, tie rods and welding electrodes for field connections,
- e) Furnish shop painting of all fabricated steelwork as per requirements of this Specification.
- f) Suitably mark, bundle, and pack for transport all fabricated materials.
- g) Prepare and furnish detailed Bill of Materials, Drawing Office Dispatch lists, Rivet and Bolt List and any other list of bought out items required in connection with the fabrication and erection of the structural steelwork.
- h) Insure, load and transport all fabricated steelwork field connection materials to site.
- i) Maintain a fully equipped workshop at site for fabrication, modification

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 4 OF 40
	and repairs of steelwork at site as may be required to complete the works in accordance with the Contract. 2.02.00 Work by others No work under this specification will be provided for by any agency other than the contractor, unless specifically mentioned otherwise elsewhere in the contract. 2.03.00 Codes and standards All work under this specification shall, unless otherwise specified in the contract, conform to the requirements of the latest revision and/or replacements of the following or any other relevant Indian Standard specifications and codes of practice. In case any particular aspect of the work is not specifically covered by any Indian Standard specification, any other standard practice, as may be specified by the Engineer shall be followed: IS : 226 - Structural steel (Standard Quality) IS : 800 - Code of Practice for general construction in steel. IS : 806 - Code of practice for use of steel tubes in general building construction. IS : 808 - Rolled steel beams, channels, and angle sections IS : 813 - Scheme of symbols for welding IS : 814 - Covered electrodes for metal arc welding of structural steel IS : 815 - Classification and coding of covered electrodes for metal arc welding of structural steels. IS : 816 - Code of practice for use of metal arc welding for general construction in mild steel IS : 817 - Code of practice for training and testing metal arc welders IS : 818 - Code of practice for safety and health requirements in electric and gas welding and cutting operations IS : 822 - Code of practice for inspection of welds IS : 919 - Recommendations for limits and fits for Engineering IS : 961 - Structural Steel (High Tensile)	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 5 OF 40
	IS : 1148 - Rivet bars for structural purposes IS : 1149 - High tensile rivet bars for structural purposes IS : 1161 - Steel Tubes for structural purposes IS : 1200 - Method of measurement of steelwork and ironwork (Part 8) IS : 1239 - Mild Steel Tubes IS : 1363 - Black hexagon bolts, nuts and lock nuts (dia. 6 to 30 mm) and black hexagon screws (dia 6 to 24 mm) IS : 1364 - Precision and semi-precision hexagon bolts, screws, nuts and 1 locknuts (dia, range 6 to 39 mm) IS : 1367 - Technical supply conditions for threaded fasteners IS : 1442 - Covered electrodes for the metal are welding of high tensile structural steel IS : 1608 - Method for tensile testing of steel products other than sheet strip, wire and tube IS : 1730 - Dimensions for steel plate, sheet, and strip for structural and general engineering purposes. IS : 1731 - Dimensions for steel flats for structural and general engineering purposes IS : 1852 - Rolling and cutting tolerances for hot-rolled steel products IS : 1977 - Structural steel (ordinary quality) St-42-0 IS : 2062 - Steel for General Structural Purposes IS : 2074 - Ready mixed paint, red oxide Zinc chromate priming IS : 2595 - Code of Practice for Radiographic Testing IS : 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and Steel IS : 2633 - Method for testing uniformity of coating on Zinc Coated Articles IS : 3757 - High strength structural bolts	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 6 OF 40
	IS : 4759 - Specifications for Hot-Dip Zinc Coatings on Structural Steel and other allied products IS : 7205 - Safety Code for Erection of Structural Steelwork IS : 7215 - Tolerances for fabrication of steel structures IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels. IS : 9595 - Recommendations for metal arc welding of carbon and carbon manganese steels. 2.04.00 Conformity with Designs The contractor shall design all connections, supply and fabricate all steelwork and furnish all connection materials in accordance with the approved drawings and/or as instructed by the Engineer keeping in view the maximum Utilization of the available sizes and sections of steel materials. The methods of painting, marking, packing and delivery of all fabricated materials shall be in accordance with the provisions of the contract and/or as approved by the Engineer. Provision of all relevant Indian Standard Specifications and Codes of Practice shall be followed unless otherwise specified in the contract. 2.05.00 Materials to be used 2.05.01 General All steel materials required for the work will be supplied by the contractor unless otherwise specified elsewhere in the contract. The materials shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. All materials shall be of tested quality only unless otherwise permitted by the Engineer and/or Consultant. If desired by the Engineer, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are required to be used from unidentified stocks, if permitted by the Engineer, a random sample shall be tested at an approved laboratory from each lot of 50 tones or less of any particular section. The arc welding electrodes shall be of approved reputed manufacture and conforming to the relevant Indian Standard Codes of Practice and Specifications and shall be of heavily coated type and the thickness of the coating shall be uniform and concentric. With each container of electrodes, the manufacturer shall furnish instructions giving recommended voltage and amperage (Polarity in case of D.C. supply) for which the electrodes are suitable.	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 7 OF 40
2.05.02	Steel All steel materials to be used in construction within the purview of this specification shall comply with any of the following Indian Standard Specifications as may be applicable: a) IS : 2062 - Steel for general structural purposes b) IS : 961 - Structural steel High Tensile c) IS : 1977 - Structural steel (Ordinary quality) St-42-0 In case of imported steel materials being used, these shall conform to specifications equivalent to any of the above as may be applicable.	
2.05.03	Rivet Steel	
	All rivet steel used in construction within the purview of this Specification shall comply with one of the following Indian Standard Specifications as may be applicable: a) IS : 1148 - Rivet Bars for structural purpose b) IS : 1149 - High tensile rivet bars for structural purposes. Where high tensile steel is specified for rivets, steps shall be taken to ensure that the rivets are so manufactured that they can be driven and heads formed satisfactorily without the physical properties of steel being impaired.	
2.05.04	Electrodes	
	All electrodes to be used under the Contract shall be of approved reputed manufacture, low hydrogen electrode and shall comply with any of the following Indian Standard Specifications as may be applicable a) IS : 814 - Covered electrodes for metal arc welding of structural steel b) IS : 815 - Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel c) IS : 1442 - Covered electrodes for the metal arc welding of high tensile structural steel d) IS : 7280 - Bare wire electrodes for submerged arc welding of	

 Maharatna Company		TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		TENDER NO. PSER/SC/BA/CL/1962/19		SPECIFICATION NO. PE-TS-442-600-C017	
				VOLUME - II B			
				SECTION - D		SUBSECTION -D17	
				REV.NO. 0		DATE 19/11/2018	
				SHEET 8		OF 40	
structural steels							
2.05.05		Bolts and Nuts					
All bolts and nuts shall conform to the requirements of Indian Standard Specification IS: 1367 - Technical Supply Conditions for Threaded Fasteners. Materials for Bolts and nuts under the purview of this contract shall comply with any of the following Indian Standard Specifications as may be applicable. a) Mild Steel All mild steel for bolts and nuts when tested in accordance with the following Indian Standard Specification shall have a tensile strength of not less than 44 Kg/mm² and a minimum elongation of 23 per cent on a gauge length of 5.6 $\sqrt{A}$, where "A" is the cross sectional area of the test specimen i) IS: 1367: Technical supply conditions for threaded fasteners ii) IS: 1608: Method for tensile testing of steel products other than sheet, strip, wire and tube b) High Tensile Steel The material used for the manufacture of high tensile steel bolts and nuts shall have the mechanical properties appropriate to the particular class of steel as set out in IS: 1367 or as approved by the Engineer.							
2.05.06		Washers					
Washers shall be made of steel conforming to any of the following Indian Standard Specifications as may be applicable under the provisions of the Contract: a) IS : 2062 - Steel for general structural purposes b) IS : 961 - Structural Steel (High Tensile Quality) c) IS : 1977 - Structural steel (Ordinary Quality) St-42-0 d) IS : 6649 - Hardened washers							
2.05.07		Paints					
Paints to be used for shop coat of fabricated steel under the purview of this							

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 9 OF 40
	contract shall conform to the Indian Standard Specification IS: 2074 - Ready mixed Paint, Red oxide Zinc Chromate Priming. 2.06.00 Coal Bin 2.06.01 Shape of bins shall be circular, polygonal, square, or rectangular in plan. Bottom hopper portion may have be conical-cum-hyperbolic or any other profile shape as shown in the drawing. Bin shall be termed as bunkers or silos according to their shape and plane of rupture of coal. 2.06.02 For general requirements, fabrication and construction details IS: 9178 (Pt.1 & 11) shall be followed as general guidance. The bins shall be fabricated and erected in segments. 2.06.03 The Coal bins shall be made of mild steel plates joined together with full strength butt weld and provided with stiffeners at regular interval. Stiffeners shall be provided on the external face and it may be welded with external face. 2.06.04 Bending of plates and rolled sections to the required shape for fabrication shall be done by plate bending machine or cold bending process Without resorting to heating, hammering, angle smithy and black smithy process. 2.06.05 Poking hole (manual or pneumatic) and striking plate shall be provided to facilitate coal flow. Poking holes shall have circular MS pipe and cover cap as detailed in the drawing. 2.07.00 New Erection Marks 2.07.01 Additional structures involving new erection marks may be required to be added at any stage of work. 2.07.02 All such new erection marks shall be detailed and included in marking schemes and fabrication carded out thereafter. 2.07.03 All such new erection marks shall be considered under item of original fabrication work. As a result of additional structures becoming necessary if the work is delayed beyond the time schedule stipulated, the Engineer shall give suitable extension of time provided he is satisfied about the reasonableness of the delay involved. However, no claim for extra payments or revision of rates due to delay shall be entertained.	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 10 OF 40
2.08.00	ELECTRO FORGED STEEL GRATINGS	
2.08.01	Factory made fabricated electro forged gratings unit with steel conforming to IS: 20 62 shall be supplied , fabricated, transported, erected and aligned in floorings, platforms, drain and trench covers, walkways, passages, staircases with edge binding strips and anti skid nosing in treads etc.	
2.08.02	All grating units shall be rectangular in pattern and electro forged. The size and the spacing of the bearing bars and cross bars shall be as detailed in fabrication drawings. The contractor shall submit the grating design for different spans and load intensities along with fabrication drawings. The depth of the grating unit shall be 40 mm, unless specified otherwise.	
2.08.03	The gratings shall be made up in panel units designed to coincide with the span of the structural steel framing or openings as indicated in the design/ scope drawings. Maximum possible standardization of the grating panel sizes shall be tried and designed.	
2.08.04	The grating unit shall be accurately fabricated and finished, free from wraps, twists, or any defects that would impair their strength, serviceability, and appearance.	
2.08.05	Grating work shall include cut outs and clearance opening for all columns, pipes, ducts, conduits or any other installation penetrating through the grating work. Such cut outs and clearances shall be treated as specified in subsequent clauses.	
2.08.06	The gratings shall be notched, trimmed and neatly finished around flanges and webs of the columns, moment connections, cap plates, and such other components of the steel structures encountered during the placement of the gratings. In all such cases, the trimming shall be done to follow the profile of the components encountered . After trimming, the binding strip shall be provided on the grating to suit the profile so obtained.	
2.08.07	Opening in gratings for pipes or ducts that are 150mm in size or diameter or larger shall be provided with steel bar toe plates of not less than 5mm thickness and appropriate width, set flush with the bottom of the bearing bars.	
2.08.08	Penetrations in gratings that are more than 50mm but less than 150mm in size or diameter shall be welded with plates of size shown in the detailed drawings set flush with the bottom of the grating panel.	
2.08.09	Unless otherwise indicated on the drawings, grating units at all penetrations shall be made up in split section, accurately fitted and neatly finished to provide for proper assembly and erection at the job site.	

TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	TENDER NO. ES/ER/SC/1/BAR/01/02/19	
	SPECIFICATION NO. PE-TS-442-600-C017	
	VOLUME - II B	
	SECTION - D	SUBSECTION -D17
	REV.NO. 0	DATE 19/11/2018
SHEET 11	OF 40	

- 2.08.10** Grating units shall be provided with all necessary clips, bolts, nuts and lock washers required for proper assembly and rigid installation and fastening to abutting units supporting structural steel framing members.
- 2.08.11** The gratings shall be of reputed make and manufacturer, as approved by Engineer. The unit rate quoted by him for this item shall be inclusive of transport of gratings to the project site, all taxes, duties etc. He shall also provide all facilities and access to the Engineer or his representative to carry out inspection during all stages of manufacturing of gratings.
- 2.08.12** Maximum deviation in linear dimension from the approved dimension shall not exceed 12mm.
- 2.08.13** All fabricated grating section and accessories shall be blast cleaned to near white metal surface (Sa 2½) followed by either of the following two:
- (a) Two coats of red lead primer and two coats of black enamel finish paint.
- (b) Hot dipped galvanization at 610 gm/sq.m.
- in the shop prior to erection at site, as the approved drawing.
- 2.08.14** Prior to finishing all surfaces shall be cleaned, free from rust, mill scale, grease, oil, or any other foreign matter by blast cleaning. BS: 4232 shall be followed for blast cleaning.
- 2.08.15** Primer can be applied by spray guns or by brushes, however the finish paint shall necessarily be applied by means of spray guns. The applied coatings shall be uniform, free from voids and streaks; drilled or punched holes shall be touched up prior to erection or assembly.
- 2.09.00 GALVANIZATION OF GRATINGS**
- 2.09.01** Purity of Zinc to be used-for galvanizing shall be 99.5% as per IS: 215
- 2.09.02** After the shop work is complete, the structural material shall be punched with erection mark and be hot double dip galvanized. Before galvanizing the steel section shall be thoroughly blast cleaned to near white metal surface (Sa 2½).
- 2.09.03** The weight of the zinc coating shall be at least 610 gm/m² - unless noted otherwise.
- 2.09.04** The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be cleaned and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter that is loosely attached to the steel, blistered surface, flaking or peeling off etc. The presence of any of

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 12 OF 40																					
	these defects noticed on visual or microscopic inspection shall render the material liable to rejection. 2.09.05 There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633. 2.09.06 When the steel section is removed from the galvanizing kettle, excess spelter shall be removed by 'burning'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose. 2.09.07 Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specifications or lack of quality control in any manner in the galvanizing plant, shall render the entire production in the relevant shift liable to rejection. 2.09.08 All structural steel shall be treated with sodium dichromate or an approved equivalent solution after galvanizing; so as to prevent white storage stains. 2.09.09 If the galvanizing of any member is damaged, the Engineer shall be shown of the extent of damage, if so directed the galvanizing may have to be redone in the similar manner as stated above at no extra cost to the Owner. 2.10.00 STAINLESS STEEL HOPPERS (As per BOQ item) 2.10.01 Material In case SS Hopper is to be fabricated & erected as per BOQ item with SS415M, following specification shall be followed. Stainless steel hopper of grade SS 415M as manufactured by SAIL or equivalent shall be provided in the lower portion of bunker hopper. SS 415M having the following chemical composition shall be used. <table> <thead> <tr> <th>Material</th><th>%</th><th>Remarks</th></tr> </thead> <tbody> <tr> <td>Carbon</td><td>10.03%</td><td>Max.</td></tr> <tr> <td>Silicon</td><td>1.60%</td><td>Max.</td></tr> <tr> <td>Manganese</td><td>0.80% to 1.50%</td><td></td></tr> <tr> <td>Phosphorous</td><td>0.03%</td><td>Max.</td></tr> <tr> <td>Sulphur</td><td>0.03%</td><td>Max.</td></tr> <tr> <td>Chromium</td><td>10.80% to 12.50%</td><td></td></tr> </tbody> </table>	Material	%	Remarks	Carbon	10.03%	Max.	Silicon	1.60%	Max.	Manganese	0.80% to 1.50%		Phosphorous	0.03%	Max.	Sulphur	0.03%	Max.	Chromium	10.80% to 12.50%		
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	Nickel 1.50% Max. Titanium 0.75% Max. Nitrogen 0.03% Max. The mechanical properties shall be as follows: <table> <tr> <th>Description</th><th>Value</th><th>Remarks</th></tr> <tr> <td>Hardness Rock Well B Scale</td><td>90</td><td>Max.</td></tr> <tr> <td>Tensile Strength</td><td>450 MPa</td><td>Min.</td></tr> <tr> <td>Yield Strength</td><td>300 MPa</td><td>Min.</td></tr> <tr> <td>Elongation</td><td>25%</td><td>Min.</td></tr> </table>	Description	Value	Remarks	Hardness Rock Well B Scale	90	Max.	Tensile Strength	450 MPa	Min.	Yield Strength	300 MPa	Min.	Elongation	25%	Min.	
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2.10.02	Fabrication The fabrication, erection, alignment and welding shall be carried out as per the accepted practice and in accordance with relevant I.S. and international specification as well as stipulations contained herein. Fabrication drawings shall be prepared by the contractor on the basis of the design / scope drawings furnished by Engineer. The fabrication and erection works shall be done as per the approved fabrication drawings.																
2.10.03	Fabrication Drawings a) Fabrication drawing shall give the cutting plan for each hopper plate. Such, cutting plan shall be based on the size of the Stainless Steel plate available at store. In order to reduce the wastage and ensure the maximum utilization of stainless steel plate, the cutting plan shall take in the consideration of the reverse curvature and place the various elements of hopper plate in opposite fashion to reduce the end wastage. Similarly the hopper plate element having different radii shall be placed one inside the other, to optimize the stainless steel plate use. Such optimization may also required adjustment in the size of the each element of hopper plate and also additional weld joints. b) The bill of material of hopper plate shall indicate the inner surface area of the hopper, weight of the hopper based on the inner surface area, weight of each of the cut plate of hopper fabrication, weight of cut and scrap pieces generated. Contractor shall return to the Owner's store all unutilized (surplus) stainless steel plates and all waste and cut pieces generated. Non return of any part of the surplus/waste steel pieces to the Owner's store will call for the penal recovery at three (03) times the maximum																

