

TENDER SPECIFICATION

TENDER NO. BHEL/ NR/SCT/GADARWARA / BUNKER/PACKAGE-A&B/993

FOR

"Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Transfer Points, Trestles and Conveyor Galleries and Misc. Civil Works for Unit # 1& Unit # 2 at 2X800 MW NTPC Gadawara Super Thermal Power Station"

PART I – TECHNICAL BID



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



ISO 9001, ISO 14001,
OHSAS 18001 & SA 8000
certified company
SubContract and Purchase Deptt.

Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)
Power Sector – Northern Region,
Plot No. 25 , Sector - 16A ,
Distt. Gautam Budh Nagar, NOIDA – 201 301(INDIA)
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TENDER NO. BHEL/ NR/SCT/GADARWARA / BUNKER/PACKAGE-A&B/993

IMPORTANT NOTE

PURCHASER OF THIS TENDER DOCUMENT IS ADVISED TO CHECK AND ENSURE COMPLETION OF ALL PAGES OF TENDER DOCUMENT AND REPORT ANY DISCREPANCY TIMELY FOR CORRECTIVE ACTION, IF ANY, TO THE ISSUING AUTHORITY BEFORE THE BIDS ARE SUBMITTED. ORIGINAL COPY OF TENDER DOCUMENT COMPLETE IN ALL RESPECTS MUST BE SUBMITTED BACK AS PART OF THE BID WITHOUT WHICH THE SAME IS LIABLE TO BE REJECTED BY BHEL.

THIS TENDER SPECIFICATION ISSUED TO:

M/S-----

Rev 01
1st Jun
2012

NOTICE INVITING TENDER

(Document No PS:MSX:NIT)

Bharat Heavy Electricals Limited



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NOTICE INVITING TENDER (NIT)

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

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To

Dear Sir/Madam

Sub : NOTICE INVITING TENDER

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

1.0 Salient Features of NIT

SL NO	ISSUE	DESCRIPTION
i	TENDER NUMBER	BHEL/ NR/SCT/GADARWARA / BUNKER/PACKAGE-A&B/993
ii	Broad Scope of job	“Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Transfer Points, Trestles and Conveyor Galleries and Misc. Civil Works for Unit # 1&Unit # 2 at 2X800 MW NTPC Gadawara Super Thermal Power Station. ”
iii	DETAILS OF TENDER DOCUMENT	
a	Volume-IA	<i>Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc</i> Applicable
b	Volume-IB	<i>Special Conditions of Contract (SCC)</i> Applicable
c	Volume-IC	<i>General Conditions of Contract (GCC)</i> Applicable
d	Volume-ID	<i>Forms and Procedures</i> Applicable
e	Volume-II	<i>Price Schedule (Absolute value).</i> Applicable
iv	Issue of Tender Documents	1. <u>Sale from BHEL PS Regional office at :</u> Start : 15/04/15 , Time : 0900 HRS Closes:06/05/15 , Time :1200 HRS 2. From BHEL website (www.bhel.com) Tender documents will be available for downloading from website till due date of submission Applicable
v	DUE DATE & TIME OF OFFER SUBMISSION	Date : 06/05/15, Time : 1500 HRS Place : Noida Applicable
vi	OPENING OF TENDER	Date : 06/05/15 <i>(Within 2 hours of the latest due date and time of</i> Applicable

		offer submission). Notes: (1) In case the due date of opening of tender becomes a non-working day, then the due date & time of offer submission and opening of tenders get extended to the next working day. (2) Bidder may depute representative to witness the opening of tender	
vii	EMD AMOUNT	Rs 2,00,000/-	Applicable
viii	COST OF TENDER	Rs 2000/-.	Applicable
ix	LAST DATE FOR SEEKING CLARIFICATION	Date: 27/04/15 Along with soft version also, addressing to undersigned & to others as per contact address given below	Applicable
x	SCHEDULE OF Pre Bid Discussion (PBD)		Not applicable.
xi	INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)	Shri V.V.R. Sastry, Ex-CMD/BEL 957, 9th Main, 3 Stage, 3 Block□□□□ Basaveswaranagar Bangalore- 560079□□	Applicable.
xii	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com -->Tender Notifications →View Corrigendums) and not in the newspapers . Bidders to keep themselves updated with all such information	