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 14 OF 40
	procurement rate for the weight of stainless steel pieces not returned to the store. c) In case the contractor does the cutting of the stainless steel without approved cutting plan then all the wastage (i.e. the difference between the weight of stainless steel plate cuts and the actual finished weight considered for the measurement for payment) shall be subjected to the penal recovery at the rate mentioned above. 2.10.04 Cuffing Cutting may be affected by shearing, or by using plasma. The cut edges of all plates shall be perfectly straight and uniform throughout. Cutting shall be done as per the cutting plan shown in the fabrication drawing. Should the Engineer find it necessary, the edges shall be ground smooth afterwards by contractor within the unit rates quoted by him. All the edges shall be ground smooth before they are welded. 2.10.05 Jointing Welding shall join stainless steel. All weld joints (along the inclined plane) shall be staggered. Any common welding process can weld stainless steel viz. MIG, metal arc or plasma using the covered compatible electrodes as per IS: 5206 or by inert gas arc welding as per IS: 2811. Shielding gas shall be Argon + Hydrogen mixture or Argon + Oxygen mixture. However, Argon + Oxygen mixture shall be preferred. Carbon-di-oxide mixture shall be avoided. 308L and 315L electrodes/fillers shall be used for the welding of Stainless Steel to Stainless Steel and Stainless Steel to Mild Steel respectively. However, the welding process and the type of the electrodes to be used for welding shall be as per welding procedure, as approved by the Engineer. On the basis of the welding procedure, the Contractor shall conduct qualification test. 2.10.06 Bending The stainless steel plates shall be subjected to cold forming and bending in order to get the desired shape and profile. 2.10.07 Welding sequence The type of electrodes, welding sequence, preheat and interpass temperature and post weld heat treatment shall be as approved by the Engineer. 2.10.08 Acceptance Criteria of Fabricated Structures The acceptance of the fabricated structure work shall depend upon correct dimensions and alignment, absence of distortion in the structure, satisfactory results from the inspection and testing of the welded structure joints and the	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 15 OF 40
	test specimens, general workmanship being good meeting the tolerance requirements given in IS: 7215. 2.11.00 BEARINGS 2.11.01 PTFE (Poly tetra fluorethylene) slide bearing a) General The bearings shall consist of upper and lower units. The upper unit shall include a sole plate with mirror finish stainless steel facing bonded to the bottom surface of the sole plate. The lower unit shall consist of a relevant laminated elastomers pad surfaced with PTFE. A rigid confining medium substructure bonds the PTFE to the pad. When the upper and lower units are mated the stainless steel slides on the PTFE surface with an extremely low coefficient of friction. These bearings shall be designed as per the performance requirements. The bearing shall be of reputed make and manufacturer as approved by Engineer, for required vertical loads, as per the construction drawings and for a maximum displacement of ± 50 mm. b) Material PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/cm². In order to prevent cold flow in the PTFE surface it shall be rigidly bonded by a special high temperature resistant adhesive to the stainless steel sub-strata. The stainless steel surface, which slides against the PTFE, is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of the stainless steel shall be between 1.0 to 1.5mm. The resilient bearing pad shall consist of multiple layers of lightweight fabric impregnated with a high quality elastomer compound vulcanized into slabs of uniform standard thickness as per the requirement. This shall withstand vertical (compressive) load not less than 500 kg/cm² and shear loads upto 40 kg/cm². c) Installation The seating area for PTFE bearing shall be prepared accurately level and furnished with a thin layer of epoxy resin mortar. The bearing will be placed on this layer while it is still workable and the bearing is levelled. The bearing should not be displaced as the beam is lowered into position. When the mortar and adhesive are fully set and the beam slightly above the top of the bearing. The upper surface of the bearing shall then be coated with sufficient thickness of epoxy resin mortar so that when the beam is lowered on to the temporary supports it comes into full contact	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 16 OF 40
	with the mortar and some is squeezed out. The surplus shall be troweled off and after the mortar is fully set the temporary supports removed. 2.12.00 Storage of material 2.12.01 General All materials shall be so stored as to prevent deterioration and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged, shall be removed from the contractor's yard immediately, failing which, the Engineer shall be at liberty to get the material removed and the cost incurred thereof shall be realised from the Contractor. The Contractor shall maintain upto date accounts in respect of receipt, use, and balance of all sizes and sections of steel and other materials. In case the fabrication is carried out in contractor's fabrication shop outside the plant site where other fabrication works are also carried out, all materials meant for use in this contract shall be stacked separately with easily identifiable marks. 2.12.02 Steel The steel to be used in fabrication and the resulting cut-pieces shall be stored in separate stacks off the ground section wise and lengthwise so that they can be easily inspected, measured, and accounted for at any time. If required by the Engineer, the materials may have to be stored under cover and suitably painted for protection against weather. 2.12.03 Electrodes The electrodes for electric arc welding shall be stored in properly designed racks, separating different types of electrodes in distinctly marked compartments. The electrodes shall be kept in a dry and warm condition if necessary by resorting to heating. 2.12.04 Bolts, Nuts and Washers Bolts, nuts and washers and other fastening materials shall be stored on racks off the ground with a coating of suitable protective oil. These shall be stored in separate gunny bags or compartments according to diameter, length, and quality. 2.12.05 Paints Paints shall be stored under cover in air tight containers. Paints supplied in sealed containers shall be used up as soon as possible once the container is opened.	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 17 OF 40
2.13.00	Quality Control The Contractor shall establish and maintain quality control procedures for different items of work and materials to the extent he deems necessary to ensure that all work is performed in accordance with this specification. In addition to the Contractor's quality control procedures, materials and workmanship at all times shall be subjected to inspection by the Engineer or Engineer's representative. As far as possible, all inspection by the Engineer or Engineer's representative shall be made at the Contractor's fabrication shop whether located at Site or elsewhere. The Contractor shall co-operate with the Engineer or Engineer's representative in permitting access for inspection to all places where work is being done and in providing free of cost all necessary help in respect of tools and plants, instrument, labour and materials required to carry out the inspection. The inspection shall be so scheduled as to provide the minimum interruption to the work of the Contractor. Materials or workmanship not in reasonable conformance with the provisions of this Specification may be rejected at any time during the progress of the work. The quality control procedure shall cover but not be limited to the following items of work - Steel: Quality manufacturer's test certificates, test reports of representative samples of materials from unidentified stocks if permitted to be used. - Rivets, Bolts, Nuts & Washers : Manufacturer's certificate, dimension checks, material testing. - Electrodes : Manufacturer's certificate, thickness and quality of flux coating. - Welders : Qualifying Tests - Welding sets : Performance Tests - Welds : Inspection, X-ray, Ultrasonic tests - Paints : Manufacturer's certificate, physical inspection reports - Galvanizing : Tests in accordance with IS 2633 - Method for testing uniformity of coating on Zinc Coated Articles and IS : 4759 - Specification for Hot-Dip Zinc coatings on Structural Steel and other allied products.	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 18 OF 40
2.14.00	Standard dimensions, forms and weights The dimensions, forms, weights and tolerances of all rolled shapes rivets, bolts, nuts, studs, washers etc. and other members used in the fabrication of any structure shall, wherever applicable, conform to the requirements of the latest relevant Indian Standards, wherever they exist, or, in the absence of Indian Standards, to other equivalent standards. 2.15.00 Fabrication Drawings The contractor shall within thirty (30) days after the award of the Contract submit to the Engineer the Schedule of Fabrication and erection of structural Steelworks, for approval. Within one week after receipt of approval on design of any steel structure (part or full) based on the approved design. As decided by the Engineer, six (6) copies each of some or all of the detailed fabrication drawings will have to be submitted for approval. The sequence of preparation of fabrication drawings shall match with the approved fabrication and erection schedule. The above-mentioned approval for fabrication drawings will be accorded only towards the general conformity with the design requirements as well as specifications. The approval of drawing however shall not relieve the contractor of his sole responsibility in carrying out the work correctly and fulfilling the complete requirements of contract documents. The fabrication drawings shall include but not limited to the following: - Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections. - Dimensional drawings of base plates, foundation bolts location etc. - Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings. - Complete Bill of Materials and detailed drawings of all sections as also their billing weights. - Any other drawings or calculations that may be required for the clarification of the works or substituted parts thereof. These drawings shall give all the necessary information for the fabrication, erection, and painting of the steelwork in accordance with the provisions of this Specification. Fabrication drawings shall be made in accordance with the best modern practice and with due regard to sequence, speed and economy in fabrication and erection. Fabrication drawings shall give complete information necessary for fabrication of the various components of the steelwork,	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 19 OF 40
	including the location, type, size, and extent of welds. These shall also clearly distinguish between shop and field rivets, bolts, and welds and specify the class of bolts and nuts. The drawings shall be drawn to a scale large enough to convey all the necessary information adequately. Notes on the fabrication drawings shall indicate those joints or groups of joints in which it is particularly important that the welding sequence and technique of welding shall be carefully controlled to minimize the locked up stresses and distortion. Welding symbols used shall be in accordance with the requirements of the Indian Standard Specification. IS: 813 - Scheme of symbols for Welding, and shall be consistent throughout. Weld lengths called for on the drawings shall mean the net effective length. The Contractor shall be responsible for and shall carry out at his cost any alterations of the work due to any discrepancies, errors or omissions on the drawings or other particulars supplied by him, whether such drawings or other particulars have been duly approved or not in accordance with the Contract. 3.00.00 WORKMANSHIP 3.01.00 Fabrication 3.01.01 General All workmanship shall be equal to the best practice in modern structural shops, and shall conform to the provisions of the Indian Standard IS: 800 - Code of Practice for general construction in steel and other relevant Indian Standards or equivalent. 3.01.02 Straightening Material Rolled materials before being laid off or worked, must be clean, free from sharp kinks, bends or twists and straight within the tolerances allowed by the Indian Standard Specification on IS : 1552 - Specification for rolling and cutting tolerance for hot-rolled steel products. If straightening is necessary, it may be done by mechanical means or by the application of a limited amount of localized heat. The temperature of heated areas, as measured by approved methods, shall not exceed 600°C. 3.01.03 Cutting Shearing, cropping, or sawing shall affect cutting. Use of a mechanically controlled gas-cutting torch may be permitted for mild steel only. Gas cutting of high tensile steel may also be permitted provided special care is taken to leave sufficient metal to be removed by machining, so that all metal that has been hardened by flame is removed. Gas cutting without a mechanically controlled torch may be permitted if special care is taken and done under expert hand, subject to the approval of the Engineer.	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 20 OF 40
	To determine the effective size of members cut by gas, 3 mm shall be deducted from each cut edge. Gas cut edges, which will be subjected to substantial stress or which are to have weld metal deposited on them, shall be reasonably free from gouges, occasional notches or gouges not more than 4 mm deep will be permitted. Gouges greater than 4 mm that remain from cutting shall be removed by grinding. All re-entrant corners shall be shaped notch free to a radius of at least 12 mm. Shearing, cropping and gas cutting shall be clean, reasonably square and free from any distortion. 3.01.04 Planning of edges Planning or finishing of sheared or cropped edges of plates or shapes or of edges gas-cut with a mechanically controlled torch shall not be required, unless specifically required by design and called for on the drawings, included in a stipulation for edge preparation for welding or as may be required after the inspection of the cut surface. Surface cut with hand-flame shall generally be ground, unless specifically instructed otherwise by the Engineer. 3.01.05 Clearances The erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 2 mm at each end. The erection clearance at ends of beams web shall be not more than 3 mm at each end, but where for practical reasons greater clearance is necessary, suitably designed cheatings shall be provided. 3.02.00 Riveted and bolted construction 3.02.01 Holes Holes through more than one thickness of material for members, such as compound stanchions and girder flanges, shall be drilled after the members are assembled and tightly clamped or bolted together. Punching may be permitted before assembly, if the thickness of the material is not greater than the nominal diameter of rivet or bolt plus 3 mm subject to a maximum thickness of 16 mm provided that the holes are punched 3 mm less in diameter than the required size and reamed after assembly to the full diameter. Holes for rivets or black bolts shall be not more than 1.5 mm or 2.0 mm (depending on whether the diameter of the rivet or bolt is less or more than or equal to 25 mm) larger in diameter than the nominal diameter of the rivet or black bolt passing through them. Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to a tolerance grade of BS as specified in IS: 919. Parts to be connected shall be firmly held together by	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 21 OF 40
	tacking welds or clamps and the holes drilled through all the thicknesses in one operation and subsequently reamed to size. Holes not drilled through all thickness in one operation shall be drilled to a smaller size and reamed out after assembly. Holes for rivets or bolts shall not be formed by gas cutting process. 3.02.02 Assembly All parts of riveted members shall be well pinned or bolted and rigidly held together while riveting. Drifting to enlarge unmatching holes shall not generally be permitted. In case drifting is permitted to a slight extent during assembly, it shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the rivets or bolts shall be reamed. Poor matching of holes shall be cause for rejection. The component parts shall be so assembled that they are neither twisted nor otherwise damaged, and shall be so prepared that the specified cambers, if any, are maintained. Rivets shall ordinarily be hot driven, in which case their finished heads shall be approximately hemispherical in shape and shall be of uniform size throughout the work for rivets of the same size full, neatly finished and concentric with the holes. Rivets shall be heated uniformly to a temperature not exceeding 1125 °C they shall not be driven after their temperature has fallen below 540°C. Rivets shall be driven by power riveters, of either compression or manually operated type, employing pneumatic, hydraulic or electric power. Hand driven rivets shall not be allowed unless in exceptional cases specifically approved by the Engineer. After driving, rivets shall be tight, shall completely fill the holes and their heads shall be in full contact with the surface. In case of countersunk rivets, the countersinking shall be fully filled by the rivet, any proudness of the countersunk head being dressed off flush, if required. Riveted members shall have all parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole. All loose, burnt, or otherwise defective rivets shall be cut out and replaced and special care shall be taken to inspect all single riveted connections. Special care shall also be taken in heating and driving long rivets. The Contractor shall prove the quality of riveting by cutting some rivets chosen at random by the Engineer. No extra payment will be made to the Contractor for such cutting and replacing. Riveting work, for any particular section or group, will be considered satisfactory when at least 90% of the corresponding cut rivets is found to be sound. If the ratio is below 75%, all the rivets in the particular section or group shall be cut, removed and replaced and tested again at the	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 22 OF 40
	Contractor's expense. For cases between 75% and 90% the engineer shall have the option to instruct cutting and replacing any number of further rivets at the Contractor's cost as he deems necessary. Bolted construction shall be permitted only in case of field connections if called for on the Drawings and is subjected to the limitation of particular connections as may be specified. In special cases, however, shop bolt connections may be allowed if shown on drawing or directed by the Engineer. Washers shall be tapered or otherwise suitably shaped, where necessary, to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least one thread. In all cases the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. In addition to the normal washer one spring washer or lock nut shall be provided for each bolt for connections subjected to vibrating forces or otherwise as may be specified on the Drawings. 3.03.00 Welded Construction 3.03.01 General Welding shall be in accordance with relevant Indian Standards and as supplemented in the Specification. Welding shall be done by experienced and good welders who have been qualified by tests in accordance with IS: 817. 3.03.02 Preparation of material Surface to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material except that mill scale, which withstands vigorous wire brushing, may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by a mechanically guided torch. 3.03.03 Assembling Parts to be fillet welded shall be brought in, as close contact as practicable and in no event shall be separated by more than 4 mm. If the separation is 1.5 mm or greater, the size of the fillet welds shall be increased by the amount of the separation. The fit of joints at contact surfaces, which are not completely sealed by, welds, shall be close enough to exclude water after painting. Abutting parts to be butt-welded shall be carefully aligned. Misalignments greater than 3 mm shall be corrected and in making the correction the parts shall not be drawn into a sharper slope than two degrees (2°). The work shall be positioned for flat welding whenever practicable.	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 23 OF 40
3.03.04	Welding Sequence In assembling and joining parts of a structure or of built-up members, the procedure and sequence of welding shall be such as will avoid needless distortion and minimize shrinkage stresses in the closing welds of a rigid assembly, such closing welds shall be made in compression elements. In the fabrication of cover-plated beams and built-up members, all shop splices in each component part shall be made before such component part is welded to other parts of the member. Long girders or girder sections may be made by shop splicing not more than three sub-sections, each made in accordance with this paragraph. When required by the Engineer, welded assemblies shall be stress relieved by heat-treating in accordance with the provisions of the relevant Indian Standard or any other Standard approved by the Engineer.	
3.03.05	Welding technique All complete penetration groove welds made by manual welding, except when produced with the aid of backing material not more than 8 mm thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section. Groove welds made with the use of the backing of the same material, as the base metal shall have the weld metal thoroughly fused with the backing material. Backing strips need not be removed. If required, they may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and weld metal and the weld metal surface is left flush or slightly convex with full throat thickness. Groove welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates need not be removed upon completion of the weld unless otherwise specified elsewhere in the contract. To get the best and consistent quality of welding, automatic submerged arc process shall be preferred. The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall all conform to the relevant Indian Standards.	
3.03.12	Temperature No welding shall normally be done on parent material at a temperature below (-) 5 °C. However, if welding is to undertaken at low temperature, adequate precautions as recommended in relevant Indian Standard shall be taken. When	

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 24 OF 40
	the parent material is less than 40 mm thick and the temperature is between (-) 5°C and 0°C, the surface around the joint to a distance of 100 mm or 4 times the thickness of the material, whichever is greater, shall be preheated till it is hand warm. When the parent material is more than 40 mm thick, the temperature of the area mentioned above shall be in no case be less than 20°C. All requirements regarding preheating of the parent material shall be in accordance with the relevant Indian Standard. 3.03. 13 Peening Where required, intermediate layers of multiple-layer welds may be peened with light blows from a power hammer, using a round-nose tool, peening shall be done after the weld has cooled to a temperature warm to the hand. Care shall be exercised to prevent scaling or flaking of weld and base metal from over peening. 3.03. 14 Equipment These shall be capable of producing proper current so that the operator may produce satisfactory welds. The welding machine shall be of a type and capacity as recommended by the manufacturers of electrodes or as may be approved by the engineer. 3.04.00 Finish Column splices and butt joints of compression members depending on contact for stress transmission shall be accurately machined and close-butted over the whole section with a clearance not exceeding 0.1 mm locally at any place. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc; after welding/riveting together, should be accurately machined so that the parts connected butt over the entire surfaces of contact. Care should be taken that those connecting angles of channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 1.0 mm. 3.05.00 Slab bases and caps Bases and caps fabricated out of steel slabs, except when cut material with true surface, shall be accurately machined over the bearing surface and shall be in effective contact with the end of the stanchion. A bearing face, which is to be grouted direct to a foundation, need not be machined if such face is true and parallel to the upper face. To facilitate grouting, holes shall be provided, where necessary, in stanchion bases for the escape of air.	

 Maharatna Company		TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	TENDER NO. PSER/SC/1/BAR-C/1962-19 SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 25 OF 40	
3.12.00	Lacing bars	The ends of lacing bars shall be neat and free from burns.		
3.13.00	Separators	Rolled section or built-up steel separators or diaphragms shall be required for all double beams except where encased in concrete, in which case, pipe separators shall be used.		
3.14.00	Bearing Plates	Provision shall be made for all necessary steel bearing plates to take up reaction of beams and columns and the required stiffeners and gussets whether or not specified in Drawings.		
3.15.00	Floor Grating	All grating units shall be rectangular in pattern and of pressure locked assembly. The size and spacing of bearing bars and cross bars shall be as approved in detailed drawings. Alternatively diamond pattern grating if approved may be used. The grating shall be made in panel units designed to span as indicated in structural steel framing drawing or as directed by the Engineer. The grating units shall be finished free from warps, twists, or any other defects. Grating work shall include cutouts and clearance openings for all columns, pipes, ducts, conduits etc. The gratings shall be notched, trimmed, and neatly finished around components of the steel structures encountered. Binding strip shall be provided on the grating to suit the profile. Openings in gratings shall be provided with steel bar toe plates of not less than 5 mm thickness and 100 mm width. Unless otherwise indicated on drawings, all penetrations of grating units shall be made up in split section, accurately fitted, and neatly finished. Grating units shall be provided with all necessary clips, bolts, lock washers etc. for proper assembly and installation on supporting steel members. Maximum deviation in linear dimension shall not exceed 12 mm.		
3.10.00	Chequered Plates	Minimum thickness of chequered plate floorings, covers etc. shall be 6 mm O/P. Chequered plate shall be accurately cut to the required sizes and shapes and the cut edges properly ground. Stiffeners shall be provided wherever required from design consideration.		

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 26 OF 40
	3.11.00 Architectural Clearances Bearing plates and stiffener connections shall not be permitted to encroach on the designed architectural clearances. 3.11.00 Shop connections a) All shop connections shall be other wise riveted or welded as specified on the Drawings. b) Heads of rivets on surfaces carry ing brick walls shall be flattened to 10 mm thick projection. c) Certain connections, specified to be shop connections, may be changed to field connections if desired by the Engineer for convenience of erection and the contractor will have to make the desired changes at no extra cost to the exchequer. 3.13.00 Castings Steel castings shall be annealed. 3.14.00 Shop erection The steelwork sh all be temporarily shop-erected complete or as directed by the Engineer so that accuracy of fit may be checked before dispatch. The parts shall be shop-erected with a s ufficient number of parallel drifts to bring and keep the parts in place. In case of parts drilled or punched using steel jigs to make all similar parts interchangeable, the steelwork shall be shop erected in such a way as will facilitate the check of interchange ability.	

बीएसटी एल  Maharatna Company		TENDER NO. PSER/SC/1/BAR-C/1962-19 TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-442-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 19/11/2018 SHEET 27 OF 40
3.15.00 Shop painting			
3.15.01 General Unless otherwise specified, steelwork, which will be concealed by interior building finish, need not be painted; steelwork to be encased in concrete shall not be painted. Unless specifically exempted, all other steelwork shall be given one coat of shop paint, applied thoroughly and evenly to dry surfaces which have been cleaned, in accordance with the following paragraph, by brush, spray, roller coating, flow-coating or dipping as may be approved by the Engineer. After inspection and approval and before leaving the shop, all steelwork specified to be painted shall be cleaned by hand-wire brushing or by other methods of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by the solvent. Steelwork specified to have no shop paint shall, after fabrication, be cleaned of oil or grease by solvent cleaners and be cleaned of dirt and other foreign material by trough sweeping with a fibre brush.			
3.15.02 Inaccessible parts Surfaces not in contact, but inaccessible after assembly, shall receive two coats of shop paint, Positively of different colours to prove application of two coats before assembly. This does not apply to the interior of sealed hollow sections.			
3.15.03 Contact surfaces Contact surface shall be cleaned in accordance with sub-clause 3.13.1 before assembly.			
3.15.04 Finished surfaces Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.			
3.15.05 Surfaces adjacent to field welds Unless otherwise provided for, surfaces within 50 of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.			





TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D

SUBSECTION – D18

REV.NO. 0

DATE 19/11/2018

SHEET 1

OF

17

VOLUME: II B

SECTION - D (PART I)

SUB-SECTION – D 18

**SPECIFICATION NO. PE-TS-442-600-C018
ERECTION OF STRUCTURAL STEELWORK**



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 2 OF 17

C O N T E N T

CLAUSE NO.	DESCRIPTION	SHEET NO.
1.00.00	SCOPE	3
2.00.00	GENERAL	3
3.00.00	WORKMANSHIP	6
4.00.00	TESTING AND ACCEPTANCE CRITERIA	12
5.00.00	INFORMATION TO BE SUBMITTED	16

	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-442-600-C018	
		VOLUME - II B	
		SECTION - D	SUBSECTION - D18
		REV.NO. 0	DATE 19/11/2018
		SHEET 3	OF 17

SUB-SECTION – D 18

ERECTION OF STRUCTURAL STEELWORK

1.00.00 SCOPE

This specification covers the erection of structural steelwork including receiving and taking delivery of fabricated structural steel materials arriving at site, installing the same in position, painting and grouting the stanchion bases all complete as per Drawings, this Specification and other provision of the Contract.

2.00.00 GENERAL

2.01.00 Work to be provided for by the Contractor, unless otherwise specified in the Contract, shall include but not be limited to the following:

- a) The Contractor shall provide all construction and transport equipment, tools, tackle, consumables, materials, labour, and supervision required for erection of the structural steelwork.
- b) Receiving, unloading, checking, and moving to storage yard at Site including prompt attendance to all insurance matters as necessary for all fabricated steel materials arriving at Site. The Contractor shall pay all demurrage and/or wharfage charges etc. on account of default on his part.
- c) Transportation of all fabricated structural steel materials from Site storage yard, handling, rigging, assembling, riveting, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location according to approved erection drawings and/or as directed by the Engineer. If necessary suitable temporary approach roads to be built for transportation of fabricated steel structures.
- d) Checking center lines, levels of all foundation blocks including checking line, level, position and plumb of all bolts and pockets. Any defect observed in the foundation shall be rectified with Engineer's approval. The Contractor shall fully satisfy himself regarding the correctness of the foundations before installing the fabricated steel structures on the foundation blocks.
- e) Aligning, plumb, leveling, riveting, bolting, welding and securely fixing the fabricated steel structures including floor gratings, chequered plates etc. in accordance with the Drawings or as directed by the Engineer.
- f) Painting of the erected steel structures.
- g) All minor modifications of the fabricated steel structures as directed by the



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 4 OF 17

Engineer including but not limited to the following:

- i) Removal of bends, kinks, twists etc. for parts damaged during transport and handling.
- ii) Cutting, chipping, filling, grinding, etc. if required for preparation and finishing of site connections.
- iii) Reaming of holes for use of higher size rivet or bolt if required.
- iv) Refabrication of parts damaged beyond repair during transport and handling or refabrication of parts, which are incorrectly fabricated.
- v) Fabrication of parts omitted during fabrication by error, or subsequently found necessary.
- vi) Drilling of holes which are either not drilled at all or are drilled in incorrect location during fabrication.
- vii) Carry out tests in accordance with this specification.

2.02.00 Work by Others

No work under this Specification will be provided for by any agency other than the Contractor unless specifically mentioned elsewhere in the contract.

2.03.00 Codes and Standards

All work under this Specification shall, unless specified otherwise, conform to the latest revisions and/or replacements of the following or any other Indian Standard Specification and codes of Practice of equivalent:

IS: 800 - Code of practice for general construction in steel.

IS: 456 - Code of practice for main or reinforced concrete.

2.04.00 Conformity with Designs

The Contractor will erect the entire fabricated steel structure, align all the members, complete all field connections and grout the foundations all as per the provisions of this specification and the sequence and the design criteria laid down by the Engineer. All work shall conform to the provisions of this specification and/or instructions of the engineer. The testing and acceptance of the erected structures shall be in accordance with the provisions of this Specifications and/or the instructions of the Engineer.

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO.	0	DATE	19/11/2018

SHEET 5 OF 17

2.05.01 General

2.05.02 Materials to conform to Indian standards

2.06.00 Storage of Materials

2.06.01 General

2.06.02 Yard

The Tenderer must visit the site prior to submission of his tender to acquaint himself with the availability of land and the development necessary by way of filling, drainage, access roads, fences, sheds etc. all of which shall be carried out by the Contractor at his own cost as directed by the Engineer.

2.06.03 Covered Store

All field connection materials, paints, cement etc. shall be stored on well

	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-442-600-C018 VOLUME - II B SECTION - D SUBSECTION – D18 REV.NO. 0 DATE 19/11/2018 SHEET 6 OF 17
	designed racks and platform s off the ground in a properly cov ered store building to be built at the cost of the Contractor. 2.07.00 Quality Control The contractor shall establish and m aintain quality control procedures for different items of work and materials as may be directed by the Engineer to assure compliance w ith the provisions of th e Contract an d shall submit the records of th e sam e to the Engineer . The quality control op eration shall include but not be limited to the Following items of work : i) Erection: Lines, levels, grades, plumbs, jo int characteristics in cluding tightness of bolts. ii) Grouting: Cleaning and roughness of foundation, quality of materials used for grouting, admixtures, consistency, and strength of grout. iii) Painting: Preparation of surface for painting, quality of primers and paints, thinners, application and uniformity of coats. 2.08.00 Taking Delivery The Contractor shall take delivery of fabricated structural steel and nece ssary connection materials from railhead/trucks as may be necessary and as directed by the Engineer. He shall check, unload; transport the materials to his stores for proper storing at his own cost. The Contractor shall subm it claim s to insurance or oth er authorities and pursue the same in case of loss or damage during transit and handling and all loss thereof shall be borne by him. The Contractor shall also take all precautions against damage of the materials in his custody after taking delivery and till the sam e are erected in place and accepted. The C ontractor shall salvage, collect, and deliver all the packing materials to the Owner free of charge. 3.00.00 WORKMANSHIP 3.01.00 Erection 3.01.01 Plant and Equipment The suitability and ade quacy of all erection tools and plant and equipm ent proposed to be used shall be thoroughly verified. They shall be efficient, dependable, in go od working condition and shall have the approval of the Engineer.	



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 7 OF 17

3.01.02 Method and sequence of erection

The method and sequence of erection shall have the prior approval of the Engineer. The Contractor shall arrange for most economical method and sequence available to him consistent with the drawings and specifications and other relevant stipulations of the contract.

3.01.03 Temporary Bracing

Unless adequate bracing is included as a part of the permanent framing, the erector during erection shall install, free of cost to the Owner, temporary guys and bracings where needed to secure the framing against loads such as wind or seismic forces comparable in intensity to that for which the structure has been designed, acting upon exposed framing as well as loads due to erection equipment and erection operations.

If additional temporary guys are required to resist wind or seismic forces acting upon components of the finished structure installed by others during the course of the erection of the steel framing, arrangement for their installation by the erector shall be made free of cost to the Owner.