- 2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly signed & stamped on each page, as part of offer. **Rates/Price including discounts/rebates, if any, mentioned anywhere/in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.**
- 3.0 Unless specifically stated otherwise, bidder shall remit cost of tender and courier charges if applicable, in the form of Demand Draft drawn in favour of Bharat Heavy Electricals Ltd, payable at Power Sector Regional HQ at Noida issuing the Tender, along with techno-commercial offer. Bidder may also choose to deposit the Tender document cost by cash at the Cash Office as stated above against sl no iv of 1, on any working day; and in such case copy of Cash receipt is to be enclosed with the Techno Commercial offer. Sale of tender Documents shall not take place on National Holidays, holidays declared by Central or State Governments and BHEL PS HQ at Noida, Sundays and second/ last Saturdays
- 4.0 Unless specifically stated otherwise, bidder shall deposit EMD through Demand Draft/Pay Order in favour of Bharat Heavy Electricals Ltd, payable at Noida. For other details and for 'One Time EMD' please refer General Conditions of Contract.
- 5.0 **Procedure for Submission of Tenders:** The Tenderers must submit their Tenders to Officer inviting Tender, as detailed below:
- PART-I consisting of 'PART-I A (Techno Commercial Bid)' & 'PART-I B (EMD/COST of TENDER)' in two separate sealed and superscribed envelopes (ENVELOPE-I & ENVELOPE-II)
 - PART-II (Price Bid) – in sealed and superscribed envelope (ENVELOPE-III)
 - One set of tender documents shall be retained by the bidder for their reference

- 6.0 The contents for ENVELOPES and the superscription for each sealed cover/Envelope are as given below.
(All pages to be signed and stamped)

Sl no	Description	Remarks
	Part-I A	
	ENVELOPE – I superscribed as : PART-I (TECHNO COMMERCIAL BID) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: CONTAINING THE FOLLOWING:-	
i.	Covering letter/Offer forwarding letter of Tenderer.	
ii.	Duly filled-in 'No Deviation Certificate' as per prescribed format to be placed after document under sl no (i) above. Note: - In case of any deviation, the same should be submitted separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be placed after document under sl no (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. - BHEL reserves the right to accept/reject the deviations without assigning any reasons, and BHEL decision is final and binding. - In case of acceptance of the deviations, appropriate loading shall be done by BHEL - In case of unacceptable deviations, BHEL reserves the right to reject the tender	
iii.	Supporting documents/ annexure/ schedules/ drawing etc as required in line with Pre-Qualification criteria. It shall be specifically noted that all documents as per above shall be indexed properly and credential certificates issued by clients shall distinctly bear the name of organization, contact ph no, FAX no, etc.	
iv.	All Amendments/Correspondences/Corrigenda/Clarifications/Changes/ Errata etc pertinent to this NIT.	
v.	Integrity Pact Agreement (Duly signed by the authorized signatory)	If applicable
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification/NIT	
vii.	Notice inviting Tender (NIT)	
viii.	Volume – I A : <u>Technical</u> Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	
ix.	Volume – I B : Special Conditions of Contract (SCC)	
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	
xiii.	Any other details preferred by bidder with proper indexing.	