The requirement of temporary bracing and guys shall cease when the structural steel is once located, plumbed, levelled, aligned, and grouted within the tolerances permitted under the specification and guyed and braced to the satisfaction of the Engineer.

The temporary guys, braces, false work, and cribbing shall not be the property of the Owner and they may be removed immediately upon completion of the steel erection.

3.01.04 Temporary Floors for Buildings

It shall be the responsibility of the Contractor to provide free of cost planking and to cover such floors during the work in progress as may be required by any Act of Parliament and /or bylaws of state, Municipal or other local authorities.

3.01.05 Setting Out

Positioning and levelling of all steelwork, plumbing of stanchions and placing of every part of the structure with accuracy shall be in accordance with the approved Drawings and to the satisfaction of the Engineer. For heavy columns, etc. the Contractor shall set proper screed bars to maintain proper level. No extra payment shall be made for this.



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 8 OF 17

Each tier of column shall be plumbed and maintained in a true vertical position subject to the limits of tolerance under this Specification.

No permanent field connections by riveting, bolting or shall be carried out until proper alignment and plumbing has been attained.

3.01.06 Field Riveting

All rivets shall be heated and driven with pneumatic tools. Hand passing or "throwing" of rivets are desirable. Any other method of conveying hot rivets from the furnace to the driving point must be approved by the engineer. No-cold rivets shall be driven. All other requirements of riveting including quality and acceptance criteria shall be in accordance with the relevant portions of the Specification for Fabrication of Structural Steelwork of the Project.

3.01.07 Field Bolting

All relevant Portions in respect of bolted construction of the Specification for Fabrication of Structural Steelwork applicable to the Project shall also be applicable for field bolting in addition to the following:

Bolts shall be inserted in such a way so that they may remain in position under gravity even before fixing the nut. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled, all joint surfaces, including those adjacent to the washers shall be free of scales except tight mill scales. They shall be free of dirt, loose scales, burns, and other defects that would prevent solid seating of the parts. Contact surfaces within friction type joints shall be free of oil, paint, lacquer, or galvanizing.

All high tensile bolts shall be tightened to provide, when all fasteners in the joint are tight, the required minimum bolt tension by any of the following methods.

a) Turn-of-nut Method

When the turn-of-nut method is used to provide the bolt tension, there shall first be enough bolts brought to a "snug tight" condition to ensure that the parts of the Joint are brought into good contact with each other. 'Snug tight' is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in any remaining holes in the connection and brought to snug tightness. All bolts in the joint shall then be tightened additionally by the applicable amount of nut rotation specified in Table-I with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 9 OF 17

there shall be no rotation of the part not turned by the wrench.

TABLE-I

Bolts length not exceeding 8 times dia or 200 mm	Bolt length exceeding 8 times dia or 200 mm	Remarks
1/2 turn	2/3 turn	Nut rotation is relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation-30° over or under.

Bolts may be installed without hardened washers when tightening is done by the turn-of-nut method. However, normal washers shall be used.

Bolts tightened by the turn-of-nut method may have the outer face of the match-marked with the protruding bolt point before final tightening, thus affording the inspector visual means of noting the actual nut rotation. Such marks can be made by the wrench operator by suitable means after the bolts have been brought up snug tight.

b) Torque Wrench Tightening

When torque wrenches are used to provide the bolt tensions, the bolts shall be tightened to the torques specified in TABLE-II (See Note below the Table). Nuts shall be in tightening motion when torque is measured. When using torque wrenches to install several bolts in a single joint, the wrench shall be returned to touch up bolts previously tightened, which may have been loosened by the tightening of subsequent bolts, until all are tightened to the required tension.

TABLE-II

Nominal Bolt Diameter (mm) (Kg.M) of IS:1367	Torque to be applied for bolt class 8.8
20	59.94
22	81.63
24	103.73

Note: The above torque values are approximate for providing tensions of 14.

	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-442-600-C018 VOLUME - II B SECTION - D SUBSECTION – D18 REV.NO. 0 DATE 19/11/2018 SHEET 10 OF 17
	7 T for 20 mm dia.; and 21.2 T for 24 mm dia. bolts under moderately lubricated condition. The torque wrench shall be calibrated at least once daily to find out the actual torque required to produce the above required tension in the bolt by placing it in a tension indicating device. These torques shall be applied for tightening the bolts on that day with the particular wrench. In either of the above two methods, if required, for bolt entering and wrench operation clearances, tightening may be done by turning the bolt while the nut is prevented from rotating. Impact wrenches if used shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds. Holes for turned bolts to be inserted in the field shall be reamed in the field. All drilling and reaming for turned bolts shall be done only after the parts to be connected are assembled. Tolerances applicable in the fit of the bolts shall be in accordance with relevant Indian Standard Specifications. All other requirements regarding assembly and bolt tightening shall be in accordance with this sub clause. 3.01.08 Field Welding All field assembly and welding shall be carried out in accordance with the requirements of the specification for fabrication work applicable to the project, excepting such provisions therein which manifestly apply to shop conditions only. Where the fabricated structural steel members have been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joints. 3.01.09 Holes, Cutting and Fitting No cutting of sections, flanges, webs, cleats, rivets, bolts, welds etc. shall be done unless specifically approved and /or instructed by the Engineer. The erector shall not cut, drill, or otherwise alter the work of other trades, unless such work is clearly specified in the Contract or directed by the Engineer. Wherever such work is obtain specified the Contractor shall obtain complete information as to size, location and number of alterations prior to carrying out any work. The Contractor shall not be entitled for any payment on account of any such work. 3.02.00 Drifting Correction of minor misfits and reasonable amount of reaming and cutting of excess stock from rivets will be considered as permissible. For this, light drifting may be used to draw holes together and drills shall be used to enlarge holes as necessary to make connections. Reaming, that weakens the member	



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 11 OF 17

or makes it impossible to fill the holes properly or to adjust accurately after reaming, shall not be allowed.

Any error in shop work which prevents the proper assembling and fitting of parts by moderate use of drift pins and reamers shall immediately be called to the attention of the Engineer and approval of the method of correction obtained. The use of gas cutting torches at erection site is prohibited.

3.03.00 Grouting of stanchion bases and bearings of beams and girders on stone, brick or concrete (Plain or reinforced)

Grouting shall be carried out with Ordinary Cement grout as described below:

The mix shall be one (1) part cement and one (1) part sand and just enough water to make it workable. The positions to be grouted shall be cleaned thoroughly with compressed air jet and wetted with water and any accumulated water shall be removed. These shall be placed under expert supervision, taking care to avoid air locks. Edges shall be finished properly. If the thickness of grout is 25 mm or more, two (2) parts of 6 mm down graded stone chips may be added to the above noted cement-sand grout mix, if required, by the Engineer or shown on the drawings.

No grouting shall be carried out until a sufficient number of bottom lengths of stanchions have been properly lined, leveled, and plumbed and sufficient floor beams are tied in position.

Whatever method of grouting is employed, the operation shall not be carried out until the steelwork has been finally levelled and plumbed, the stanchion bases being supported meanwhile by steel wedges, and immediately before grouting, the space under steel shall be thoroughly cleaned.

If required by the Engineer, certain admixtures like aluminium powder, "ironite" or equivalent, may be required to be added to the grout to enhance certain desirable properties of the grout. Approved non-shrink pre-mixed grout having required flowability and compressive strength may also be used with Engineer's approval.

3.04.00 Painting after Erection

Field painting shall only be done after the structure is erected, levelled, plumbed, aligned and grouted in its final position, tested and accepted by the Engineer. Normally, final painting shall be done only after the floor slabs are concreted and masonry walls are built. However, touch up painting, making good any damaged shop painting and completing any unfinished portion of the shop coat shall be carried out by the Contractor free of cost to the Owner. The materials and specification for such painting in the field shall be in accordance with the requirements of the specification for fabrication of structural



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 12 OF 17

steelwork applicable for the project.

Painting shall not be done in frosty or foggy weather or when humidity is such as to cause condensation on the surfaces to be painted. Before painting of steel, which is delivered unpainted, is commenced, all surfaces to be painted shall be dried and thoroughly cleaned from all loose scale and rust.

All field rivets, bolts, welds, and abrasions to the shop coat shall be spot painted with the same paint used for the shop coat. Where specified, surfaces, which will be in contact after site assembling, shall receive a coat of paint (in addition to the shop coat, if any) and shall be brought together while the paint is still wet.

Surface, which will be inaccessible after field assembly shall receive the full, specified protective treatment before Bolts and fabricated steel members who are galvanized or otherwise treated and steel members to be encased shall not be painted.

The final painting shall be of two coats of Synthetics Enamel painting or Aluminium paint of approved manufacture as per the approved "Schedule of Painting". The shades shall also be as per the approved schedule. Synthetic enamel paint shall conform to IS: 2932.

3.05.00 Final cleaning up

Upon completion of erection and before final acceptance of the work by the Engineer, the contractor shall remove free of cost all false work, rubbish and all Temporary Works resulting in connection with the performance of his work.

4.00.00 TESTING AND ACCEPTANCE CRITERIA

4.01.00 General

Loading tests shall be carried out on erected structures, if required by the Engineer, to check adequacy of fabrication and/or erection. Any structure or a part thereof found to be unsuitable for acceptance as a result of the test shall have to be dismantled and replaced with suitable member as per the Contract and no payment towards the cost of the dismantled portion and any connected work shall be made to the contractor. In course of dismantling, if any damage is done to any other parts of the structure or to any fixtures, the same shall be made good free of cost by the Contractor, to the satisfaction of the Engineer. The Cost of the tests specified hereinafter shall be borne by the Owner; but if the structure fails to pass the tests, the cost of the tests shall be recovered from the Contractor. Any extra claim due to loss of time, idle labour, etc. arising out of these testing operations shall not be entertained, however, only reasonable and appropriate time extensions will be allowed.



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 13 OF 17

The structure or structural member under consideration shall be loaded with its actual dead load for as long a time as possible before testing and the tests shall be conducted as indicated in the following sub-clauses 4.01.01, 4.01.02 and 4.01.03. The method of testing and application of loading shall be as approved by the Engineer.

4.01.01 Stiffness Test

In this test, the structure or member shall be subjected, in addition to its actual dead load, to a test load equal to 1.5 times the specified superimposed load, and this loading shall be maintained for 24 hours. The maximum deflection attained during the test shall be within the permissible limit. If, after removal of the test load, the member or structure does not show a recovery of at least 80 per cent of the maximum strain or deflection shown during 24 hours under load, the test shall be repeated. The structure or member shall be considered to have sufficient stiffness, provided that the recovery after this second test is not less than 90 per cent of the maximum increase in strain or deflection recorded during the second test.

4.01.02 Strength Test

The structure or structural member under consideration shall be subjected, in addition to its actual dead load, to a test load equal to the sum of the dead load and twice the specified superimposed load, and this load shall be maintained for 24 hours.

In the case of wind load, a load corresponding to twice the specified wind load shall be applied and maintained for 24 hours, either with or without the vertical test load for more severe condition in the member under consideration or the structure as a whole. Complete tests under both conditions may be necessary to verify the strength of the structure. The structure shall be deemed to have adequate strength if, during the test, no part fails and if on the removal of the test load, the structure shows a recovery of at least 20 per cent of the maximum deflection or strain recorded during the 24 hours under load.

4.01.03 Structure of same design

Where several structures are built to the same design and it is considered unnecessary to test all of them, one structure, as a prototype, shall be fully tested, as described in previous Sub-clauses, but in addition, during the first application of the test load, particular note shall be taken of the strain or deflection when the test load 1.5 times the specified superimposed load has been maintained for 24 hours. This information is required as a basis of comparison in any check test carried out on samples of the structure.



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-442-600-C018

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 19/11/2018

SHEET 14 OF 17

When a structure of the same type is selected for a check test, it shall be subjected, in addition to its actual dead load, to a superimposed test load, equal to 1.5 times the specified live load, in a manner and to an extent prescribed by the Engineer. This load shall be maintained for 24 hours, during which time, the maximum deflection shall be recorded. The check test shall be considered satisfactory, provided that the maximum strain or deflection recorded in the check test does not exceed by more than 20% of the maximum strain or deflection recorded at similar load in the test on the prototype.

4.01.04 Repair for subsequent test and use after strength tests

An actual structure which has passed the "Strength Test" as specified in Sub-clause 4.1.2 hereinbefore and is subsequently to be erected for use, shall be considered satisfactory for use after it has been strengthened by replacing any distorted members and has subsequently satisfied the 'Stiffness Test' as specified in Sub-clause 4.01.01 hereinbefore.

4.02.00 Tolerances

Some variation is to be expected in the finished dimensions of structural steel frames. Unless otherwise specified, such variations are deemed to be within the limits of good practice when they are not in excess of the cumulative effect of detailed erection clearances, fabricating tolerances for the finished parts and the rolling tolerances for the profile dimensions permitted under the Specifications for fabrication of structural steel work applicable to this Project and as specified below: The specified tolerance is mainly for welded erection. In case of bolted erection, no tolerance is desired so that all prefabricated bolt holes are matched on erection.

I. For Buildings Containing Cranes

Component	Description	Variation Allowed
1.	2.	3.
Main columns	a) shifting of column axis at foundation level with respect to building line	
	i) In longitudinal direction	i) ± 3.0 mm
	ii) In lateral direction	ii) ± 3.0 mm
	b) Deviation of both major column axis from vertical between foundation and	

	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-442-600-C018 VOLUME - II B SECTION - D SUBSECTION – D18 REV.NO. 0 DATE 19/11/2018 SHEET 15 OF 17
	other member connection levels: i) For a column upto and including 10M height ii) For a column greater than 10M but less than 40M height c) For adjacent pairs of columns across the width of the building prior to placing of truss d) For any individual column deviation of any bearing or resting level from levels shown on drawings. e) For adjacent pairs of columns either across the width of building or longitudinally level difference allowed between bearing or seating Trusses least. Trusses Crane Cirders a) Difference in levels of crane rail measured between adjacent columns. b) Deviation to crane rail-gauge	i) ± 3.5 mm from true vertical ii) ± 3.5 mm from true vertical for any 10 M length measured between connection levels, but not more than ± 7 mm per 30m length. ± 9.0 mm on true span. ± 3.0 mm 3.0 mm 1/1500 of the span or greater than 10mm whichever is the centre of bottom chord. 1/250 of depth of truss or 20 mm which ever is the - least. 2.0 mm. ± 3.0 mm

	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-442-600-C018 VOLUME - II B SECTION - D SUBSECTION - D18 REV.NO. 0 DATE 19/11/2018 SHEET 16 OF 17
	c) Relative shifting of ends of adjacent crane rail in plan and elevation after thermite welding. 1.0 mm. d) Deviation of crane rail axis from centre line of web. ± 3.5 mm Setting of Expansion gaps At the time of setting of the expansion gaps, due regard shall be taken of the ambient temperature above or below 30°C. The coefficient of expansion or contraction shall be taken as 0.000012 per °C per unit length. iv) For Building without Cranes The maximum tolerances for line and level of the steel work shall be ± 3.0 mm on any part of the structure. The structure shall not be Out of Plumb more than 3.5 mm on each lox section of height and not more than 7.0 mm per 30 m section. These tolerances shall apply to all parts of the structure unless the drawings issued for erection purposes state otherwise. 4.03.00 Acceptance Structures and members have passed the tests and conform to all requirements specified in the foregoing Sub-clause 4.01.00, 4.01.01, 4.01.02, 4.01.03 and 4.01.04 and other applicable provisions of this specification and are within the limits of tolerances specified in Sub-clause 4.02.00 and/or otherwise approved by the Engineer shall be treated as approved and accepted for the purpose of fulfillment of the provisions of this contract. 5.00.00 INFORMATION TO BE SUBMITTED 5.01.00 Before Tender 5.01.01 Tentative Programme The Tenderer shall submit a tentative programme based on the information available in the Tender Document and visit to site indicating the structure-wise erection schedule proposed to be maintained by the Contractor to complete the job in time in accordance with the Contract.	

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

VOLUME - II B

SECTION - D SUBSECTION - D18

REV.NO.	0	DATE	19/11/2018

SHEET 17 OF 17

Constructional Plant and Equipment, Tools, Temporary works & manpower A detailed list Of all constructional plant and equipment like cranes, derricks, winches, welding sets, erection tools etc. along with their make, model, present condition and location available with the Tenderer which he will be able to employ on the job to maintain the progress of work in accordance with the Contract shall be submitted along with the Tender. The total number of each category of experienced personnel like fitters, welders, riggers etc. that he will be able to employ on the job shall also be indicated.

Erection Yard

A site plan showing the layout and location of the erection yard proposed to be established by the tenderer shall also be attached with the tender indicating the storage space for fabricated steel materials, site-fabrication and repair shop, covered stores, offices, locations of erection equipments and other facilities. The Engineer shall have the right to modify the arrangement and location of the proposed yard to suit site conditions and the Contractor shall comply with the same without any claim whatsoever.

After award of the Contract

After award of the contract, the Contractor shall submit the following:

Detailed Programme

The Contractor shall submit a detailed erection programme within a month of the award of the Contract for completion of the work in time in accordance with the Contract. This will show the target programme, with details of erection proposed to be carried out in each fortnight, details of major equipment required, and an assessment of required strength of various categories of workers in a proforma approved by the Engineer.

Fortnightly Progress Report

The Contractor shall submit fortnightly progress reports in triplicate to the Engineer showing along with necessary photographs, 125 mm x 90 mm size, and all details of actual achievements against the target programme specified in Sub-clause 5.02.01 above. Any shortfall in the achievement in a particular fortnight must be made up within the next fortnight. Along with this report, the Contractor shall also furnish details of fabricated materials in hand at site and the strength of his workers.

	TITLE: QUALITY ASSURANCE TESTS AND INSPECTION	SPECIFICATION NO. PE-TS-999-600-C024	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D24
		REV. 0	DATE 03/10/2017
		SHEET 1 of 6	

VOLUME: II B

SECTION – D

SUB SECTION – D24

QUALITY ASSURANCE TESTS AND INSPECTION

SPECIFICATION NO. PE-TS-999-600-C024



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301

	TITLE:		SPECIFICATION NO. PE-TS-999-600-C024	
	QUALITY ASSURANCE TESTS AND INSPECTION		VOLUME - IIB	
			SECTION - D	SUB SECTION- D24
			REV. 0	DATE 03/10/2017
			SHEET 2 of 6	

QUALITY ASSURANCE TESTS AND INSPECTION

CIVIL & STRUCTURAL WORKS				
Remarks/Frequency of Test		* For Test at S.No. 1, 2, 6 & 7 frequency of test shall be one in every 2000 M³ for each type & source of fill material. # Frequency of test for Sr. No. 3, 4 & 5 shall be one in every 5000 M³ for each type & source of fill material. @ For foundation filling, one for every 10 foundations for each compacted layer. However for heavily loaded foundations, each layer shall be tested. For area filling, one for every 1000 M² area for each compacted Layer. Note: The contractor shall include provision for setting up testing laboratory with all apparatus and equipments necessary for carrying out field tests.		
All tests as per Indian/International STDS	11	Y		Y
Dry Density by Proctor Needle Penetration @	10	-		Y
Relative Density Index @	9	-		Y
Dry Density by core cutter/sand display cut @	8	-		Y
Moisture Content *	7	Y		-
STD Proctor Test *	6	Y		-
Chemical Analysis #	5	Y		-
Free Swell Index #	4	Y		-
Shrinkage Limit #	3	Y		-
Liquid Limit & Plastic Limit *	2	Y		-
Grain Size Analysis *	1	Y		-
Test Requirements	Item/Components	1. EARTH WORK a) Earth Fill Material (Before Compaction) b) Earth Fill Material (After Compaction)		

 BHEL Bharat Heavy Electricals Limited	TITLE: QUALITY ASSURANCE TESTS AND INSPECTION	SPECIFICATION NO. PE-TS-999-600-C024	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D24
		REV. 0	DATE 03/10/2017
		SHEET 3 of 6	

CIVIL & STRUCTURAL WORKS						
Remarks/Frequency of Test		* Quantum of check for test at Sr. No 1 & 2 shall be one per 100 m ³ or part thereof or change of source whichever is earlier. # To be done every day before start of work. Note: For test at Sr. No. 3, 4, 5, 6, 7, 8, 9, 11 & 12 once per source. For remaining as per IS Code.				
All tests as per IS-Codes	21	Y	Y	Y	Y	Y
Rebound Hammer Test	20	-	-	-	-	Y
Cement Content	19	-	-	-	-	Y
W.C. Ratio	18	-	-	-	-	Y
Slump and Compaction Factor	17	-	-	-	-	Y
Harmful substance	16	-	-	-	Y	-
pH Value	15	-	-	-	Y	-
Crushing Strength	14	-	-	Y	-	Y
Setting Time	13	-	-	Y	-	-
Petrographic Exam.	12	Y	Y	-	-	-
Silt, Clay and organic impurities	11	-	Y	-	-	-
Bulkage	10	-	Y #	-	-	-
Mortar Making Properties	9	-	Y	-	-	-
Deleterious Matl. And MICA content	8	Y	Y	-	-	-
Flakiness Index	7	Y	-	-	-	-
Reaction with Alkali	6	Y	Y	-	-	-
Soundness	5	Y	Y	-	-	-
Mech. Properties	4	Y	-	-	-	-
Specific Gravity, Density, Void, Absorption	3	Y	Y	-	-	-
Moisture Content	2	Y *	Y #	-	-	-
Particle Size and Shape Sieve analysis	1	Y *	Y *	-	-	-
Test Requirement Checks	Item/Components	2. CONCRETING a) Coarse Aggregate b) Fine Aggregate/ Sand c) Cement d) Water e) Concrete				

	TITLE: QUALITY ASSURANCE TESTS AND INSPECTION	SPECIFICATION NO. PE-TS-999-600-C024	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D24
		REV. 0	DATE 03/10/2017
		SHEET 4 of 6	

CIVIL & STRUCTURAL WORKS															
Remarks/Frequency of Test	* These tests shall be carried out, in case of doubt regarding grade of concrete due to poor workmans-hip based on results of cube strength.														
Load test on structures as per IS: 456 & core test	.	.	.	.	.	.	.	.	.	.	Y*	.	.		
Water tightness test as per IS: 3370 & Is: 6494	.	.	.	.	Y	.	.	Y	.	.	.	.	.		
All Tests as per Indian/International Standard/ BHEL Tech. Spec.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	.	Y		
Core Test	.	.	.	.	.	.	.	.	.	.	Y	.	Y		
Ultrasonic Test	.	.	.	.	.	.	.	.	.	.	.	.	.		
Verticality all	.	.	.	.	.	Y	.	.	.	.	.	Y	.		
Work man ship	.	.	.	.	.	Y	.	.	.	.	.	.	.		
Water Retentivity as per IS: 2250	.	.	.	.	Y	.	.	.	.	.	.	Y	.		
Consistency as per IS: 2250	.	.	.	.	Y	.	.	.	.	.	.	.	.		
Warpage	.	.	.	Y	.	.	.	.	.	.	.	.	.		
Effloresces	.	.	.	Y	.	.	.	.	.	.	.	.	.		
Water Absorption	.	.	.	Y	.	.	.	.	.	.	.	.	.		
Compressive Strength	.	.	.	Y	Y	.	.	.	.	.	.	.	.		
Plumb	.	Y	.	.	.	Y	.	.	.	.	.	.	.		
Cutting tolerances	.	.	Y	.	.	.	.	.	.	.	.	.	.		
Placement	.	.	Y	.	.	.	.	.	.	.	.	.	.		
Dimensions	.	Y	Y	Y	.	.	.	.	.	.	.	Y	Y		
Physical & Chemical Properties	.	.	Y	.	.	.	.	.	.	.	.	.	.		
Cleanliness	.	Y	.	.	.	.	Y	.	.	.	.	.	.		
Visual Exam.	Y	Y	Y	Y	.	Y	.	.	.	.	Y	.	Y		
Joint Adequacy	Y	.	.	.	.	.	.	.	.	.	.	.	.		
Durability, strength an soundness	Y	.	.	.	.	.	.	.	.	.	.	.	.		
Test Requirement Checks	Item/Components	3. Form Work	a) Staging	b) Shuttering	4. Reinforcement	5. Bricks	6. Mortar	7. Masonary	8. Water Supply & sanitary items	9. Water retaining structures (Tank/reservoir etc.)	10. Roof water proofing	11. RCC structures	12. Doors Windows	13. Pre-cast concrete members	14. All bought out items Approval by BHEL

 BHEL Bharat Heavy Electricals Limited	TITLE: QUALITY ASSURANCE TESTS AND INSPECTION	SPECIFICATION NO. PE-TS-999-600-C024	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D24
		REV. 0	DATE 03/10/2017
		SHEET 5 of 6	

CIVIL & STRUCTURAL WORKS

Remarks/Frequency of Test		1. Quantum of check for R.T. on butt welds under tension zone shall be 100% and for remaining butt welds unless specified shall be 10%. Acceptances norms for NDTs shall be as per AWS D1.1 2. RT on all butt welds for bunker supporting girders (Longitudinal/Transverse) shall be 100 %. 3. RT on all butt welds for deaerator supporting girders shall be 100 %. 4. All site fillet welds of bunker supporting structure shall be 100 % NDT. 5. All above quality control and super vision shall be carried out by an independent inspection body. * 100% on "T" joints and 10% on longitudinal and circumferential butt welds.	
Hydraulic test			Y
All tests as per Indian/International Codes/Standards	Y		Y
Dimensional	Y		Y
Mechanical Test of Butt Weld Coupons	Y		-
Macrotech Exam. of Fillet Welds Coupons	Y		-
Fit up/Assy	Y		Y
Visual Exam.	Y		Y
Radiographic Test (RT) on Welds	Y		Y*
Liquid Penetration Test (LPT) on Welds	Y		Y
WPS/PQR/WQR	Y		Y
Ultrasonic Test (UT) on Material Above 40 mm Thickness	Y		-
Material T.Cs	Y		Y
Test Requirements	Item/Components	15. Structural Steel Like Columns, Girders, Beams & Truss Etc.	16. C.W. Pipes/Ducts

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 1 of 41	

VOLUME: II B

SECTION – D

SUB SECTION – D25

RCC STACK

SPECIFICATION NO. PE-TS-442-620-C025



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 2 of 41	

TABLE OF CONTENT

CLAUSE NO.	DESCRIPTION	PAGE NO.
1.0.0	SCOPE	3
2.0.0	GENERAL	3
3.0.0	EXECUTION	14
4.0.0	TESTING AND ACCEPTANCE CRITERIA	37
5.0.0	INFORMATION TO BE SUBMITTED	38

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 3 of 41	

TECHNICAL SPECIFICATION FOR REINFORCED CONCRETE CHIMNEY

1.0.0 SCOPE

This specification covers reinforced cement concrete works, including brick flue and insulation work, painting and protective treatment work, and other works associated with construction of RCC single flue chimney.

2.0.0 GENERAL

2.1.0 Work to be provided for by the Contractor

Work to be provided by the Contractor, unless specified otherwise, shall include but shall not be limited to the following:

- a) Furnish all labour, supervision, services, insurance, material, power, fuel forms, templates, supports, scaffolding, tools, plants, construction equipment, approaches, transportation etc. required for the entire work.
- b) Design and prepare working drawings for formworks, scaffoldings, supports, staging hoisting arrangement for men and material etc. and submit them for approval.
- c) Prepare and submit for approval, as per approved schedule, detailed drawings for RCC work in shell, platforms at various levels, roof and ground floor and bending schedules for reinforcement bars, showing the positions and details of spacers, chairs, supports, hangers, openings etc.
- d) If in scope, prepare detailed fabrication and erection marking drawings for steel flues including flue expansion compensators, steel flue supports and restraint arrangements along with fittings and accessories and submit them for approval.
 - e) Prepare and submit for approval detailed shop drawings, with list of materials and material specifications for Load Bearing Insulation Blocks and Lateral Restraint Insulation Blocks.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 4 of 41	

- f) Prepare and submit for approval detailed schemes for operations like material handling, placement of concrete erection of steel flues, fixing of insulations, installation, dismantling and maintenance of flue expansion compensator etc. and for items like approaches, services etc.
- g) Design and submit for approval mix proportions for concrete to be adopted on job.
- h) Furnish samples and submit for approval the results of tests for various properties of the following materials :
- Ingredients of concrete, (ii) Concrete,
 - Acid/Chemical Resistant Tiles, (iv) Castable refractories, (v) Insulation materials, (vi) Paints. (vii) S/S liner.
- i) Provide all incidental items not specified or shown on drawings in particulars but reasonably implied or necessary for successful completion of the work in accordance with drawings and specifications.
- j) Produce, if directed by the Engineer, a guarantee, in approved proforma, for satisfactory performance, for a specified period, of material manufactured by specialist firms.

2.2.0 Work by Others

No work under this specification will be provided for by agency other than the Contractor for this Contract unless specifically mentioned otherwise in the Contract.

2.3.0 Codes and Standards

All works under this Specification, unless specified otherwise, shall conform to the latest revisions/replacements of the following Indian Standard Codes, Criteria, Specifications, along with those mentioned therein. In case any particular aspect of work is not covered by Indian Standards, other standard specification, as may be specified by the Engineer, shall be followed. "IS Specification" shall mean Codes, Criteria etc. of ISI.

- IS:6 Moderate heat duty fireclay refractories, Group-A.
- IS:104 Ready mixed paint, brushing, zinc chrome, priming.
- IS:158 Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting for general purposes.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 5 of 41	

IS:195	Specification for fire clay mortar for laying fireclay refractory bricks.
IS:269	Ordinary, and low heat Portland cement.
IS:383	Coarse and fine aggregates from natural sources for concrete.
IS:432	Mild steel and medium tensile steel bars.
IS:456	Code of practice for plain and reinforced concrete.
IS:516	Methods of test for strength of concrete.
IS:732	Code of practice for electrical wiring installations (System Voltage not exceeding 650 Volts).
IS:800	Code of practice for general construction in steel.
IS:813	Scheme of symbols for welding.
IS:814	Covered electrodes for metal arc welding of structural steel.
IS:816	Code of practice for use of metal arc welding for general construction in mild steel.
IS:817	Code of practice for training and testing of metal arc welders.
IS:818	Code of practice for safety and health requirements in electric and gas welding and cutting operations.
IS:822	Code of procedure for inspection of welds.
IS:875	Draft Standard for Code of practice for structural safety of buildings loading standards.
IS:1080	Code of practice for design and construction of simple spread foundations.
IS:1139	Hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcements.
IS:1161	Steel tubes for structural purposes.
IS:1199	Methods of sampling and analysis of concrete.
IS:1200	Methods of measurement of building works.

 Maharatna Company	TITLE:	RCC STACK	TENDER NO. PSER/SC/BA/CL/1962/19																																													
			SPECIFICATION NO. PE-TS-442-620-C025																																													
			VOLUME - IIB																																													
			SECTION - D	SUB SECTION- D25																																												
			REV. 0	DATE 22/02/2018																																												
		SHEET 6 of 41																																														
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 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-442-620-C025	
	RCC STACK	VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 7 of 41	
(Part-V)			
IS:2386 (Part-VI)	Measuring mortar making properties of fine aggregate.		
IS:2386 (Part-VII)	Alkali aggregate reactivity.		
IS:2386 (Part-VIII)	Petrographic examination.		
IS:2502	Code of practice for bending and fixing of bars for concrete reinforcement.		
IS:2505	Concrete vibrators, immersion type.		
IS:2506	Screed board concrete vibrators.		
IS:2633	Methods of testing uniformity of coating on zinc coated articles.		
IS:2722	Portable swing weighbatchers for concrete (single and double bucket type).		
IS:2750	Steel scaffoldings.		
IS:2751	Code of practice for welding of mild steel bars used for reinforced concrete construction.		
IS:2950	Code of practice for design and construction of raft foundations.		
IS:3025	Methods of sampling and test (Physical and Chemical) for water used in industry.		
IS:3043	Code of Earthing.		
IS:3144	Methods of Test for Mineral Wool Thermal Insulation Material.		
IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot- plate method).		
IS:3495 (Part-I to IV)	Method of test for clay building bricks.		
IS:3550	Methods of test for routine control for water used in industry.		
IS:3558	Code of practice for use of immersion vibrators for consolidating concrete.		

 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-442-620-C025	
	RCC STACK	VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 8 of 41	
IS:3677 Unbonded rock and slag wool for thermal insulation. IS:4014 Code of practice for steel tubular scaffolding. (Part-I&II) IS:4031 Method of physical tests for hydraulic cement. IS:4457 Ceramic Unglazed Vitreous acidresistant tiles. IS:4634 Method for testing performance of batch-type concrete mixers. IS:4687 Gland packing asbestos. IS:4832 Chemical Resistant mortars. IS:4860 Acid-resistant bricks. IS:4990 Plywood for concrete shuttering work. IS:4998 Criteria for design of reinforced concrete chimneys. (Part-I) IS:5410 Cement paint, colour as required. IS:5445 Long fluted machine reamers with Morse taper shanks. IS:5495 Sizes and shapes for firebrick (300 mm. and higher series). IS:6911 Stainless Steel plate, sheet and strip. IS:8112 High strength ordinary portland cement. IS:8183 Bonded Mineral Wool. IS:9595 Recommendation for Metal Arc Welding of Carbon and Carbon Manganese steels. CP326 - British Standard - Protection of structures against lightning. NEPA NO. 78 Code of protection against lightning. The Indian Electricity Rules. The requirements of Department of Civil Aviation, Govt. of India.			
2.4.0	Conformity with Drawings and Specifications		

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 9 of 41	

The Contractor shall carry out all the work in strict accordance with the drawings stamped "Released for Construction" and specification issued to him and as per Contractor's detailed drawings approved by the Consulting Engineer. Prior to concreting, the Contractor shall prepare a check list on a set format of all items of work involved, and inform the Engineer well in advance so that the Engineer shall have the opportunity of satisfying himself if the works mentioned in the format are done according to drawings and specification, and he can allow the Contractor in writing to start pouring of concrete. The entire operation of concreting shall be carried on as per specification, to the complete satisfaction of the Engineer. No deviation from the drawings will be allowed unless otherwise directed by the Engineer in writing.

For Load Bearing Thermal Insulation block assembly and lateral restraint insulation block assembly, Contractor shall design sizes of all components of the blocks and details of their connections, supply and fabricate the same in accordance with the approved shop drawings prepared by him.

For steelwork and metal work, the Contractor shall design all connections, inserts for scaffolding, supply and fabricate all steelwork and metal work and furnish all connection materials in accordance with approved shop drawings prepared by him and/or as instructed by the Engineer, keeping in view the maximum utilization of the available sizes and shapes for metal components.

2.5.0 **Materials to be used**

2.5.1 **General Requirement**

All materials, whether to be incorporated in the work or to be used temporarily for the construction, shall conform to the relevant IS specifications unless stated otherwise and shall be of the quality approved by the Engineer.

2.5.2 **Cement**

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 10 of 41	

Ordinary Portland cement of grade 43, as per the requirements laid down in IS:8112, shall be used, until otherwise stated elsewhere in the specification.

2.5.3 Coarse Aggregate

Coarse aggregate shall be graded crushed or broken stone from approved sources, free from impurities and shall be screened free of dust and other deleterious matter. It shall conform to IS:383 or IS:515 and shall be washed clean, if necessary. The maximum size of coarse aggregate for stack superstructure shall be 25 mm down graded, unless otherwise stated (vide serial 5(b) of clause 3.03.06). Grading for a particular size shall conform to relevant IS Codes and shall be such as to produce a dense concrete of specified proportion and strength and shall be of consistency that will work readily into position without segregation.

2.5.4 Fine Aggregate

Fine aggregate shall be river or pit sand, free from any clay, earth, vegetable matters, salt or other impurities and shall be clean and fit for use, to the satisfaction of the Engineer. Sand acceptable for the work shall normally have a grading falling within the limits of one of the three grades, mentioned in the relevant IS Specifications.

2.5.5 Water

The water for both mixing and curing of concrete shall be clean, free from oil, acid, alkali, organic or other deleterious substances. Contractor shall test the water as and when required by the Engineer.

2.5.6 Reinforcement

Mild steel or Medium or High Tensile steel deformed bars specified for reinforcement shall conform to the latest relevant IS Specifications and shall be of tested quality under ISI

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 11 of 41	

Certification Scheme. The reinforcement shall be free from any oil, foreign material or mill or rust scales.

2.5.7 Steel Flue

- a) All mild steel material to be used in construction of steel flue shall comply with IS:2062, IS:1239, IS:1367, IS:1608, IS:800 and with other relevant IS Specifications. The ultimate tensile strength of this steel shall not be less than 410 N/Sq.mm.
- b) Stainless steel liners shall be fabricated using materials conforming to the requirements of relevant IS Specifications and/or AISI 316L or BS:1449 Part-2. Grade of Stainless steel shall be equivalent to BS:1449 (Part-2) 316 S.12.
- c) Materials to be used for fabrication of Flue expansion compensator shall be suitable for the flue gas temperature and shall be acid resisting.

The Expansion compensator shall comprise several layers of materials given below in order from the gas side.

- i) Two layer of insulation, each consisting of heavy weight texturized glass cloth impregnated with graphite suspension, having an approximate weight of 1.00 Kg/Sq.m
- ii) A continuous filament glass cloth coated both sides with a fluoro-elastomer having an approximate weight of 1.5 Kg/Sq.m.
- iii) Two layers of PTFE (Poly Tetra Fluoro-Ethylene) film of minimum thickness 0.15 mm each.
- iv) A layer of glass felt of minimum thickness 10 mm and an approximate weight of 1.5 Kg/Sq.M.

2.5.8 Paints

Paints to be used for shop coat of fabricated steel shall conform to the IS:2074. Paint for treatment of outside face of Chimney with Cement water proof paint shall conform to IS:5410.

2.5.9 Acid Resistant Tiles and Castable Refractories

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 12 of 41	

Acid resistant tiles to be provided over roof of stack should conform to IS:4457. Matching mortars to be used for tiles. Castable refractories shall be of hydraulic setting, rapid hardening type. It shall have refractory properties similar to Fire bricks conforming to IS:6, Group-A and working temperature shall be upto 1350 Deg.C.

2.5.10 Insulations

a) On Exterior Surface of Flues

The normal flue gas temperature inside the flue shall be 145 Deg.C with momentary rise upto 400 Deg.C (Maximum) occasionally. The insulation material shall be able to withstand this temperature without any deterioration in thermal properties or breakdown. The thermal conductivity of the insulating material shall not exceed 0.06 W/M Deg.C at a mean temperature of 150 Deg.C. The insulation shall also not be affected by any acid condensation from flue gas and shall be free from any impurities which may cause corrosion to the flue material.

For steel flues 65 mm thick semi rigid resin bonded fibrous mineral wool of density not less than 96 Kg/Cu.m as per IS:8183 or resin bonded fibrous crown glass wool (high temperature) of same thickness and density not less than 36 Kg/Cu.m capable of sustaining temperature to the tune of 540 Deg.C without any loss of material thermal property, may be used. The mineral wool for exposed top portion of flue shall be semi-rigid with minimum density of 200 Kg/Cu.M or the glass wool for exposed top portion of flue shall have minimum density of 75 Kg/Cu.M.

Slag wool insulation shall not be accepted.

The insulation free from shots should be supplied in the form of mat to be fixed with staggered joints on outer surface of the flue with suitably spaced stud by galvanised wire mesh. Insulation on the top portion of flue shall be covered by stainless steel cladding.

b) At Load Bearing and Side Restraints of Flues

Load bearing insulation assembly to have (i) a properly mechined mild steel plate with recess at its top for seating PTFE (Poly Tetra Fluoro Ethylene) sheets conforming to BS:5400 (ii) saddle plate (MS) in the middle having stainless steel plate fixed at its bottom surface and lead/elastomeric sheet at top, and (iii) top plate formed of two numbers insulation blocks each made of minimum 50mm thick rigid, non-combustible asbestos fibre reinforced lime-silica board (SINDANYO BLOCKS NATURAL GRADE CS-51) bonded to mild steel plates at top and bottom. For side restraints assembly of insulation blocks of SINDANYO Natural Grade CS-51 and stainless

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 13 of 41	

steel plate shall be used. All stainless steel in these assemblies shall conform to AISI-316L and Mild steel to IS-2062. SINDANYO BLOCKS shall be suitable for operation at 320 Deg.C and shall primarily satisfy the following physical properties :

- i) Minimum compressive stress prior to onset of compression yield of not less than 12 N/Sq.mm.
- ii) Minimum shear strength of 30 N/Sq.mm when tested in accordance with BS:3497-1979.
- iii) Thermal conductivity shall not exceed 0.67 W/m Deg.C at a mean temperature of 200 Deg.C and its coeff. of linear expansion not to exceed 1.2×10^{-5} per Deg.C.
- iv) Adhesive used for bonding purposes shall be of material with equivalent high temperature properties as approved by the Engineer. It may be of "Fortafix Fiborclad Adhesive" as manufactured by Fortafix Ltd., England.

2.6.0 Storage of Materials

2.6.1 General

All materials shall be so stored as to prevent deterioration and intrusion of foreign matter and to ensure the preservation of their quality and characteristics for the work. Any material, which is deteriorated or is damaged or is otherwise considered defective by the Engineer, shall not be used for construction and shall be removed from site immediately, failing which the Engineer shall be at liberty to get the materials removed. The Contractor shall maintain an upto date accounts of receipt, issue and balance of all materials issued by the Owner.

2.6.2 Cement

Contractor shall store cement in water-tight and properly designed stores so that the Cement can be kept dry and the stock can be handled in rotation. The doors of stores shall

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 14 of 41	

be at least 30 cm. above G.L. Deteriorated cement shall be removed immediately from the site. Not more than ten bags of cement shall be stacked one above the other.

2.6.3 Aggregate

Different materials shall be transported, handled and stored separately in such a manner as to prevent damage, deterioration or contamination. Stock piles of fine and coarse aggregates shall be allowed to drain, so that aggregates do not contain too much water.

2.6.4 Reinforcement

Reinforcement shall be stored preferably under cover and stacked off ground in size and grade-wise separate stacks for easy identification.

2.6.5 Steel, Metal and Fittings

All steel, metal and fittings to be used for fabrication and erection shall be stored sectionwise and lengthwise in separate stacks, off ground, so that they can be handled, inspected, measured and accounted for easily at any time. If required by the Engineer, the materials may have to be stored in a covered shed.

2.6.6 Paints

Paints shall be stored under cover, in air-tight containers. Paints supplied in sealed containers shall be used as soon as possible once the container is opened. Left over paints shall be kept in air-tight containers.

2.6.7 Steel Flue

Fabricated pieces of steel (flue) liner shall be stored systematically for ease of handling.

2.6.8 Insulation Material

All insulation materials like bearing insulation blocks, restraint insulation blocks, glass or mineral wool, asbestos ropes etc. shall be stored in packing boxes, under covered shed, avoiding their coming in contact with objectionable matter.

2.7.0 Quality Control

Contractor shall establish and maintain quality control for different items or work and materials as may be directed by the Engineer to assure compliance with contract requirement and submit to the Engineer records of the same.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 15 of 41	

The Contractor shall submit all records and test results in original to the Engineer for his approval, if so desired by him.

The quality control operation shall include but shall not be limited to the following items of work :

- a) Cement : Test to satisfy relevant IS Specifications if supplied by the Contractor.
- b) Aggregate : Physical, Chemical and Mineralogical qualities, grading, moisture contents and impurities.
- c) Water : Impurities Test.
- d) Reinforcement: Material tests or certificates to satisfy relevant IS Specification if supplied by the Contractor.
- e) Structural : Material tests or certificate to satisfy Steelrelevant IS Specification if supplied by the Contractor.
- f) Steel flue : Material tests or certificate to satisfy relevant IS Specification if supplied by the Contractor.
- g) Stainless : Material tests or certificate to satisfy Steel relevant IS Specification if supplied by the Contractor.
- h) Acid Resistant : Compressive and tensile strength, acid tiles& mortar resistance and water absorption test.
- i) Mortar : Compressive and tensile strength, adhesion and acid resistance test.
- j) Insulation : Thermal conductivity, density, heat and acid resistance tests. Bearing capacity will be tested for bearing/restraint insulation blocks.

3.0.0 EXECUTION

3.1.0 Concrete

3.1.1 Trial Mix, Grades of Concrete

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 16 of 41	

At least three weeks before commencing any concreting in the work the Contractor shall make trial mixes using samples of coarse aggregates, sand, water and cement, typical of those to be used in the work. A clean dry mixer shall be used for mixing and the first batch shall be discarded.

For guidance in designing the mix, standard tables for maximum allowable water-cement ratio, minimum cement content, maximum proportion of aggregates and limits of consistency may be used by the Contractor. The Contractor's design mix shall fall within limits of the following tables :

- i) Strength requirements of concrete : Table-2 of IS:456-2000.
- ii) Concrete Mix Proportion : Table-3 of IS:456-2000.
- iii) Minimum cement content/Cu.m. of finished concrete shall be as per Table 5 of IS 456-2000.
However, it should be noted that minimum cement content for concrete of chimney shell of grade M30,M35,M40 shall be 400kg, 430 kg and 450 kg respectively.
- iv) Limit of consistency : Refer Table in Item 3.1.4 of this specification.
- v) Cement/Total Aggregate Ratio : As per the following table.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 17 of 41	

MIX PROPORTIONS (BY WEIGHT) EXPECTED TO GIVE DIFFERENT DEGREES OF WORKABILITY WITH DIFFERENT VALUES OF WATER - CEMENT RATIO (FOR GUIDANCE)

3.1 CEMENT/TOTAL AGGREGATES RATIOS

Workability	Water/ Cement Ratio	Ratio by Weight of Cement to Gravel Aggregate		Ratio by Weight of Cement to Crushed Stone Aggregate	
		20 mm. Size	38 mm. size	20 mm. size	38 mm. size
Very Low slump 0-25 mm.	0.4	01:04.8	01:05.3	01:04.5	1:05
	0.5	01:07.2	01:07.7	01:06.5	01:07.4
	0.6	01:09.4	1:10	01:07.8	01:09.6
	0.7	1:10	1:12	01:08.7	01:10.6
Low slump 25-50 mm	0.4	01:03.9	01:04.5	01:03.5	1:04
	0.5	01:05.5	01:06.7	1:05	01:05.5
	0.6	01:06.8	01:07.4	01:06.3	1:07
	0.7	1:08	01:08.5	01:07.4	1:08
Medium slump 50-100mm.	0.4	01:03.5	01:03.8	01:03.1	01:03.6
	0.5	01:04.8	01:05.7	01:04.2	1:05
	0.6	1:06	01:07.3	01:05.2	01:06.2
High slump 100 - 175 mm.	0.4	01:03.2	01:03.5	01:02.9	01:03.3
	0.5	01:04.4	01:05.2	01:03.9	01:04.6
	0.6	01:05.4	01:06.7	01:04.7	01:05.7
	0.7	01:06.2	01:07.4	01:05.5	01:06.5

NOTE-1 : Notwithstanding anything mentioned above, the cement / Total aggregate ratio is not to be increased beyond 1:9 without specific permission of the Engineer.