	PART-I B	
	ENVELOPE – II superscribed as:	

	PART-I (EMD/COST of TENDER) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: CONTAINING THE FOLLOWING:-	
i.	1. Earnest Money Deposit (EMD) in the form as indicated in this Tender <u>OR</u> Documentary evidence for 'One Time EMD' with the Power Sector Region of BHEL floating the Tender 2. Cost of Tender (Demand Draft or copy of Cash Receipt as the case may be)	

	PART-II	
	PRICE BID consisting of the following shall be enclosed	
	ENVELOPE-III superscribed as: PART-II (PRICE BID) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: CONTAINING THE FOLLOWING	
i	Covering letter/Offer forwarding letter of Tenderer enclosed in Part-I	
ii	Volume II – PRICE BID (Duly Filled in Schedule of Rates – rate/price to be entered in words as well as figures)	

	OUTER COVER	
	ENVELOPE-IV (MAIN ENVELOPE / OUTER ENVELOPE) superscribed as: TECHNO-COMMERCIAL BID, PRICE BID & EMD TENDER NO: NAME OF WORK: PROJECT: DUE DATE OF SUBMISSION: CONTAINING THE FOLLOWING:	
i	○ Envelopes I ○ Envelopes II ○ Envelopes III	

SPECIAL NOTE: All documents/ annexures submitted with the offer shall be properly annexed and placed in respective places of the offer as per enclosure list mentioned in the covering letter. BHEL shall not be responsible for any missing documents.

- 7.0 Deviation with respect to tender clauses and additional clauses/suggestions in Techno-commercial bid / Price bid shall NOT be considered by BHEL. Bidders are requested to positively comply with the same.

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

9.0 **Assessment of Capacity of Bidders:**

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

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

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

i). Total number of Packages

Total number of Packages in hand = P

Where

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

- II. **PERFORMANCE:** Here 'Monthly Performance' of the bidder for all the packages (**under execution/** executed during the 'Period of Assessment' in all the Power Sector Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced shall be taken into consideration. The 'Period of Assessment' shall be 6 months preceding the cut off month. The cut off month for reckoning 'Period of Assessment' shall be the month two (2) months preceding the month corresponding to the 'latest date of bid submission', in the following manner:

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

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

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

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

- d) Overall Performance Rating ' R_{BHEL} ' for the similar Package/Packages (under execution/ executed during the 'Period of Assessment') in all the Power Sector Regions of BHEL):

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

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

- e) Bidders to note that the risk of non evaluation or non availability of the 'Monthly Performance Evaluation' reports as per relevant formats is to be borne by the Bidder

- f) Table showing methodology for calculating 'a', 'b' and 'c' above

Sl no	Item Description	Details for all Regions							Total
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
1	Similar Packages for all Regions → (under execution/ executed during period of assessment)	P_1	P_2	P_3	P_4	P_5	...	P_N	Total No of similar packages for all Regions = P_T ie Sum (Σ) of columns (iii) to (ix)
2	Number of Months for which 'Monthly Performance Evaluation' as per relevant formats should have been done in the 'period of assessment for corresponding similar Package (as in row 1)	T_1	T_2	T_3	T_4	T_5	...	T_N	Sum (Σ) of columns (iii) to (ix) = 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 'similar Package/Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment':

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

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

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

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

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

III. **'Assessment of Capacity of Bidder':**

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

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

Note:

- In case the value of P_{Max} results in a fraction, the value of P_{Max} is to be rounded off to next whole number
- For $R_{BHEL} = 60$, $P_{Max} = '1'$
- For $R_{BHEL} \geq 80$, there will be no upper limit on P_{Max}

The Bidder shall be considered 'Qualified' as per 'Assessment of Capacity of Bidder' for the subject

Tender if $P \leq P_{Max}$

(where P is calculated as per clause 9.I)

IV. **Explanatory note:**

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

Table-1

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

			xi). Material Handling & Material Management xii). Others (Mechanical)
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- c) Bidders who have not been evaluated for at least six package months in the last 36 months in the online BHEL system for contractor performance evaluation in BHEL PS Regions, wef July'2010 shall be considered "NEW VENDOR".