It should be noted that such high aggregate cement ratios will be required for concretes of very low slump and high water-cement ratios which may be required to be used in mass concrete work only.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 18 of 41	

NOTE-2 : The above figures are for guidance only, the actual cement/ aggregate ratios are to be worked out from the specific gravities of coarse aggregates and sand being used and from trial mixes. For each grade of concrete, a set of eighteen cubes shall be made. Of these not more than six may be made on any day and further, of the six cubes made in one day not more than two cubes may be made from any single batch. Nine of these cubes each representing a different batch of concrete shall be tested at the age of seven days and remaining at twenty eight days. The making of the cubes, their curing, storing, transporting and testing shall be in accordance with the relevant IS Specifications. The test shall be carried out in laboratory approved by the Engineer. If the average strength of the concrete cubes falls below the requirement, the method described above shall be repeated till acceptable results are obtained. The method may have to be repeated whenever there is a significant change in the quality of any of the ingredients for concrete, at the discretion of the Engineer.

3.1.2 Batching of Concrete

For controlled concrete, only weigh batching shall be allowed. All concrete ingredients, except water, shall be batched by weight, using an approved make of weigh batcher. Batching shall be accurate to 1/2 Kg. The batcher shall be tested for accuracy of calibration, first before commencement of work and at least once a fortnight or as directed by the Engineer thereafter. Water shall be batched by weight or by volume measures, as approved by the Engineer.

3.1.3 Mixing of Concrete

Materials for concrete shall be emptied in rotation into the mixer. When all the ingredients are in the drum, the drum will rotate for one minute for dry mixing. After that water shall be added in measured quantities in the manner specified. The mixer shall then rotate for at

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 19 of 41	

least two minutes, or at least forty revolutions or until there is apparent uniform distribution of the materials and till the mass is uniform in colour. The entire content of the drum shall be discharged before the ingredients for the succeeding batch are fed into the drum. The mixer shall be thoroughly cleaned to the satisfaction of the Engineer, before a different quality of concrete is put through the mixer and also at the end of day's work.

3.1.4 **Workability of Concrete**

The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of formwork and around the reinforcement and embedments, and to give the required surface finish shall depend on the type and nature of structure and shall be based on experience and tests. 120 mm to 150 mm, where concrete is pumped, otherwise, 100mm-120mm slump in chimney shell works shall be adopted subject to Engineer's approval unless stated otherwise (vide serial 1(d) of clause no. 3.3.6). The usual limits of consistency for various types of structure are given below:

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 20 of 41	

LIMITS OF CONSISTENCY

Degree of Workability	Slump in mm. with Standard Concrete		Use for which Concrete is suitable
	Min.	Max.	
Very Low	0	15	Large mass concrete work with heavy compaction equipment.
Medium	35	65	Deep and wide RCC structures with congestion of reinforcement and inserts.
1.1.1	High	65	100
	RCC structures		Very narrow and deep
	1.1.2		with congestion due to reinforcement
	1.1.3		and inserts.

NOTE: The above table is for guidance only. Notwithstanding anything mentioned above, the slump to be obtained for work in progress shall be as per direction of the Engineer.

With the permission of the Engineer, for any grade of concrete, if the water has to be increased in special cases, cement shall also be increased proportionately, to keep the ratio of water to cement same, as adopted in trial mix design, for each grade of concrete.

The workability of concrete shall be checked at frequent intervals by slump tests. Alternatively, where facilities exist or if required by the Engineer, the compacting factor test, in accordance with IS:1199, shall be carried out.

3.1.5 Placing and Compaction of Concrete

Concreting shall proceed in a manner directed by the Engineer, concrete shall be placed in forms as soon as possible but in no case later than twenty minutes, after mixing.

The height of any single lift of concrete, for different structural members, shall be decided by the Engineer. The concrete shall be placed in the forms gently and not dropped from a height which may cause segregation of aggregates. Each layer of concrete shall be compacted fully before the succeeding layer is placed and separate batches shall follow

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 21 of 41	

each other so closely that the succeeding layer shall be placed and fully compacted before the layer immediately below has taken an initial set.

The concrete, after placing, shall be consolidated only by power driven vibrators. The vibrators shall be of a make and size, approved by the Engineer. In using the vibrator, the standard practice and the Engineer's directions, shall be followed.

Vibration shall begin as soon as one batch of concrete has been placed and shall continue till the entire section being poured has been thoroughly consolidated.

To secure even and dense surfaces, free from aggregate pockets, vibration shall be supplemented by tamping or rodding by hand in the corners of forms and along the form surfaces while the concrete is plastic, without damaging or endangering the stability of the formwork.

A sufficient number of spare vibrators including petrol vibrators shall be kept readily accessible to the place of deposition of the concrete to assure adequate vibration in case of breakdown of those in use.

3.1.6 Curing of Concrete

Curing of exposed surface of concrete shall commence immediately after the concrete has set. Exposed sides shall be covered with canvas etc. immediately after stripping of forms, and curing shall be continued for a period of not less than 14 days, reckoned from the date and hour of completion of concreting. All surfaces of the pour shall be kept wet with water at all times after concreting and till the curing period is over. The Contractor shall plan and employ proper equipment and sufficient labour considered adequate by the Engineer under able supervisor for curing.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 22 of 41	

3.1.7 Construction Joints

In concreting the chimney shell one full ring lift shall be completed in a day's pour. Before the formwork for the following pour starts the horizontal surface of the Chimney shell shall be chipped, cleaned and washed with water, and when the formwork is complete, the surface shall be cleaned and washed again and covered with 1:2 sand cement slurry before fresh concrete is placed. The horizontal construction joints shall be so arranged and made that they are regular and neat. No vertical joint shall be allowed. No separate payment shall be allowed to the Contractor for forming joints or chipping and cleaning them or cover with slurry prior to concreting. The number of construction joint shall be kept minimum and the spacing should not exceed three (3) meters. The Contractor shall submit to the Engineer, any proposal of providing construction joints to facilitate his work, for the study and approval of the Engineer well in advance.

3.1.8 Ordinary Concrete

Ordinary concrete like lean concrete shall be of nominal mix as per relevant clauses of IS:456.

3.2.0 Reinforcement

3.2.1 Bending of Reinforcement

All bars shall be carefully and accurately bent by the Contractor in accordance with approved Drawings and bar bending schedules. Special care shall be taken to ensure correct lengths of laps. The bars shall not be bent or straightened in any manner that will injure the bars or impair the bond between reinforcement & concrete. Bends and hooks are to be provided as laid down in the IS:2502.

3.2.2 Placing

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 23 of 41	

All reinforcement shall be placed and maintained in the position shown in the drawings.

Contractor shall provide approved type of cover blocks to suit the requirement of the Drawings. Where reinforcement is to be provided on two faces of the shell, the Contractor shall provide adequate number of separators, with the approval of the Engineer. Any additional support to the reinforcing cage, if required at the time of concreting, shall also be provided, to the satisfaction of the Engineer. Lapping of reinforcement as specified in the drawings or as directed by the Engineer, shall be provided. Laps shall be staggered and too many laps shall be avoided. Welded laps shall be provided only when directed or approved by the Engineer.

3.2.3 Fixing of Reinforcement

18 SWG annealed steel wire shall be used as binding wire. Bar crossing one another and contact laps shall be bound with this wire twisted tight to make the skeleton or network rigid so that the reinforcement is not displaced during placing of concrete.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 24 of 41	

3.10 Forms

Construction by Slip-form Method

Slip-form construction shall be for construction of the wind shield. Type of Slip-form proposed should be indicated in the offer with sketches, drawings and construction statement as explained hereinafter. Number, type and capacities of jacks, the control system and achievable rate of progress in mm/hour should also be indicated. The chosen scheme shall be of a past proven design. A certified performance record of the scheme should be submitted with the offer to guarantee workability of the scheme both from execution time and safety point of view.

The Tenderer should furnish a brief but comprehensive statement indicating the planning & programme and method of work to be followed, for the approval of Owner at the time of submitting Tender. This statement shall include the following items:

- i) Type and description of Slip-form equipment and its accessories.
- ii) Design of scaffolding and staging.
- iii) Description of materials including admixtures to be used for construction.
- iv) Manpower planning, construction spaces required, standby arrangement.
- vi) Rate of Slip-forming.
- vii) Proposed workability requirement of concrete and type of cement & admixture to be used.
- viii) Quality assurance programme.
- ix) Method of Transportation of material
- x) Method of curing and rectification of defects.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 25 of 41	

- xi) Planned interruption, if proposed, and activities during planned interruption. Treatment of construction joint.
- xii) Contingency solution for unplanned interruptions.
- xiii) Time of completion.

While selecting the Contractor, due consideration will be given to the merit of the above mentioned statement proposed by the Tenderer.

Notwithstanding what have been specified in earlier clauses, following guide lines are being presented which should be kept in view by intending Tenderers, while quoting for Slip-form method of construction:

1. Care to be taken to prevent dragging of concrete along with upward movement of the shuttering. For this purpose following steps are advisable:
 - a) Shutter plates have to be smooth and should be thoroughly clean. Before fixing them in position all the surfaces which will be coming in contact with concrete to have a coat of epoxy paint.
 - b) In areas where concrete thickness is 750 mm or more, rate of pouring should be such that minimum slipping of shuttering is maintained to avoid initial set of concrete before slip form movement.
 - c) Mix design should be so done that it will be self- lubricant at the contact face of shutter and concrete and thus reduce friction. Suitable cement of approved manufacturer (conforming to relevant I.S. Specification) may be used for the purpose. An optimum ratio of coarse/fine aggregate should be established to suit the purpose depending on availability of aggregates.
 - d) Mix design also should be so done that it has a slump of around 100mm-120mm, at the point where concrete is placed under an ambient temperature of around 40 Deg.C. This will also keep vibration by needle vibrators to required minimum. Slump should not drop down to zero in less than 45 minutes. Suitable retarding agent and plasticizer of approved manufacture may be added in mix to achieve this purpose.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 26 of 41	

These admixtures to be properly identified by preliminary tests both for performance and for compatibility with particular type of cement proposed to be used.

Additional steps like spraying of water over the shutters and keeping down the temperature of coarse aggregates by continuous spraying of water over those may be resorted to if ambient temperature is more than 40 Deg.C.

2. Care must be taken to prevent twist, which predominantly occur in the initial stages because of low slipping rate, in the horizontal plane of Slip-form assembly. A thorough check on this aspect must be kept at every 15 minutes interval. One person should exclusively be assigned this work together with rectifying any defect.
3. Every endeavour has to be made so as not to occur any tilt in the shutter assembly. To achieve this following steps need be taken:
 - a) Performance of jacks has to be closely observed and any defective one needs immediate replacement. Difference in levels of opposite jacks at any instant of time should not exceed 5 mm.
 - b) Loading on Slip-form truss/yokes has to be fairly equal.
 - c) Sleeve through which jacking rod passes has to be of sufficient length so that later gets an uniform clearance and does not get any chance to tilt. Sleeve should have a minimum wall thickness of 3.25 mm and should be such that jacking rod gets a maximum clearance of 1 mm to 1.5 mm around.
4. For taper walled chimneys overlapping of shutters which are kept to effect the tapering, needs careful attention otherwise these may be filled with concrete slurry.
5. In designing the mix following aspects should be borne in mind:
 - a) Cement used should have an initial setting time of not less than 50 minutes and preferably should have a specific surface around 3600 Sq.Cm.per gram.
 - b) Coarse and fine aggregates should be well graded and rounded aggregates offer better performance in Slip-form technique. These help to keep down water/cement ratio and also offers better lubrication between concrete and shutter surface. 40 mm down size of coarse aggregates should preferably be used unless reinforcement detailing calls for lesser size aggregates.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 27 of 41	

- c) From the point of view of creep, shrinkage as well as initial setting property of concrete, cement content should not preferably be more than 450 Kg. per Cu.M of concrete.
- d) Minimum compressive strength (after 4 to 6 hours of mixing) of concrete immediately below the shutter as slipform proceeds should be between 0.1 to 0.2 Newton/ Sq.mm.
- e) It is advisable to use cement from a single source during the entire operation of slipform technique since once the system starts, there might not be any time left for conducting trial mixes if the source of procurement of cement changes.

6. Large diameter vibrator needles should not be used for vibrating concrete. Sizes of these needles should preferably be restricted to 25 mm diameter and to 40 mm diameter - only in exceptional cases. At least two nos. standby vibrator units should always be maintained on top of working deck at all time during the entire period of slipform operation.

7. It is preferable to have membrane curing compounds sprayed on fresh surfaces emerging out of shutter panels for ensuring proper curing at great heights.

In case such spraying is not envisaged then elaborate arrangement has to be made for adequate supply of water both on inside and outside vertical surfaces with spraying arrangement, necessary length of pipelines and pump of adequate head to serve the purpose. It is always advisable to have a stand-by pump for effective utilisation of the system.

8. Rate of slipping should be around 100 mm – 150mm per hour, subjected to a maximum limit of 3.0 m per 24hrs.

9. Exact number and capacity of jacks as well as spacing of yoke frames are to be determined taking into account various loadings including self weight of the system, dead and live loads on working and other platforms, horizontal load on formwork, wind load etc.

It is desirable that jacking system, based on which the entire slip form system works, should consist of jacks 3 Tonne/ 6 Tonne capacity and a hydraulic pump with necessary pipe connections.

Spacing of yoke legs should preferably be kept within 2 metres to prevent overloading on jacks and consequent failure resulting in twist of the formwork.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 28 of 41	

Jacking rods should be of 25 mm diameter for 3 Tonne Jacks and 32 mm diameter for 6 Tonne Jacks.

10. At least 30% spare jacks and jacking rods should be kept ready during the entire operation. It is obligatory to maintain spare hydraulic pump along with a set of loose pipes in perfect working condition on top of working deck.
11. In sections where thickness is 500 mm or more it is prudent to go in for two nos. of jacks for each slip form yoke.
12. For effective utility of this technique following areas need careful attentions at the very conceptual stage:
 - a) Detailed quality assurance programme.
 - b) Advance Planning and preparations.
 - c) Arrangement for on site supervision and adequate access facilities.
13. Construction methods including description and types of different equipment proposed to be used, structural arrangement and analysis of the system, description and type of different materials, planned interruptions, description and frequency of various checks and tests for Slipform technique as well as for material, method of preparing, transporting and pouring of concrete, solution for probable defects during slipping, sequence of operations during planned interruptions etc. should be prepared beforehand by executing agency and to be approved by Engineer before starting the actual work.
14. Placing and binding of reinforcement is also a very critical item and needs special attention. From practical considerations not more than two or three layers of horizontal steel can be tied at a time and this causes a definite limitation in placement of reinforcement.

 Vertical reinforcements should be kept vertical by providing suitable holders within the slipform system.
15. It is desirable to have a break of at least one day for every two weeks of continuous operation. Such break should be utilised for various maintenance activities, removal of jack rods etc.
16. Numbers and locations of hoists for lifting concrete, reinforcement and other materials have to be planned well in advance. Capacity of hoists should be such as to match with hourly requirement of concrete and

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 29 of 41	

reinforcement. If felt necessary one hoist may be exclusively earmarked for transporting concrete.

For movement of personnel supervising the work a separate hoist must be arranged for.

17. The system being operative round the clock it is obligatory to have adequate lighting arrangement both on various platform levels as well as on ground below. Arrangement has to be made for facilitating continuous upward movement of the entire system alongwith slipform.

18. Winches for lifting men and material and mixers, if located within unsafe area around chimney, should be protected by adequate shelter from possible damage.

19. Proper tele-communication system has to be established between the personnel working on top of Chimney and control room below.

20. A small laboratory should be maintained at site for testing different materials like cement, coarse and fine aggregates. A cube testing machine may also be installed at site for getting quick feed back results.

Apart from using plumb bobs, level and theodolite instruments for survey purpose arrangement should also be kept for lasers.

21. In case of interruption in the course of slipping of formwork following measures should be taken:

- a) Provision of a key and additional reinforcement at the junction of new and old concrete.
- b) Slip form system should be brought up freely to have a minimum overlap of 100 mm or so over previously cast concrete.
- c) Washing of old concrete surface with compressed air and water jet and thereafter pouring a layer of neat cement grout.
- d) Clearing of shuttering panels of loose materials, concrete etc. by compressed air and applying a coat of epoxy paint, if felt necessary by Engineer.
- e) Neatly finishing the interface of old or new concrete as soon as it comes out of shutter panel.

22. It is preferable to suspend the construction work under high wind condition.

23. It is of utmost importance that for effective implementation of this system an Engineer fully conversant with Slip form technique with

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 30 of 41	

enough experience in planning and control of formwork should be in overall command of the site and he should be ably supported by well trained mid level supervisory staff, skilled workers and operators, having experience of similar construction in past. It is to be noted that enough manpower (as agreed by owners engineer at site) of above mentioned quality, is always ensured at site for smooth and uninterrupted work of slip form.

24. Operation of slip form method of construction is a continuous one and it demands continuous/intermediate inspection of accuracies in line, level, dimensions and position and immediate rectification of any noticed deviation. All these ask for personnel of high quality having constant vigilance over the construction activity.
25. While all the activities in effective implementation of the work needs utmost care keeping safety of men and material in mind it is obligatory that all activities should be carried out under the guidance of a qualified and trained safety Engineer.
26. For smooth and unhindered supply of concrete, while the slip form is in operation, it is desired that batching plant for concrete of chimney shell be placed in close proximity of chimney shell. However, all the safety measures required for placing batching plant close to shell must be ensured.

Safety measures as listed below must be adhered to but should not be limited to only these:

- a) Safety helmets and belts to be provided to all supervising staff and workers.
- b) Safety nets to be provided below both inside and outside platforms as instructed by Engineer.
- c) Hand railing and toe guard to be provided around all openings and platforms.
- d) Regular maintenance of equipment, checking of hoists, scaffoldings etc.
- e) Passenger hoist must have multiple ropes with adequate factor of safety.
- f) Emergency lights, coloured lamps to be provided in accordance with relevant Indian Standards and as supplemented in the Specification and to be operative in case of sudden power failure Emergency standby generator must be kept ready during the entire period of slipform method of construction.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 31 of 41	

g) Emergency vehicles, first aid facilities must be kept ready during the entire period of work.

26. Permissible construction tolerances should be limited to the following:

Variation in wall thickness : (-) 5 mm, (+) 25 mm

Variation from Design Diameter : ($\pm$) 25 mm or ($\pm$) 2.5 mm per 3 m dia. whichever is larger, but in no case more than ($\pm$) 5 mm.

Out of Plumb in General : 1 in 1000 of height subject to a maximum of 200 mm.

3.4.0 Steel Flues

3.4.1 General

Fabrication and erection of Steel Flues shall conform to "Technical Specification for Fabrication and Erection of Structural Steelworks" furnished in this Specification.

3.4.2 Fabrication

Plates out of which flues will be fabricated, should be bent to the required shape on an appropriate machine. No smithy process shall be adopted for the purpose. Plates are to be prevented from distorting by more than the tolerances specified during transportation, storage, handling, erection and jointing. All components should be correctly located and brought into correct alignment and level within specified erection tolerances, before adjacent pieces are jointed or secured.

3.4.3 Assembly

Each flue would be assembled from its Component "Cans" near to ground level within the wind-shield. Incomplete flue would be hung only from the flue support platform during assembly, and progressively hoisted to enable connection of further cans at its lower end. Upon completion of the initial sectional length, this length will be hoisted and supported in its final position at the flue support floor as indicated in the drawing. It is envisaged that each flue will be assembled and hoisted in three sectional lengths; site joints between sectional length being located just above a steel floor level.

Joints between individual cans should be flanged and bolted on outside and to have sealed welded joints on inside in accordance with clause 3.3.0 - "Welded Construction" under Technical Specifications" for Fabrication of

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 32 of 41	

structural steel work. The Contractor shall submit a drawing showing proposals for erection and indicating locations of all site joints which should be kept to minimum.

3.4.4 Flue Expansion Compensator

For installation of Expansion Compensators, the manufacturer's instruction should form the basis of the Contractor's method. This method, in a statement, should be submitted to the Engineer for approval. Once approved it has to be followed throughout the installation sequence. Expansion Compensators should be prevented from distortion during transportation, handling, erection and jointing, by more stringent tolerances than specified by the manufacturer.

3.4.5 Tolerances

Permissible tolerances in the fabrication and erection of steel flues are given below :

- a) Internal diameter shall not vary by more than : $\pm 12 \text{ mm}$
- b) Centre of any section shall not be eccentric from vertical centre line by more than : 10 mm in any 15 metre height
- c) Centre of any section at height 'h' is in mm. above GL shall : $(h/2500 + 10) \text{ mm}$, not be vertical centre where line by more than
- d) Local deviation from a true circular form should not exceed the shell thickness (Measurement should be made from a segmental circular template having radius of flue shown in drawing and a chord length equal to 0.15 of that radius).
- e) Peaking or stepping at welded horizontal seams shall not exceed 4 mm. (Measurement shall be made with a straight edged template long enough to contact the straight shell on either side of the peaked area).

3.4.6 Erection

Erection of Steel Flues and C.I. Chimney caps shall be done as per requirement of IS:800.

The Contractor shall submit to the Engineer a programme of erection for his approval. All plant, equipment, tools, tackle and any other accessories required for the erection shall be

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 33 of 41	

provided by the Contractor. Storing and handling of fabricated materials for erection, setting out of members, providing temporary supports, bracing, fasteners, bolts, nuts etc. shall be the responsibility of the Contractor and shall be taken into account in quoting the rate.

3.5.0 Insulation and Protective Treatment

3.5.1 Acid and Heat Resistant Paint

Top 15 meters of the outside face of R.C.C. windshield horizontal surface at the top of windshield and inside face from the top of the windshield to the top of roof slab or as specified in the drawing shall receive a protective treatment of three coats of acid and heat resistant black paint. The quality and type of the paint shall have the prior approval of the Engineer. For this, a small area shall be painted and a sample of paint shall be shown to the Engineer.

The surface to be painted shall be prepared and primary coat, if required as per the paint manufacturer's specification and direction of the Engineer, shall be applied. The paint shall conform, unless otherwise stated, to the requirement of IS:158. Necessary samples, test certificates and manufacturer's literature shall be submitted to the Engineer for his approval. The surface to be painted shall be completely dry before the paint is applied and the drying time between consecutive coats shall not be less than 5 hours. The overall combined thickness of paint shall be a minimum of 230 microns.

3.5.2 Cement Paint

The outside face of the Chimney shell, unless specified otherwise, shall be painted with Cement water proof paint. The quality shall be approved by the Engineer. Necessary samples shall be submitted to the Engineer for his approval. The surface of the shell shall be prepared as per paint manufacturer's specification. In addition, care shall be taken that the surface is free from stain, honey comb and any rough and uneven surface. The joints between two shuttering and two lifts of shuttering shall be so prepared that any unevenness, if by chance exists, shall be removed. If one coat of paint is not sufficient to give the required finish, the Contractor shall repaint the surface, until the Engineer is satisfied with the workmanship. The paint shall conform, unless otherwise stated, to IS:5410. Necessary samples, test certificates and manufacturer's literature shall be submitted to the Engineer for approval.

3.5.3 Insulation and Packing

All insulation material should be of dimension and type, shown in the drawing. Load bearing insulations at supports and side restraints of Steel liners should be an assembly of M.S. Plates, Stainless Steel Plates, PTFE (Poly Tetra Fluoro Ethylene) sheets and or/asbestos fibre reinforced boards (SINDANYO BLOCKS). Insulation to be fixed on outer surface of steel flues should be made of glass or mineral wool.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 34 of 41	

a) **Load Bearing Insulation Block**

Load bearing assembly should consist of three units and be fabricated according to approved drawings. It would be fabricated from mild steel units with a stainless steel sheet bearing plate and load bearing insulation blocks as indicated in drawing.

The first unit is bolted to the supporting beam. It consists of a M.S. base plate with bolt holes on which a machined M.S. plate is welded. This plate is provided with recess for PTFE sheet (conforming to BS : 5400) to seat, being lubricated with silicon grease.

The second unit also consists of a M.S. plate having adequate size & thickness as shown in drawing. While one surface of the plate is provided with a stainless steel bearing plate the other surface has a thin layer of lead/ elastomeric sheet. The side having stainless steel surface is placed on PTFE surface of First unit.

The third unit consists of two layers of load bearing insulation blocks each having a minimum thickness of 50 mm and factory bonded to top & bottom M.S. plates. These are separated by 100 mm. long load bearing insulation dowels as shown in the drawing. These plates are in turn welded to two additional M.S. plates. Of the two surfaces thus created one shall be welded to bracket assembly while the other should rest on the lead sheet of second unit. Bearing assembly, thus formed, should be levelled by using suitable M.S. shims.

Support arrangement typically consists of flue support shoe (a part of flue), flue support bracket connected to the shoe by precision bolted connection. The bracket in turn is welded to the bearing assembly, which in turn is bolted to available supporting beams.

Support brackets and bearing assembly are welded to locally thickened area of flue. These support the flue on support platform at suitable locations indicated on the drawing.

The arrangement described above should cater for easy and smooth thermal movements of linear element. Suitable restraint brackets and M.S. stop plates need be provided as shown in drawings to prevent excessive movement and thus keeping different units of bearing assembly in proper position.

b) **Insulation Block at Lateral Restraints**

At flue restraint platforms, necessary restraint arrangement with load bearing insulation blocks and stainless steel bearing plates fixed to the insulation blocks should be provided as indicated in drawings.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 35 of 41	

Restraint and support brackets need be provided for the bottom supported portion of the flue which rests on the support platform provided at the base to cater for bearing and restraint requirements.

c) **Glass or Mineral Wool**

Insulation thickness of 65 mm as is specified in clause 2.05.10 shall be built up using two (2) layers composed of 40mm and 25 mm thick insulation blocks. Thicker layer shall be put as first layer around the flue on its exterior surface.

The insulation on the flue shall be fixed using chicken G.I. wire mesh, G.I. wire ties, insulation retaining studs, washers etc. All joints shall be staggered. The insulation shall be tightly secured to the exterior surface of the flue by impaling on the studs and fixing in place by means of 63mm round or square metal plated speed washers. 20 gauge galvanized wire netting shall be wrapped continuously over the entire exterior of insulation. The wire mesh shall be 25mm hexagonal pattern conforming to IS:1566. All joints in the mesh shall be tapped a minimum of 150 mm tied by 16 gauge soft annealed wire at 300 mm spacings. Lacing at joints shall not be used. The Contractor before application of insulation, shall take prior approval of actual fixing arrangement from the Engineer.

The insulation shall be able to sustain structural vibrations and shall not settle under such conditions during erection, construction & operation. The insulation shall be suitably tied to prevent dislocation under adverse conditions.

The cladding of stainless steel sheet over the insulation shall be well secured using pins, fasteners etc.

d) **Vermiculite Concrete**

Vermiculite concrete shall be made by mixing exfoliated vermiculite, portland cement and water. It shall be of Grade-B, having a density of 210 Kg./Cu.M. The vermiculite aggregate size shall be maximum 6 mm. The mix shall be 1 cement and 8 vermiculite by volume.

3.6.0

Acid-Proof/Chemical Resistant Protection to Roof Slab

Acid-Proof/Chemical Resistant tiles bedded on acid proof/chemical resistant mortar shall be provided for the protection of roof slab. The intervening space between the tiles shall also be filled up by chemical resistant/acid-proof epoxy mortar grouts. The mortar shall be used immediately after mixing.

Tiles shall be made of clay, feldspar or quartz and vitrified at a high temperature in ceramic kilns. These should be unglazed, free from

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 36 of 41	

deleterious materials and should conform to IS:4457. Iron oxide in the raw materials used, shall not exceed 2 percent. They should show a fine grained, dense and homogenous fracture when broken. They shall be sound, true to shape, flat and free from flaws and other manufacturing defects. Dimensions of the tiles shall be 198.5 x 198.5 x 35 mm. Depth of the groove on the underside shall not be more than 3 mm. Compressive and tensile strengths of the tiles shall not be less than 70 N/Sq.mm and 3.5 N/Sq.mm respectively.

3.7.0 **Flue Acid Drains and Manholes**

Flue acid drainage system, where provided, will comprise of collection sumps, dilution manholes, conveying pipes including connection to main drainage system.

Stainless steel pipes, bends, collection sumps, fixing straps, bolts etc. conforming to the relevant Indian Standards (or in absence of which British Standard BS:3605) shall be used in work. Pipes should be cut and joined as per manufacturer's instructions so as to leave the surface clean and square to the axis of pipe.

Manhole should be constructed as per drawing. However, for general guidance it may be noted that pit of required dimensions should be excavated, lean concrete (1:2:4 mix) of required thickness to be laid, Acid-proof/Chemical resistant brick masonry in 1:4 acid resistant cement mortar of necessary thickness be built and both sides plastered by 12mm thick acid proof plaster (1:3 mix) having waterproof admixtures.

Manholes should be covered by reinforced concrete slab on which a heavy duty (HD) manhole cover with frame having diameter 560mm and total weight 255 Kg (140 Kg for manhole and 115 Kg for cover) is to be fixed. For additional safety another inner cover or other approved methods may be adopted. The manhole cover shall be distinctively coded to indicate the type of drainage involved.

Inside manholes necessary channels and benchings finished smooth by neat cement in cement concrete (1:2:4) and foot rungs made from 20mm round bars at 300mm centres and staggered should be provided. Rungs should project 100mm from wall face and be embedded 200mm inside cement concrete block made in that location of brick work. These foot rests shall be painted with coal tar in the projected portions and cement slurry in the embedded part. Joint of any pipe with brick work shall be rendered perfectly leak proof.

Pipes and fittings in the connection pipe to the main drainage system shall be vitrified clayware conforming to relevant IS and laid to the line and level indicated in the drawings.

3.8.0 **Roof Drainage**

3.8.1 **General**

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 37 of 41	

Rainwater outlets and down comers to run along inner face of stack wall, shall be made of standard cast iron rainwater pipes conforming to IS:1230. The brackets used to hold the pipes alongside the walls shall be wrought iron clevis type, split ring type or of perforated strap iron as approved by the Engineer. Each vertical pipe shall hang freely on its bracket fixed just below the socket. Suitable spacer blocks are to be kept in between the pipe and wall surface for fixing the pipe. All bends and junctions shall be provided with water tight clean-outs.

3.8.2 Pipe Joints

All joints between pipes, pipes and fittings and manholes shall be gas-tight when above ground and water tight when under ground. Method of pipe cutting and jointing shall be as per instruction of the pipe and fittings manufacturer or as approved by the Engineer. However following guidelines may be followed in absence of any instruction available from the manufacturer.

Socket and Spigot pipes shall be joined by cast lead joints. Spigot of the following pipe should be centred in the socket of the preceding pipe by tightly caulking in sufficient turns of tarred gasket or hemp yarn to have unfilled half the depth of socket. After the gasket or hemp yarn has been caulked tightly, a jointing ring shall be placed round the barrel and tightened against the face of the socket to prevent air lock. Molten lead shall then be placed round the barrel and tightened against the face of the socket. Thereafter molten lead should be poured in to fill the remainder of the socket and caulked with suitable tools tight round the joint to make up for shrinkage of the molten metal on cooling and should be finished 3mm behind the socket face. If any joint is suspected to be damaged it has to be opened out & redone. Joints in cast iron pipes with special jointing arrangements like "Tyton" joints etc. shall follow the instructions of the manufacturer.

4.0.0 TESTING AND ACCEPTANCE CRITERIA

4.1.0 General

The Contractor shall carry out all sampling and testing in accordance with the relevant IS Specifications and as supplemented herein, for the following items or any other item as may be required by the Engineer unless otherwise specified in this specification. The Contractor shall get the specimens tested in laboratory, approved by the Engineer and shall submit to him, the original test results in triplicate, within seven days after the completion of the test. Engineer may present himself while such tests are being carried out.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 38 of 41	

4.2.0 **Cement**

Representative samples shall be taken as per the relevant IS Specification from each consignment of Cement received from the Purchaser/Manufacturer/Supplier for carrying out the tests for fineness (by hand sieving), setting time, compressive strength and soundness tests, and the Contractor shall carry out the above tests as per relevant Indian Standard. If the cement is supplied by the Contractor the test shall be carried out by him. The Contractor shall carry out any or all the tests on aggregates as may be required by the Engineer, in accordance with IS:2386 Parts-I to VIII. The acceptance criteria of the samples tested shall be in accordance with the requirements of the relevant IS specifications.

4.3.0 **Water**

Sampling and testing of water being used for concrete works shall be carried out as per IS:3550, by the Contractor, at regular intervals and whenever directed by the Engineer. The final acceptance criterion in case of doubt shall be as per IS:3025.

4.4.0 **Concrete**

The Contractor shall take cubes for works test as per requirement laid down in IS:516 regularly from the day's pour. The number of test cubes to be taken shall be as per IS:456. The Engineer may also use his discretion in deciding the rate of cubes to be taken. The acceptance criteria is to meet the requirement of IS:456. If the cube test results indicate that some portions of the work is below the required strength, the Engineer may order demolition of that portion of work which is below strength and ask the Contractor to rebuild, provided a satisfactory method of load testing is not possible. Such testing or demolishing and rebuilding shall be carried out by the Contractor.

4.5.0 **Steel Flue**

All site and shop welded joints shall be inspected and tested in accordance with clause 4.00.00 of Technical specification for Fab. and Erection of structural steel work.

4.6.0 **Insulations**

The insulating materials shall be tested for its stipulated characteristics and properties in accordance with the latest editions of IS:3144 and IS:3346 and/or as directed by the Engineer.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 39 of 41	

5.0.0 INFORMATION TO BE SUBMITTED

5.1.0 With Tender

The following technical information are required with the tender:

- a) Source and arrangement of processing of aggregates proposed to be adopted.
- b) Type of plant and equipment proposed to be used.
- c) Names of firms with which association is sought for to execute the special items of work e.g. flue expansion compensator, load bearing insulation blocks etc. in the contract.
- d) Types of formwork proposed to be used. All details as per clause no. 3.03.06 to be submitted, if slip form method is proposed to be used.
- e) Shop proposed for fabrication of steel (flue) liners. Detailed write-up on procedure of erection of complete liner system including details of equipment proposed for the same.
- f) For insulating material tests to be offered for inspection & tests for which test certificates will be submitted. A drawing showing the details of fixing insulation on the flues at bearings, lateral restraints and exterior surface.
- g) Proposal for lifting of men and material in constructing the chimney.

5.2.0 After Award

The following information and data including samples where necessary, shall be submitted by the Contractor, progressively during the execution of the Contract.

5.2.1 Programme of Execution and requirement of Materials

Within 30 days of the award of the Contract, the Contractor will submit a Master Programme for completion of the work giving monthwise requirement of materials, particularly mentioning in details the materials which are to be supplied by the Owner and for the procurement of which the help of the Owner is required as per the terms & conditions of the Contract. In case the Contractor proposes to take on hire any

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 40 of 41	

machinery or tools and plants from the Owner, the detailed phased out programme of such hire is also to be submitted.

The master programme may have to be reviewed and updated by the Contractor quarterly or at more frequent intervals as may be directed by the Engineer depending on the exigencies of the work.

Detailed day to day programme of every month is to be submitted by the Contractor before the commencement of the month.

5.2.2 **Samples**

Samples of all materials proposed to be used shall be submitted as directed by the Engineer, in sufficient quantities, for approval. All samples shall be submitted well in advance of starting work at site. Approved samples will be preserved by the Engineer for future reference. The approval of the Engineer shall not, in any way, relieve the Contractor of his responsibility of supplying material of specified quality.

5.2.3 **Design Mix**

Design mix as per details of this specification giving proportions of ingredients, sources of aggregates and cement along with accompanying test results of trial mixes as per relevant IS Specifications shall be submitted to the Engineer, for his approval, before it can be used on the work. Further, the mix design for concrete of shell to be validated from a third party agency of national repute, as agreed upon by the owner.

5.2.4 **Detail Drawings**

Following items shall be provided by the Contractor which are to be approved by the Owner and Consultant.

- a) Detail drawings and designs of form work including scaffolding to be used. If slipform method of construction is adopted, then detail drawings showing all the arrangements for slipform technique including methods for reducing internal diameter and providing required slopes on outer diameter.
- b) Detail drawings and bar bending schedules for concrete components.
- c) Shop drawings for structural steel and metal work, including inserts etc. The Contractor shall submit his proposal for testing site and shop joints provided in steel members.

	TITLE: RCC STACK	SPECIFICATION NO. PE-TS-442-620-C025	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D25
		REV. 0	DATE 22/02/2018
		SHEET 41 of 41	

- d) Detail drawings for templates and temporary supports for embedments.
- e) Category wise requirements of MS, tor and structural steel including GI flats of various sizes for procurement.
- f) Detailed drawings of steel flues indicating details of joints, supports and restraints including insulation blocks, and details of expansion compensator.
- g) Detailed drawing of hoisting arrangement for men and material satisfying statutory regulations laid down for safety purpose.

5.2.5 Reports

Following Test Reports shall be furnished by the Contractor :

- a) Mill Test Report for cement and reinforcing steel if the materials are supplied by the Contractor.
- b) Inspection Report of bought out items.
- c) Inspection Report of formwork and reinforcement, insulations etc.
- d) Reports of tests of various material and concrete.
- e) Radiographic tests on welded joints in steel flues.
- d) Any other data or report or test result required by the relevant IS Specifications and if required by the Engineer for satisfactory quality control of the workmanship.

	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 1 of 13	

VOLUME: II B

SECTION – D

SUB SECTION – D26

TECHNICAL SPECIFICATION FOR BOROSILICATE GLASS BLOCK LINING SYSTEM

SPECIFICATION NO. PE-TS-442-620-C001



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301

	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 2 of 13	

Table of Contents

1. Scope of work
2. Technical Specification
3. Technical Requirements
4. Special equipment, tools and instruments
5. Standard and codes
6. Quality assurance and quality control
7. Safety, Noise and Environment requirements
8. Handling, Storage and protection
9. Job site inspection and preparation

	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 3 of 13	

1 SCOPE OF WORK

The subject project includes design/Engineering, supply and installation of closed cell Borosilicate glass lining system, Wet stack flow model study and associated civil and structural works in the existing chimneys at 3x660MW BARH STAGE-I Plant. The work is to be executed in Two existing tall R.C.C chimneys of 275m high, one with already erected in position two MS flue cans and other with already erected in position one MS flue can.

For more detail about the project refer Annexure-III of the specification.

1.1. Intent of specification

The intent of this technical specification is to provide a complete Chimney Lining system to protect the existing MS flue cans in wet/dry condition as per specification. The bidder shall study the specification and make a site visit if required to satisfy himself thoroughly about the nature of work, Workability and suitability of the system. The bidder shall take full responsibility for guaranteed and satisfactory operation of the system as regard to its performance and smooth and reliable working of supplied equipment's/systems. All work shall be carried out as per specification. The bidder shall be responsible for providing all material, tools and plants and services, which are required to complete the project and fulfill the objective of safe and trouble free operations, maintainability and reliability of the complete work covered under this specification. The bidder shall fulfill all the features of the work as per specification, the relevant codes and standards and adhere to all the local regulations, as applicable. Design, manufacture, supply, construction, erection, and commissioning shall be as per the state of the art technology and satisfy all the statutory and mandatory laws and regulations to its fullest extent.

1.2. Annexures I, II and III.

Annexure-I: Preliminary data of Flue gas characteristics shall be as per Annexure-I and specification.

Annexure-II: - The Chimney General configuration

However, during detailed engineering, minor modification if any required may also be done with owner's consent but without any extra cost implication.

Annexure-III: - Project information

Annexure-IV: - Wet stack flow model study

2 Technical specification

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 4 of 13	
2.1 The works includes Design/Engineering, supply and installation of closed cell Borosilicate glass lining system in the existing chimney which includes but not be limited to the following. 2.1.1 Design, preparation of drawing, material supply, fabrication, erection/installation, application, handling, transportation, storage, preservation, borosilicate blocks shall be supplied with adequate moisture proof packing, testing at site, application of borosilicate glass block lining system including expert supervision of borosilicate glass block lining manufacturer/supplier, over MS liner in the existing chimney, including: a) Design of closed cell Borosilicate glass lining system and getting approval from BHEL/NTPC. b) Supply of suitable primer, supply of two components adhesive membranes and supply of closed cell borosilicate glass blocks. c) Surface finish of MS flue can with blast cleaning of internal surface of existing steel flue liner to near white metal surface finish conforming to Sa 2 ½ finish as per ISO 8501-1, application of suitable epoxy primer, including expert supervision of borosilicate glass block lining manufacturer/supplier. d) Installing closed cell borosilicate glass block lining system, over all heights, in erected position, on internal surface of MS flue can and concrete mini shell, using two components suitable adhesive membrane material under controlled temperature and humidity conditions, including, tools & tackles, equipment required to create controlled temperature & humidity conditions, hot blow cleaning (after priming) of internal surface before application if required, mixing of two components adhesive membrane by automated mixing machines. e) Complete onsite Quality assurance (QA) and supervision, by borosilicate glass block lining manufacturer/supplier, during surface finish, application of primer, application of two components adhesive membrane, installation of borosilicate glass block on internal surface of MS flue can. f) Ten (10) year full replacement guarantee for borosilicate glass block, supply, erection/installation, enabling works, labor, material, adhesive, primer, surface preparation, arrangement for application etc. all complete, and fulltime onsite QA supervision during erection & commissioning. During the guarantee period if the lining system fails to protect the chimney flue from deterioration, the bidder shall replace the partially affected portion or complete borosilicate lining system as per time schedule but without any additional cost, including labor, material, surface finish (SA 2 ½), supply and application of primer, supply and application of two component adhesive membrane, supply and application of closed cell borosilicate glass blocks, arrangement for application on erected flue cans etc all complete with onsite QA supervision of borosilicate glass block supplier. g) Submission of comprehensive QA documentation. <u>Mode of measurement:</u>			

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 5 of 13	
Area of payment for the item shall be calculated by multiplying the height of flue can over which blocks are installed with inner perimeter of flue can over that height. Payment for closed cell borosilicate lining system shall be inclusive of scope mentioned above.			
2.1.2 Complete engineering, procurement and installation for the following: a) Replacement of the expansion joints with acid resistant materials which shall withstand acidic flue gas and shall also prevent dust accumulation. The space between the expansion joint material and the liner shall be packed and sealed by providing a bolster made up of light weight compressible material suitable for wet stack operations and acid resistant to withstand acidic flue gas condensates. The bolster shall be confined in texturized glass fabric having a final covering of stainless steel wire mesh. Design of expansion joint shall comply EPRI guideline to avoid contact of condensate with expansion joint material and to ensure drainage of condensate. The scope includes all labor, material and tools and plants, transportation, hoisting, fixing in position, drilling, cutting, bolts and bolting, Testing etc. Approval of user handbooks giving details of installation, dismantling and maintenance procedures for the expansion joints shall be obtained from BHEL/NTPC. b) Replacement of Sample port with acid resistant material like C276, fiber gasket etc, and also modification (if required) of existing steel flue liner to suit the same. Measurement for payment shall be done for net weight of Titanium/c276 pipe including flange plate/cover plate only (weld thickness not to be considered) which is welded over liner surface. c) Modification of Manhole / access door with acid resistant material or with borosilicate glass block lining d) Provision of suitable Condensate drains/gutter in MS flue cans. Measurement for payment shall be done for net weight of c-276 Strips, plates, gutters/vanes/pipes, bends & its fittings etc (weld thickness not to be considered) which is welded over liner surface. e) Modification in existing RCC mini-shell having AR brick lining. Measurement for payment shall be done for total weight of C276 sheet only (weld thickness not to be considered). f) Supply and Installation of condensate collection system as per wet stack study report.			
2.1.3 All necessary parts, and works necessary for transport, storage and application purposes. Coordination with chimney designer & chimney contractor- providing required inputs.			
2.1.4 Submission of the drawings and getting the same approved from BHEL and the project owner for borosilicate glass block lining system, erection, transportation and storage.			
2.1.5 The Bidder shall furnish all design, labor, materials, tools and equipment necessary for the installation of borosilicate lining system, as indicated and specified herein.			
2.1.6 The Work shall include everything requisite and necessary to finish the job properly, to the satisfaction of engineer in charge, notwithstanding that every item of labor			

	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 6 of 13	
or materials or accessories required to make the installation complete may not be specifically mentioned. 2.1.7 The Equipment / material for the Unit shall be supplied complete with provisions for appurtenances and accessories, to form a complete system which will achieve and assure safe and reliable operation with best overall performance. 2.1.8 Bidder shall provide, in the required format and form and in a timely manner, all drawings and documentation required by this Specification and/or required by applicable Standards and codes. A consistent nomenclature shall be used project-wide in naming all component parts within the Scope of Work. This shall apply to all drawings, Bill of Materials, special instructions, etc. The cost of correcting inconsistent nomenclature shall be borne by the Bidder. 2.1.9 Changes in design and drawings already approved by the owner are normally unacceptable. However, should such changes become necessary on an exceptional basis, the Bidder shall obtain the owners approval prior to introducing any such change. 2.2 Bidder Services Field personnel provided by the Bidder shall be capable and qualified to perform the required duties to the satisfaction of BHEL and the owner. Erection services: The Bidder shall furnish competent supervision for erecting the equipment provided under this Specification. The erection services shall be coordinated with other agencies in the scope of the subject chimney contract. 3 TECHNICAL REQUIREMENTS 3.1 Design parameters 3.1.1 Liner considerations The borosilicate glass block liner will have a minimum thickness of 38 mm, for all its entire length. Proper provisioning should be made for borosilicate lining system for lining around gas sampling ports, expansion joints, man holes and other appurtenances. 3.2 Operating conditions - o Operating conditions shall be as per Annexure-I and specification. - o A margin of 15 deg centigrade above the operating conditions mentioned in Annexure-I shall be taken while selecting the appropriate material and thickness for design of the lining system. 3.3 Performance Requirements 3.3.1 Borosilicate brick lining system will be designed in such a way that it will not require unscheduled outages for repair except for planned and scheduled routine maintenance and inspections.			

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 7 of 13	
3.3.2 Ten (10) year full replacement guarantee, including cost of supply, erection, enabling works, all labor, material, adhesive, primer, surface preparation, arrangement for application etc. all complete, and fulltime onsite QA supervision during erection & commissioning. During the guarantee period if the lining system fails to protect the chimney flue from deterioration, the borosilicate glass block lining manufacturer/supplier shall replace the partially affected portion or complete borosilicate lining system without any additional cost, including all labor, material, surface finish (SA 2 1/2), supply and application of primer, supply and application of two component adhesive membrane, supply and application of closed cell borosilicate glass blocks, arrangement for application on ground or erected flue cans etc all complete with onsite QA supervision of borosilicate glass block supplier. 3.3.3 The lining system shall be tested for its wet stack surface properties by an independent institute of sufficient knowledge and experience, subject to acceptance by the project owner, and furthermore the lining system supplier has a demonstrable track record of providing technical advice and support to customers for the design of environmentally effective liquid control systems in flue gas ducts and chimneys. 3.3.4 The lining system (borosilicate glass block and adhesive) shall be offered by a supplier with demonstrated capabilities in the area of onsite technical support and QA/QC supervision, who employs QA/QC supervisors with a demonstrated experience in technical support and QA/QC supervision of the subject lining system. 3.3.5 The lining system (borosilicate glass block and adhesive) shall be tested for fire risk by an independent institute of sufficient knowledge and experience, subject to acceptance by the project owner, and shall be demonstrated to them the ability to protect the steel chimney flues from structural damage for a minimum period of 2 hours, as per ASTM E-119. 3.3.6 The lining system (borosilicate glass block and adhesive) has been tested for worker health and safety on an actual large scale installation project by an independent institute of sufficient knowledge and experience, subject to acceptance by the project owner, and it has demonstrated through such testing that it can be used by teams of workers safely, without adverse health effects, and such without requiring excessive protective measures.			

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 8 of 13	
3.4 Design Requirements 3.4.1 General - o Design of the borosilicate lining system must be performed by a professional engineer in the design of such system for chimney flues. - o Specified requirements of this specification are to be regarded as minimum requirements. If the Fabricator's design and/or experience dictate these minimum requirements should be exceeded, the design, supply and application shall be performed accordingly, without any extra cost implication. 3.5 Materials Requirements The steel chimney flues, made of mild steel, shall be internally protected with a lining system consisting of minimum 38 mm thk closed cell borosilicate glass blocks, applied with a flexible, chemically resistant adhesive, using a lining system that meets all of the following requirements: 3.5.1 The lining system shall use closed cell borosilicate glass blocks with the following minimum physical properties: a. Density $0.144 \times 10^3 \text{ kg/m}^3$ b. coefficient of linear thermal expansion not greater than $5.5 \times 10^{-6} / ^\circ\text{C}$, c. compressive strength greater than 1.00 Mpa as per ASTM C 165, d. flexural strength greater than 0.62 Mpa as per ASTM C.203/C.240. e. The blocks shall be resistant to thermal cyclic loading under FGD bypass/ hot gas service conditions, and sudden temperature changes, including high temperature spikes. 3.5.2 The borosilicate glass block system shall use a flexible, chemically resistant adhesive, with all required surface preparation, primer, labor, equipment etc., all complete. The adhesive membrane shall be a 2-component having excellent elastomeric properties and be acid & heat resistant. The adhesive membrane shall be applied in between and behind the blocks in a 3 mm thick layer ensuring a proper bond and adhesion. A 1.5 mm thick layer should be troweled onto the liner as well as to the sides and back of each block before installation. Double buttering technique shall be used to ensure full bond of each block to the liner and to each other. Contractor shall get installation procedure approved by BHEL/NTPC before installation including verification of installation procedure & workmanship standards of the lining system. The adhesive membrane shall have the following properties.			

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 9 of 13	
a. tensile strength at 23 °C greater than or equal to 1.0 N/mm2 as per ASTM D.412 b. Resistant to corrosive flue gas environments. c. Remain elastomeric and flexible under hot gas conditions and sudden temperature changes. d. The adhesive shall be suitable for trowel application. 3.5.3 The steel surface shall be blast cleaned to a cleanliness of SA 2 1/2 and approved by the supplier of the lining system. The substrate shall thereafter be primed using a high performance epoxy primer within a short time window approved by the supplier. The lining system manufacturer shall demonstrate a proven Quality Control system that monitors and documents the key physical properties, as described above. 4 SPECIAL EQUIPMENT, TOOLS AND INSTRUMENTS Bidder shall provide all special equipment, tools and instruments, skilled manpower required for handling and storage, and for test and maintenance of borosilicate lining system provided under this Contract. 5 STANDARDS AND CODES 5.1 The borosilicate lining system to be provided under this Specification, including all appurtenances and accessories, and shall be designed, fabricated, inspected, tested, stamped and preserved to the extent indicated in said referenced Standards and Codes. Where this Specification does not include such reference, the system, or any of its components, shall be designed, fabricated, inspected, tested and preserved, as applicable, to comply with currently recognized International and/or manufacturer’s specification, whichever is stringent and more restrictive. 5.2 In all cases Bidder shall adhere to and comply with the requirements of Indian standards, which are found to be more restrictive than those specified herein. 6 QUALITY ASSURANCE AND QUALITY CONTROL 6.1 The Bidder shall submit upon request a copy of Its Quality Assurance Manual including Quality Procedures. 6.2 The Bidder shall conduct an inspection and testing program which shall record and verify the essential properties of the constituent materials and the finished liner. 6.3 The Bidder shall conduct test to verify the mechanical properties of borosilicate bricks and adhesive/mortar and the tests shall be documented during the course of design and fabrication, and shall be made available to owner. 6.4 Unless otherwise specified the bidder’s standard tests shall be performed on all batches of materials furnished. The owner may or may not elect to witness tests, but the bidder			

	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 10 of 13	

shall notify the Owner's Quality Assurance Department no later than 10 days in advance of all scheduled tests.

7 SAFETY, NOISE AND ENVIRONMENT REQUIREMENTS

7.1 SAFETY

The equipment supplied under this Specification shall meet the U.S. "OCCUPATION, SAFETY, AND HAZARD ADMINISTRATION" (OSHA) requirements or equivalent.

7.1.1 Jobsite Safety and Scrap Disposal

- o Safety programs and procedures shall be within the scope of this Specification, it should be noted that the all materials that are potentially flammable materials and must be handled in keeping with good industry practice and in compliance with the manufacturer's recommendations.
- o Owner shall supply the Bidder with the applicable rules and regulations for disposal of scrap and waste materials, which are to be followed by the bidder.

7.1.2 Safety and protection of work and property:

The Bidder shall provide for the safety and protection of the work and of materials and equipment to be incorporated therein, whether in storage on or off the site. Provide protection at all times against rain, wind, storms, condensation, or heat so as to maintain all work and equipment and materials free from injury of damage. At the end of each day, all new work likely to be damaged shall be appropriately protected.

7.2 Environmental Data

- 7.2.1 Should the lining system to be furnished by the Bidder have discharge points to the environment and/or generate waste materials that must be discharged to the environment, the Bidder shall provide, upon Purchaser's request, a plan for the treatment of the discharge/waste to meet current regulations of the Indian government/ regulatory authorities.
- 7.2.2 The Bidder shall submit, within thirty (30) days of demand, additional information on noise and/or other environmental data. All information shall be prepared in a manner acceptable Indian government/ regulatory authorities.

	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 11 of 13	

8 HANDLING, STORAGE AND PROTECTION

8.1 Facilities

- 8.1.1 Bidder shall construct adequate facilities for the storage of material. Upon completion of fabrication, the Bidder shall remove the fabrication facility from the site and return the area to the pre-construction condition.
- 8.1.2 The installation of borosilicate lining system must be done in a suitable environment (temperature, humidity etc. control as per manufacturer recommendation to stand by the required guarantee). Maintenance of the required suitable condition and any tools/tackles, machinery required to maintain the controlled environment during installation of borosilicate glass block shall be in the scope of bidder.

8.2 Storage

- 8.2.1 Materials shall be stored in a dry area and within the temperature and humidity limits recommended by the material Bidders. Do not allow shelf-life limits, as determined by the Bidder, to be exceeded.
- 8.2.2 Materials surfaces shall be protected from dust, fog, rain and other contaminants.
- 8.2.3 Affected plies shall be removed if any of the above requirements are not met during final surface preparation. The surface exposed due to the removal of the plies shall be abraded and prepared, per this Specification, before applying new plies.

9 JOB SITE INSPECTION AND PREPARATION

- 9.1 In coordination with the chimney contractor, the borosilicate installation agency should submit a plan detailing the application sequence and methods to be employed, including moving, handling, storage, erection, fit up and the methods to be used for environmental protection.



TITLE:

**BOROSILICATE GLASS BLOCK
LINING SYSTEM
(3X660 MW BARH STAGE-I FGD)**

SPECIFICATION NO. PE-TS-442-620-C001**VOLUME - IIB****SECTION - D****SUB SECTION- D26****REV. 1****DATE****23/01/2019****SHEET 12 of 13****ANNEXURE-I**

352 - 286 A

DATA FOR CHIMNEY DESIGN

GENERAL DATA				
Project Name		Barh 13x660 MW		
Boiler Application		Utility	No. of Chimneys	By PEM (Existing Chimney)
Boiler Capacity		660 MW	Type of Chimney	By PEM (Existing Chimney)
No. of Boilers / No. of Absorbers		Three (03) / Three(03)	Chimney Arrangement	By PEM (Existing Chimney)
Fuels Fired		Coal	Height of Chimney	By PEM (Existing Chimney)
OPERATING CONDITIONS (Per Boiler)				
Boiler Load		Guarantee point		Design point
		660 MW		VWO
Type of Coal		-----		-----
At absorber outlet				
Flue Gas Flow	:	TPH	3303	3604
Flue Gas Volume	:	m³ / s (wet)	892	999
Flue Gas Temperature	:	°C	58.2	62.0
Flue Gas Density	:	kg /m³	1.02845	1.00227
FGD OUTLET-FLUE GAS COMPOSITION % BY Volume – (WET BASIS)				
CO ₂	:	%	9.35	8.97
N ₂	:	%	66.81	64.07
O ₂	:	%	5.89	5.65
SO ₂	:	%	0.0021	0.0020
H ₂ O	:	%	17.95	21.31
*DUST SIZE DISTRIBUTION AT CHIMNEY INLET - % MICRONS				
Below 3		94.3	Between 10 - 15	22.19
Between 3 - 5		45.79	Between 15 - 20	15.0
Between 5 - 10		28.8	> 20	10.69
OTHER DATA				
Elevation of Breeching Line of the Duct			NA (Existing Chimney)	
Duct Opening Size			NA (Existing Chimney)	
Chimney Shell Opening Dimensions			NA (Existing Chimney)	
Flue Gas Pressure at Chimney Entry Level			mm WC	PEM Chimney designer to decide
REMARKS: Above mentioned parameters are for one boiler only.				

 Maharatna Company	TITLE: BOROSILICATE GLASS BLOCK LINING SYSTEM (3X660 MW BARH STAGE-I FGD)	SPECIFICATION NO. PE-TS-442-620-C001	
		VOLUME - IIB	
		SECTION - D	SUB SECTION- D26
		REV. 1	DATE 23/01/2019
		SHEET 13 of 13	



TENDER NO :PSER:SCT:BAR-C1962-19	
TITLE:	SPEC. NO.: PE-TS-442-142-N102
TECHNICAL SPECIFICATION FOR	VOLUME: I
WET STACK FLOW MODEL STUDY	SECTION:
3X660 MW NTPC BARH STPP STAGE I (FGD	REV. NO. 00 DATE 17.01.2019
System Package)	SHEET 1 OF 12

ANNEXURE-IV
TECHNICAL SPECIFICATION FOR WET STACK FLOW
MODEL STUDY



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 2	OF 12

CONTENTS

1. INTENT OF ENQUIRY/ SPECIFICATION
2. SCOPE OF WORK
3. BID EVALUATION CRITERIA
4. DELIVERY SCHEDULE
5. SUGGESTIVE DRAWINGS/ DOCUMENTS SUBMISSION
6. OTHER TERMS OF CONTRACT
7. DOCUMENTS TO BE SUBMITTED WITH BID

ENCLOSURES:

Annexure-I: Flue gas process parameters

Annexure-II: - FGD Layout, chimney liner dwg and GA

Annexure-III: FGD Layout and Project information



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 3	OF 12

1.00.00 INTENT OF SPECIFICATION:

The intent of this enquiry/ specification is to carry out the Wet stack flow model study of 3X660 MW NTPC BARH STPP STAGE I (FGD System Package) project for complete duct system from absorber outlet to the top of the stack, design and optimization of gas flow and liquid collection system to mitigate stack liquid discharge (SLD) and shell corrosion, Preparation of final report and recommendations, preparation of drawings/ documents for execution of collection system, obtaining approval on documents from BHEL/ Customer/ customer's consultant, Preparation of BOQ, preparation of bought out item specification, procurement assistance for specialized items, site visit as specified later in the specification & as necessary for completeness in all respects and for efficient & trouble free operation of chimney and liquid collection system for project.

2.00.00 SCOPE OF WORK:

Wet stack model study shall consist of the following:

- Condensation calculations & design of condensate collection system
- A scale physical flow model for liquid collector system (LCS) design.
- A computational flow model for plume downwash analysis.
- A physical or computational flow model for CEMS elevation flow performance.
- Design of optimum choke geometry if required.
- Review & Approval of liquid collector system construction drawings.
- Site inspection & supervision for 7 days to verify and evaluate LCS system performance prior to commissioning.

Wet stack study shall be performed for each unit with a wet stack installation where there does not exist an identical or mirror image installation. The objective of the wet stack study shall be to maximize liquid collection downstream of the mist eliminators and to preclude ground level rainout from the stack by recommending experimentally developed, tested, and optimized liquid collection devices and drainage systems to return collected liquid to the absorber with minimum re-entrainment.

The following codes and standard shall be followed for the conductance of this study:

- Revised wet stack design guidelines, 2012 by EPRI
- ACI 307 (American concrete institute code requirement for RC chimney
- EPRI report CS-2520 Entrainment in wet stack 1982
- EPRI report TR 107099 Wet stack design guide 1996



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 4	OF 12

- EPRI report TR-109380 guidelines for fluid dynamic design of power plant ducts, 1998
 - EPRI report GS-6984 FGD mist eliminator system design and specification guide
 - CICIND, ICAC, US EPA and other international and other latest codes and standards.
- The study shall be carried out by design methods and tools:
- Preliminary design review based on experience
 - Laboratory flow modeling -3-D
 - Computer flow modelling -3-D
 - Computer program calculations – 2-D

2.01.01 Preliminary design review based on experience

Based on the inputs furnished as per enclosed Annexure with this specification for the duct work and stack, preliminary design review need to be carried out to estimate the liquid collection requirements, predict the condensation rate in the duct & stack and perform the preliminary system design.

2.01.02 Condensation calculations using analytical / numerical tools

Gas flow study should include the calculation for the condensate formed and / or condensate carry over. The condensate flow study should include condensate quantity formed due to:

- i) Thermal condensation on the liners
- ii) Adiabatic condensation
- iii) Turbulence of flue gas flow near entry of the stack
- iv) At the outlet duct from absorber mist eliminator outlet
- v) Contribution from mist eliminator carryover in case of normal wash cycle or mist eliminator become fouled with time.

Detailed calculations along with the design basis for condensation rate in the duct from absorber outlet to the top of the chimney for the worst operating case, minimum boiler load and design conditions shall be furnished as a function of ambient air temperature, wind velocity and liner design variables in the report with an accuracy of $\pm 10\%$.

2.01.03 Design of Condensate collection & drainage system

- (i) Size of gutter(s) along with inner surface of Chimney flue can and inlet duct from absorber outlet to inlet of chimney flue can, such that condensate is collected



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 5	OF 12

efficiently and drained off with a drainage system till its terminal point at ground outside the duct & Chimney shell.

- (ii) As the gutter shall be made of Titanium/C-276 as compatible with inner surface, suitable shape, size and thickness is to be recommended so that gas flow occurs efficiently.
- (iii) The size, thickness, location and material of condensate drainage pipe shall be included in recommendation. It is envisaged that pipe from gutter to outside of Chimney liner shall be of Titanium/C-276 and thereafter the drainage pipe shall be of FRP up to the collection pit. Routing of the drain pipes shall be provided.

After the flow-model study is performed, accordingly design of liquid-collection devices for the full scale Wet Stack is to be carried out and detailed drawings, design basis and calculations shall be submitted.

2.01.04 Computational 3-D fluid-dynamic-model study (CFD Analysis)

Performance of a computational 3-D fluid-dynamic-model study of the minimum upper one third of the stack liner and shell to evaluate downwash of the wet plume. CFD model shall include the surrounding structure which are significant to wind/ plume flow patterns preferably minishell, external handrails and floor at the stack outlet.

A computational model of the stack shell and liner(s) shall be constructed for the plume downwash study. The plume downwash study shall include analysis of the local wind/temperature data to identify the occurrence of critical wind and temperature conditions. The plume downwash study shall identify the stack velocity and ambient wind conditions that produce downwash and the maximum extent of expected downwash throughout the year for shell corrosion protection. For sites where ambient temperatures reach freezing, a "winter" period shall be simulated to evaluate icing potential on the stack.

Depending on the results of the downwash study, there may be a need to develop an optimum choke geometry, if required, to minimize the plume downwash & liquid impingement of the shell. This includes evaluation of liquid collectors and drains to prevent re-entrainment and discharge of large droplets from the top of the choke.

Bidder to use the latest software for the CFD modelling and shall submit the model along with results in form of contours and vector plots of velocity, pressure, concentration and temperature at various test locations and summarized in tabular



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER/SCT/BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 6	OF 12

format. The model shall be tested with various simulated operating, minimum and design flow conditions, maximum wind speed, wind orientations, to evaluate the potential of the downwash.

The Bidder shall review Minishell details (Liner extension above roof) enclosed as an Annexure and confirm the liner-extension design with their recommendation.

In case of the excessive downwash or reversed flow at stack exit or liquid exiting the stack liner and forming on the top of the concrete shell, bidder to provide the corrective actions, design modifications and evaluate the modified geometry.

2.02.00 Physical model of the system

An experimental gas-flow-model study to design and develop collectors for the duct and stack downstream of the mist eliminator that will collect and drain liquid from the walls to prevent re-entrainment.

Laboratory Physical model study shall include the following details for wet stack design:

- i. Estimation of the total liquid load on the liner surface as a result of thermal and adiabatic condensation. This estimate shall be based on the liner and shell geometry, thickness, materials of construction and the flue gas-flow rate and properties over a range of expected plant-operating conditions and worst-case ambient weather conditions considering the mist eliminator fouling / wash cycles.
- ii. Design and optimization of liquid collectors in the absorber-outlet hood, absorber-outlet ducts, stack-liner entrance region and stack liner outlet to prevent SLD. The collectors will collect liquid from surfaces, re-entrainment, and guide the liquid to locations where it can be drained out of the system. This development work shall be conducted on a scale model of the wet duct and stack system, from the outlet of each absorber's mist eliminator include the absorber outlet and ducting, the stack breaching duct and a minimum of three (3) diameters of the stack liner above the top of the stack breaching duct. Model scales shall be minimum 1:12 and to be selected to ensure accurate modeling results for all tested parameters. The same shall be finalized after the award of the contract. The design should be of integrated complete system of liquid collectors from absorber outlet to chimney top for each unit.



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 7	OF 12

- iii. The laboratory test includes details of liquid re-entrainment and drainage behavior over the expected range of unit operating conditions and confirm the stack-liner design velocity.
- iv. Physical model shall include any internal devices larger than 3 inches in diameter/protrusion that may affect the flow, such as structural members, internal dampers, flow controls, and expansion joints. The model shall be mainly constructed from transparent acrylic or plastic, sheet metal, or coated rigid tubing such that it is suitable for wet testing. Modeled flow control and liquid collection devices may be constructed with sheet metal, or other suitable construction materials, so long as the scaled liquid flow performance is not adversely modified.
- v. The physical model shall be tested for pressure and velocity profiles at selected cross sections through the ducts and liner. A velocity traverse shall be conducted within the modeled liner to ensure that the cyclonic flow levels are within the U.S. EPA Method 1 recommended limitations for CEMS operation. In the event testing indicates that cyclonic flow could be a concern at the continuous emissions monitoring system (CEMS) elevation, a simulation, either by extension to the physical model or using a computational fluid dynamic model, shall be performed to evaluate this flow at the CEMS level. If needed, corrective devices shall be designed and tested to reduce stack swirl at the CEMS elevation.
- vi. The physical model shall be tested by introducing liquid in a size and quantity such that the model shall approximately match the two-phase flow modeling requirements for droplet trajectory and loading. This testing shall be used to locate and design the liquid collection devices and drains.
- vii. Evaluation of re-entrainment at liner-expansion joints in the laboratory test rig and development of a unit-specific liquid-collector geometry to collect and drain the liquid from the liner-expansion joints.
- viii. Using this model effective internal liquid collection devices shall be developed and optimized to improve the droplet deposition and liquid collection in the stack as well as to prevent the re-entrainment of droplets from liquid pools and films.
- ix. Bidder shall submit the detailed standard procedure for carrying out the physical model study at vendor lab for customer information / approval before the conductance of physical model study at lab.



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102
			VOLUME: I
			SECTION:
	REV. NO.	00	DATE 17.01.2019
	SHEET	8	OF 12

Site inspection & supervision

Bidder to perform an onsite inspection as per the EPRI Revised Wet Stack Design Guideline, 2012. Site visit should occur for 7 days time during the construction phase, when liquid collection system is nearing completion, to inspect the liquid collection system as installed to ensure that the designed flow controls, liquid collectors, drains, and drain protection are installed properly and shall perform as intended. Bidder to provide the site inspection report to validate the design and installation.

The onsite inspection should confirm that the liquid-collection system has been fabricated and installed correctly and to identify any deviations to the recommended design as a result of field modifications made to ease installation. The bidder shall also ensure the liquid collection system is installed properly.

The key deliverables from this study are:

- a) Bidder to furnish the total quantity of condensate formed from absorber mist eliminator outlet to top of the stack.
- b) Bidder to furnish the number, sizing and location of required various liquid collectors/ gutters, their shape, design of its evacuation piping from inside the chimney to outside and their Influence on the flow in the chimney liner.
- c) Flow model study shall minimize system pressure losses and optimize collection and drainage and provide expected field wet stack system pressure loss across expected load range.
- d) Bidder to achieve minimum stack liquid discharge. In case of excessive stack liquid discharge, possible means of modification to duct and stack geometry need to be proposed by bidder for improvement.
- e) Bidder to ensure the design of effective liquid collection system for various plant load operating conditions and absorber combinations.
- f) Bidder to furnish the comparison of the experimental and computer modelling.
- g) Bidder to recommend modifications to prevent the chimney liquid discharge issues and to make the geometry more favorable for liquid collection.
- h) Bidder to furnish the fabrication/installation drawings after the completion of model study for fabrication.



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19	
	SPEC. NO.: PE-TS-442-142-N102	
	VOLUME: I	
	SECTION:	
	REV. NO. 00	DATE 17.01.2019
	SHEET 9	OF 12

- i) Bidder to identify appropriate liner system and gas inlet geometries (including flow control devices) to ensure homogeneous gas flow conditions and achieve cyclonic free flow distribution at the CEMS location.
- j) Bidder to provide recommendations and design for sealing drain piping/ seal pots to inhibit backflow.
- k) Bidder to recommend drain protection devices to minimize pluggage occurrences an flow and recommend method for monitoring liquid collection drainage flow in case of liquid collection system pluggage and SLD problems.
- l) Bidder to provide stack outlet modifications, such as liner extensions or chokes, to minimize stack icing occurrences and to provide Stack shell coating requirements to protect concrete shells from corrosion due to plume downwash.
- m) Bidder to evaluate the plume downwash and recommend modifications to minimize downwash using CFD model preferably at reduced unit load operation and high wind speed conditions.
- n) Bidder to provide the drawings/documents for the necessary provisions in Chimney during the course of this study, if applicable, to carry out the performance test for wet stack at site in future.



TENDER NO : PSER:SCT:BAR-C1962-19	
TITLE:	SPEC. NO.: PE-TS-442-142-N102
TECHNICAL SPECIFICATION FOR	VOLUME: I
WET STACK FLOW MODEL STUDY	SECTION:
3X660 MW NTPC BARH STPP STAGE I (FGD	REV. NO. 00 DATE 17.01.2019
System Package)	SHEET 10 OF 12

Customer Specific Technical Requirements



TENDER NO :PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102
TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)		VOLUME: I
		SECTION:
		REV. NO. 00 DATE 17.01.2019
		SHEET 11 OF 12

2.05.00 GENERAL

- a) Bidder to furnish the detailed Master drawing list for wet stack flow model study for BHEL and customer approval.
- b) Bidder to provide technical advice/ recommendations/ assistance & solutions regarding site related construction problems related to condensate collection and drainage system in the duct and chimney as and when required including site visits, participation in meetings through VC/WEB with BHEL/ customer/ customer's consultant.
- c) The physical model study may be witnessed by BHEL / Plant Owner for approximately 3 days. Intimation for the witnessing shall be provided by the bidder 4 weeks prior to conductance of physical model test at vendor lab. Video streaming facility shall also be provided for witnessing the physical model test from India. In addition, complete physical model test including the flow patterns and droplets trajectory shall be recorded on video CD which shall be provided after the physical model study.
- d) The physical model shall be stored at the vendor lab at no cost for a period of 1 year after the submission of final report and completion of the study. Thereafter its further disposal or storage shall be decided after the award of the contract on the cost basis. Optional prices may be quoted for the same and this shall not be considered for the evaluation of bid.
- e) The bidder is advised to take care all information that may be necessary for preparing the bid and entering into the contract. Claims of any kind due to variation or ignorance of site conditions and environmental conditions after award of works will not be entertained.
- f) All revisions/changes required as per BHEL/ Project owners, comments/ requirements, site requirement etc. shall be carried out by the bidder.
- g) Three hard copies of approved reports/documents/drawings shall be submitted by the bidder. Electronic copies of the CFD model, analysis and report shall be submitted in primary original format as well as in printable non-proprietary formats (e.g. .pdf).



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO : PSER:SCT:BAR-C1962-19		SPEC. NO.: PE-TS-442-142-N102	
			VOLUME: I	
			SECTION:	
			REV. NO. 00	DATE 17.01.2019
			SHEET 12	OF 12

- h) Change in recommendation / design after the analysis shall be taken care by bidder without any commercial implication in this contract value.
- i) Bidder shall furnish detailed activity schedule, report generation schedule and list of inputs required for successful execution of Wet stack flow model study.
- j) The Purchaser/ Customer however also reserve the rights to check the detailed calculations in the event of order and their interpretation shall be final in the event of any conflict.
- k) Bidder shall furnish all the documents in English and SI units shall also be followed in the calculations and reports wherever used.

3.00.00 BID EVALUATION CRITERIA

PSER to include

4.00.00 DELIVERY SCHEDULE

PSER to Review.

5.00.00 SUGGESTIVE DRAWINGS/ DOCUMENTS SUBMISSION:

Following Basic drawings/documents to be submitted within 2 weeks from LOI date.

1. MASTER DRAWING /DOCUMENT LIST. (to be finalized after order)
2. WET STACK STUDY SCHEDULE, PLANNING AND MILESTONES
3. LIST OF CODES AND STANDARDS TO BE FOLLOWED.
4. DETAILED STANDARD PROCEDURE FOR PHYSICAL MODEL & CFD STUDY, DRAWINGS & DOCUMENTS SUBMISSION.
5. DESIGN DRAWINGS OF CONDENSATE COLLECTION AND DRAINAGE SYSTEM
6. THERMAL AND ADIABATIC CONDENSATION CALULATIONS WITH DESIGN BASIS

Following Basic drawings/documents to be submitted and duly approved within **12 weeks from LOI date. May be reviewed in view of project completion targets.**

1. TECHNICAL DATASHEETS
2. BILL OF QUANTITIES
3. WET STACK STUDY REPORT WITH RECOMMENDATIONS



TITLE: TECHNICAL SPECIFICATION FOR WET STACK FLOW MODEL STUDY 3X660 MW NTPC BARH STPP STAGE I (FGD System Package)	TENDER NO.: PSER:SCT:BAR-C1962-19	
	SPEC. NO.: PE-TS-442-142-N102	
	VOLUME: I	
	SECTION:	
	REV. NO. 00	DATE 17.01.2019
	SHEET 13	OF 12

4. CFD MODEL, ANALYSIS AND RESULTS

This is not an exhaustive list of drawings/ documents for WET STACK STUDY.

Bidder shall furnish all applicable drawings /documents other than as mentioned above which is/are required for successful execution of condensate collection and drainage system after the absorber outlet to stack outlet.

NOTE:

1. Subsequent revisions of above drgs/docs to be submitted within 7 days of comments received from BHEL/ CUSTOMER.
2. Drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays to bidder's account.

6.00.0 OTHER TERMS OF CONTRACT

The reports / design and drawings prepared by the bidder may be required to be revised / modified due to various reasons including site condition, engineering inputs, layout changes and CUSTOMER's requirement. The quoted rate shall be inclusive of additional effort to take care of such revisions.

7.00.00 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- a) Detailed procedure adopted for the conductance of the study.
- b) Wet stack study planning and scheduling.
- c) Computer program to be used for the 3D modelling and analysis.
- d) Mathematical tools & codes / programs used for the analytical calculations.
- e) Technical deviation schedule (if reqd.) (enclosed herein)

Apart from above no other drawings/documents/data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.

TENDER NO: PSER:SCT:BAR-C1962:19

VOLUME -III

PRICE SCHEDULE-REV-00

FOR

**APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS
FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER
THERMAL POWER PROJECT, STAGE-I,**

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVT. OF INDIA UNDERTAKING)

POWER SECTOR – EASTERN REGION

PLOT NO. – 9 / 1, DJ – BLOCK,

SECTOR – II, KARUNAMOYEE,

SALT LAKE CITY,

KOLKATA – 700091.

VOLUME-III PRICE SCHEDULE, REV-0	
NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARRH SUPER THERMAL POWER PROJECT, STAGE-I,	
TENDER NO - PSER:SCT:BAR:C-1962:19	
PREAMBLE	
1	This preamble forms part of tender document and schedule of items. The tenderer should read this preamble carefully before filling in rates for various items. Clauses under this preamble shall be read in conjunction with various volumes of tender and other tender sections as applicable and shall have precedence over any contrary statement mentioned anywhere in this document.
2	The work shall be carried out strictly as per specifications, description of the items in these schedule and / or engineer's instructions. Drawings enclosed with the tender are only preliminary and for tender purposes and giving some idea of the work involved. The work is to be executed as per drawings & documents, which shall be furnished during execution.
3	Items of work provided in this schedule but not covered in this specification shall be executed strictly as per instruction of the engineer.
4	Unless specifically mentioned otherwise in the tender document, the tenderer shall quote for the finished items and shall provide for the complete cost towards power, fuel, tools, tackles, equipment, constructional plants, temporary works, labour, dismantling of all temporary piping, structures, valves, pumps, tanks & other misc. equipment, strengthening of roads/culverts/bridges etc. including arranging all clearances etc. required for carrying out different activities & tests, materials, levies, transport, layout, repairs, rectification, maintenance till handing over, supervisions, colonies, shops, establishments, overheads, profits and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work according to the complete tender document and this schedule.
5	The quantities of the various items mentioned in this schedule of items are approximate, based on very preliminary information and may vary to any extent or be deleted altogether. The quoted rates of each item will remain firm throughout the period of execution including extension, for reasons whatsoever, as long as variation in the total value of work executed under any part of this contract including extra items, if any but excluding any price variation remains, within plus minus fifteen percent ($\pm 15\%$) of the awarded price as per LOI.
6	Prior written approval of BHEL shall be sought by the contractor in case quantity variation of any item crosses +50% (plus fifty percent) limit during execution, an approval to be obtained before execution of further quantity for this item.
7	In case Sealed /Paper Price Bids are opened for finalisation of the tender, for any Item Rate/BOQ based contract, possibility of variation of quantity/ addition/deletion of items can not be ruled out. Under such circumstances, after execution of work, if it is observed that standing as L-1 is changed based on actual quantity executed, the bidder shall give suitable rebate to maintain your standing as L-1. Since this aspect can be assessed at the end of execution, necessary adjustment will be effected at the end of execution in final bill. This condition shall not be applicable where the tender is finalised through Reverse Auction.
8	BHEL reserve the right to rationalize the rates, quoted by L-1 bidder against unit rate items and/ or other optional items with respect to item-wise lowest rates (amongst the participating bidders), before placement of order.
9	The rates quoted shall be inclusive of cleaning of site of any vegetation, dressing, clearing of old structures and leveling etc. including fixing of grid pillars, benchmarks etc. required for commencement of site activities. No separate payment will be made towards the same. However, if separate rate for such item is available in the rate schedule, the same shall be considered.
10	Rates shall be quoted in figures and in words in clear legible writing. No overwriting is allowed. All scoring and cancellations should be countersigned and in case of illegibility the interpretation of engineer shall be final. All entries shall be in English language.
11	All works item wise shall be measured upon completion and paid for at the rates quoted and accepted as per BHEL approved payment schedule/billing break-up.
12	The tender shall be deemed to have visited site and made himself aware of all the site conditions, studied the specifications and details of work to be done within the time schedule attached and to have acquainted himself of the conditions prevailing at site.
13	No splitting of the job is envisaged. Decision of BHEL in this regard shall be final and binding to the bidders.
14	Bidders are not allowed to alter the Price Schedule format including item description, quantity etc. and the offer is liable for rejection if the bidders submit their prices in Price Schedules modified by them. BHEL reserves the right to reject the offers of bidders who submit offers in Price Formats which are modified/altered by them. Also putting any comments instead of rates/price in the designated column of the rate schedule shall make the offer liable for rejection.

VOLUME-III PRICE SCHEDULE, REV-0	
NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARRH SUPER THERMAL POWER PROJECT, STAGE-I,	
TENDER NO - PSER:SCT:BAR:C-1962:19	
PREAMBLE	
15	Bidders to note that for Civil &/Structural packages, against a particular item against a ST No. appearing in more than one schedule of the BOQ, same rate must be quoted in all schedules for that particular items with same descriptions. If by error, different rates are quoted in different schedules for same ST No.(i.e. item with same description), then the higher of the rates shall be considered for evaluation but awarding shall be done with the lower rate, if the bidder becomes L-1."
16	For Lumpsum Service Contract : The items/components indicated in the tender is indicative and may vary to any extent. No compensation shall be payable in case of any variation in the items/components listed in the bill of quantities if the executed weight remains within the variation limit. However, in case of deletion of any item or addition of new items over and above the items listed or variation of existing quantity beyond variation limit specified, adjustment (i.e. Payment or recovery as the case may be) shall be done on pro-rata basis based on the Rate per MT worked out from the quoted lump-sum Price and the total weight of components listed /indicated in price schedule plus 15% weight variation limit.
17	Engineer's decision shall be final and binding on the contractor regarding clarification of items in the schedule with respect to the other sections/volumes of the contract.
18	In case of tender for Civil and/or Structural works, if the Non-schedule items are not quoted by the bidder, it will be treated at par with rate of corresponding item of CPWD/PWD/DSR schedule as prescribed in the tender/BOQ cum Rate Schedule.
19	No interest, whatsoever, shall be payable by BHEL on the security deposit, any bank guarantee submitted or any amount due to successful bidder/contractor.
20	Size and weights of various items are mentioned in the attached BOQ cum rate/price schedule for reference purpose only & these shall not be taken into consideration for quoting/calculating amount in the rate schedule. These shall be utilised as per relevant sections of tender. Bidders shall quote for each item in the rate column, taking unit as mentioned in the quantity column. Rates shall be filled in both figures and words. Amount shall be calculated based upon these rates multiplied by the mentioned quantity for the respective items.
21	Bidder's Total price shall be considered for evaluation unless stated otherwise.
22	In case of BOP packages, if Bidder does not quote/indicate the price for freight chages against indicated rate schedule, the same shall be considered as 2% of basic price and adjusted with the total quoted price against each item keeping the total quoted price unaltered.

VOLUME-III PRICE SCHEDULE, REV-0			
NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,			
TENDER NO - PSER:SCT:BAR-C1962:19			
SCH-1-TOTAL PRICE			
SL NO	DESCRIPTION	PRICE SCHEDULE REF	TOTAL QUOTED PRICE (IN INR)
1.0	TOTAL PRICE FOR APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I	SCH 2 - BREAK UP OF TOTAL PRICE	IN FIGURES:- IN WORDS:-
2.0	NON-SCHEDULE ITEM For items not covered in Schedule 2, quote % above / below or at per the CPWD Schedule of rates 2016		
a)	Rate of complete item	_____ % above / _____ % below _____ at per of CPWD Rate Schedule 2016	
b)	Rate of supply of material at site only	_____ % above / _____ % below _____ at per of CPWD Rate Schedule 2016	
c)	Rate for execution complete excluding supply of materials.	_____ % above / _____ % below _____ at per of CPWD Rate Schedule 2016	
NOTE			
1.0	Bidder shall quote total price for total price of SCH-1- Part only at sl no 1 above. All other amounts/ rates of each item of works in respective schedules/ parts will be derived based on allocated percentages. As such, any uncalled figure/ amount noted at any other place/ schedule of Volume-III will not be reckoned & will stand null & void.		
2.0	Bidder to note that total price at sl no 1.0 above shall be considered for evaluation & awarding. As such grand total price should be complete in all respect for the full scope defined and considering all terms and conditions.		
3.0	Bidder to note that SCH-2 is Break- up of Total Price.		
4.0	Bidder to note that SCH-3 covers Service of respective items, unless specified otherwise in the description of items.		
5.0	Bidder to note that SCH-4 covers Supply of respective items, unless specified otherwise in the description of items.		
6.0	Bidder's quoted total price at Sl. no 1 above respectively shall be apportioned into amount of various items of works based on allocated percentages against respective item, in respective schedules/ parts. As such, bidder shall not indicate/ quote any amount/ rate in these schedules/ parts and any amount/ rate quoted against any item shall not be taken into cognizance/ account and offer may be liable for rejection.		
7.0	Based on the itemwise percentage allocations, the amount for the individual items of the Bill of Quantity shall be arrived at. The rates of individual items shall be derived from the amount against each item after rounding off.		
8.0	Bidders to note that this is an item rate contract. Payment shall be made for the actual quantities of work executed at the unit rate arrived at as per Sl No.9 below.		
9.0	Unit rates of each item of works of respective schedules/ parts will be derived by dividing derived amount by corresponding quantities. In deriving the unit rates of each item in this manner, figures only upto 2 decimal places will be taken into account. Any adjustment, if required, due to such methodology, will be effected in final bill.		
10.0	Successful bidder shall draw a schedule of quantities of various items of work of SCH-4 and obtain BHEL's approval / clearance in writing before procurement, supply, etc.		
11.0	Any item as per scope of work, if not included in the price quoted above and shown separately will not be taken cognizance of and the offer shall be liable for rejection.		
12.0	Price format shall not be changed by bidder in any case and it may lead to cancellation of their offer.		
13.0	The quantity of items may vary during execution mainly due to actual requirement etc. The unit rates work out from the overall amount quoted & accepted by BHEL shall be considered and no separate unit rates shall be allowed. Unit rates shall be valid throughout the contract period.		
14.0	For payment of non schedule items, the rate shall be derived from CPWD Schedule of Rates 2016.		

VOLUME-III PRICE SCHEDULE, REV-0		
NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,		
TENDER NO - PSER:SCT:BAR:C-1962:19		
SCH-2 - TOTAL PRICE BREAK UP		
SL NO	DESCRIPTION	WEIGHTAGE
1.0	TOTAL PRICE OF SCH-3 - SERVICE.	0.796749230
2.0	TOTAL PRICE OF SCH-4 - SUPPLY	0.203250770
3.0	TOTAL	1.000000000

**VOLUME-III
PRICE SCHEDULE, REV-0**

**NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY
OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,**

TENDER NO - PSER:SCT:BAR:C-1962:19

SCH-3-SERVICE PRICE BREAK UP

SL No.	Description	Unit	Quantity	Weightage
B26	Installation of closed cell borosilicate glass block lining system at all elevations, in MS flue liner and RCC minishell, with minimum 38 mm thick borosilicate glass block, adhesive membrane having a minimum thickness of 3 mm and primer including blast cleaning of internal surface of existing steel flue liner to near white metal surface finish conforming to Sa 2 ½ finish as per ISO 8501-1, in supervision, and as directed by and satisfaction of borosilicate glass block manufacturer, testing, including getting approval of design / drawings and installation procedure from BHEL / NTPC etc all complete as per specification, drawings and as directed by the Engineer-in-charge, including cost of skilled labour, material, tools & tackles, equipments etc all complete. Installation of borosilicate lining system shall be done under controlled temperature and humidity conditions, as mentioned in specification, including providing all equipments required to create controlled temperature & humidity conditions inside chimney during installation, hot air blow cleaning of internal surface before application etc. all complete.	SqM	5950	0.732487390
26F	Fabricating and erecting C276 strips, plates, gutters/vanes/pipes, bends, fittings and any other appurtenances as required at all elevation in existing chimney for collection and withdrawal of condensate from inside of flue liner to outside based on the approved design in line with gas-flow-model study report, sealing, testing including surface preparation, TIG or any other type of specialised welding for C276 Strips etc all complete as per specification, drawing and as directed by the Engineer-in-charge. Measurement for payment shall be done for net weight of C276 strip only (weld thickness not to be considered).	Kg	1800	0.020834440
29A	Supplying, fabricating and installing gas sampling and gas ocapacity measurement ports made of C276 pipe in existing chimney liners, including bolts, non metallic gaskets, cover plates and any other accessories as required, painting, removing the existing sampling ports, modification in existing steel liner (if required) to suit the same, etc, all complete as per specification, drawing and as directed by the engineer-in-charge. Measurement for payment shall be done for net weight of C276 pipe, flange plate/cover plate etc.(weld thickness not to be considered)	kg	100	0.005350880
30AA	Fabricating and erecting titanium sheet (Grade 2 as per ASME B265) over chimney mini-shell including nuts, bolts, washers, screws and any other accessories as required for proper fixing, surface finishing, testing, preparation of detailed fabrication drawings etc all complete per specification, drawing and as directed by the Engineer in-charge.	MT	2	0.015145330
A32	Installation of expansion compensator joints, comprising of non-metallic material suitable for wet stack operations and acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as per specification and shall also prevent dust accumulation, including nuts, bolts, washers, screws and any other accessories as required, preparation of detailed fabrication drawings etc all complete as per specification, drawing and as directed by the Engineer-in-charge.	SqM	60	0.008327440
43	Providing, and fixing asbestos ropes at expansion joints at all elevation for packing/sealing etc all complete as per specification, drawing and as directed by the Engineer-in-charge for the following.			
b	12 mm diameter	Rm	300	0.001110600
47	Installation of resin bonded rock wool insulation having a density of not less than 100 kg/cu.m with an installed thickness of not less than 100 mm in two layers of each 50 mm thick including plated or galvanised accessories such as pins/studs/anchors/wire netting, speed washers, tying wires, etc, on the outer surface of steel flue liners/on the inside surface of concrete windshield/ inside surface of concrete minishells/ under the cast iron caps and wherever as required at all elevation, testing etc all complete as per specification, drawing and as directed by the Engineer-in-charge.	SqM	500	0.003317100
49	Supply and packing/sealing of rock wool insulation with loose rock wool having a density not less than 100 kg/cu.m between the insulated minishells at expansion joints/ between the lining segments and wherever as required at all levels including filling, ramming, testing, etc. all complete as per specification, drawing and as directed by the Engineer-in-charge.	Cum	10	0.002535520
50	Providing and painting with acid and heat resisting black bituminous paint conforming to type I(i) of IS:158 in not less than 4 coats having a DFT of not less than 150 microns over inside surface of chimney shell/inside and outside surfaces of minishells / underside of roof slab/ other concrete components / surfaces of the existing chimney and wherever as required etc at all elevation including surface preparation, primer etc so as to give a good finish all complete as per specification, drawing and as directed by the Engineer-in-charge.	SqM	100	0.000571490

**VOLUME-III
PRICE SCHEDULE, REV-0**

**NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY
OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,**

TENDER NO - PSER:SCT:BAR:C-1962:19

SCH-3-SERVICE PRICE BREAK UP

SL No.	Description	Unit	Quantity	Weightage
58	Providing and painting, with epoxy phenolic coating system in three coats having 220 microns DFT over the inside surface of chimney shell above roof / horizontal surface of shell at top / underside of concrete roof slab and wherever as required at all elevation including surface preparation, primer etc so as to give a good finish all complete as per drawing and specification. The coating system shall be as follows. All concrete surfaces shall be provided with two component transparent polyamide cured epoxy sealer coating (having solid by volume minimum 40% ±2%) of minimum 50 micron DFT to be applied over cleaned surface in multiple coats. Surface to be coated shall be absolutely dry, clean and dust free. Sealer coat shall be followed with the application of Intermediate coat of epoxy phenolic coating (solid by volume minimum 63%) of minimum 100 micron DFT. This coat shall be applied after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique. Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT. This coat shall be applied after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Engineer-in charge.	SqM	250	0.001428720
73	Erecting FRP Pipes with all bends, flanges, stiffeners, all other flue attachments, including support system, collars, connection with C276 pipes and any other accessories as required outside chimney flue liner at all elevation based on the approved design in line with gas-flow-model study report, including surface finishing, sealing, lamination, moulding, testing, guarantee/warranty etc. complete as per drawings, specification, manufacturer's recommendations and relevant codes.	Kg	490	0.000929280
74	Removing acid resistant brick lining on the inner surface of existing chimney mini-shell including stacking of removed materials at designated location as directed by the Engineer-in-charge.	SqM	250	0.004711040
TOTAL				0.796749230

VOLUME-III PRICE SCHEDULE, REV-0				
NAME OF JOB: APPLICATION OF BOROSILICATE GLASS BLOCK LINING SYSTEM INSIDE THE MS FLUE CAN OF EXISTING CHIMNEY OF FGD UNIT-1 AT 3x660 MW BARH SUPER THERMAL POWER PROJECT, STAGE-I,				
TENDER NO - PSER:SCT:BAR:C-1962:19				
SCH-4-SUPPLY PRICE BREAK UP				
SL No.	Description	Unit	Quantity	Weightage
26FS	Supplying C276 strips, plates, gutters / vanes / pipes, bends, fittings and any other appurtenances based on the approved design in line with gas-flow-model study report as per specification, drawing and as directed by the Engineer-in-charge. (Net quantity of C276 erected will be paid)	Kg	1800	0.083337350
30AA S	Supplying titanium sheet (Grade 2 as per ASME B265) for chimney mini-shell including nuts, bolts, washers, screws and any other accessories as required for proper fixing, preparation of detailed fabrication drawings etc all complete per specification, drawing and as directed by the Engineer-in-charge.(Net quantity of titanium erected will be paid)	MT	2	0.060581320
A32 S	Design, supply, fabrication of expansion compensator joints, comprising of non-metallic material suitable for wet stack operations and acid resistant to withstand acidic flue gas condensates arising out of flue gas parameters & operating conditions as per specification and shall also prevent dust accumulation, including nuts, bolts, washers, screws and any other accessories as required, preparation of detailed fabrication drawings etc all complete as per specification, drawing and as directed by the Engineer-in-charge. Design of expansion joint shall comply EPRI guideline to avoid contact of condensate with expansion joint material and to ensure drainage of condensate and the same shall be approved by BHEL/NTPC. (Net erected quantity will be paid)	SqM	60	0.033309750
33 S	Supply of fabricated ready to install expansion compensator in line with item no A32 as spare including nuts, bolts, washers, screws and any other accessories as required for successful installation.	SqM	15	0.009036810
47 S	Supply of resin bonded rock wool insulation having a density of not less than 100 kg/cu.m with an installed thickness of not less than 100 mm in two layers of each 50 mm thick including plated or galvanised accessories such as pins / studs / anchors / wire netting, speed washers, tying wires, etc. testing etc all complete as per specification, drawing and as directed by the Engineer-in-charge. (Net erected quantity will be paid)	SqM	500	0.013268300
73 S	Supplying and fabricating FRP Pipes with all bends, flanges, stiffeners, all other flue attachments, including support system, collars, connection with C276 pipes and any other accessories as required outside chimney flue liner on the approved design in line with gas-flow-model study report, including surface finishing, sealing, lamination, moulding, testing, guarantee / warranty etc. complete as per drawings, specification, manufacturer's recommendations and relevant codes. (Net erected quantity will be paid)	Kg	490	0.003717240
TOTAL				0.203250770