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

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

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

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

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

- d) In the unlikely event of all bidders shortlisted against Technical and Financial Qualification criteria not meeting the criteria on 'Assessment of Capacity of Bidders' detailed above, OR leads to a single tender response on applying the criteria of 'Assessment of Capacity of Bidders' or due to non-approval by Customer, then BHEL at its discretion reserves the right to consider the further processing of the Tender based on the **Overall Performance Rating 'R_{BHEL}'** only, starting from the upper band.
- e) 'Under execution' shall mean works in progress as per the following:
- i. up to Boiler Steam Blowing in case of Steam Generator and Auxiliaries
 - ii. upto Synchronisation in case of all other works excepting sl no (i) and (iii)
 - iii. Upto execution of at least 90% of anticipated contract value in case of Civil & Structures (unit wise), Enabling works and upto 90% of material unloading (in tonnage) as per the original contract in case of MM Package.
- Note : BHEL at its discretion can extend (or reduce in exceptional cases in line with Contract conditions) the period defined against (i), (ii) and (iii) above, depending upon the balance scope of work to be completed.
- f) Performance evaluation in CL 9 above is applicable to Prime bidder and consortium partner (or Technical tie up partner) for their respective scope of work.

10.0 Since the job shall be executed at site, bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.

11.0 For any clarification on the tender document, the bidder may seek the same in writing or through e-mail, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any

other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.

- 12.0 BHEL may decide holding of pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.
- 13.0 In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail.
- 14.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.
- 15.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), **if applicable**, along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. **The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (1) above.**
- 16.0 The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the Pre Qualification Criteria specified in this NIT as per Annexure-I (as applicable), past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right not to consider offers of parties under HOLD.
- 17.0 In case BHEL decides on a 'Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful/Disqualified bidders under intimation to the respective bidders.
- 18.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise.
- 19.0 BHEL reserves the right to decide the successful bidder on the basis of Reverse Auction process. In such case all qualified bidders will be intimated regarding procedure/ modality for Reverse Auction process prior to Reverse Auction and price will be decided as per the rules for Reverse Auction. .
- However, if reverse auction process is unsuccessful as defined in the RA rules/procedures, or for whatsoever reason, then the sealed 'PRICE BIDS' will be opened for deciding the successful bidder. BHEL's decision in this regard will be final and binding on bidder.
- 20.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.
- 21.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.
- 22.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.
- 23.0 **Not used**
- 24.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements' duly self certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.

- 25.0 The bidder may have to produce original document for verification if so decided by BHEL.
- 26.0 The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.
- 27.0 BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit „online sealed bid“ in the Reverse Auction. Non-submission of „online sealed bid“ by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.”

Information and General Terms and Conditions governing RA shall form part of the RFQ/ Enquiry.

- 28.0 It may please be noted that **guidelines/rules** in respect of Suspension of Business dealings', 'Vendor evaluation format', 'Quality, Safety & HSE guidelines', etc may undergo change from time to time and the latest one shall be followed. The abridge version of extant 'Guidelines for suspension of business dealings with suppliers/ contractors' is available on www.bhel.com on “**supplier registration page**”.
- 29.0 **Micro and Small Enterprises (MSE)**
Any Bidder falling under MSE 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 MSE	SC/ST owned	Others
Micro		
Small		

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

MSE suppliers can avail the intended benefits only if they submit along with the offer, or before price bid opening, attested copies of either EM-II certificate having deemed validity (two years from the date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM-II certificate along with CA certificate (format enclosed as Annexure - 3) applicable for the year, certifying quantum of investment in plant and machinery within the permissible limit as per the act for relevant status (Micro or Small) where the deemed validity of EM-II is over. Date to be reckoned for determining the deemed validity will be last date of technical bid submission. Non submission of such documents will lead to consideration of their bids at par with other bidders and MSE status of such suppliers shall be shifted to Non MSE supplier till the supplier submits these documents.

MSEs shall be exempted from payment of earnest money at the time of tender deposit. However, there is no exemption of security deposit submission

No benefits shall be applicable for that particular enquiry if the required documents are not submitted before price bid opening.

30.0 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
- Technical Conditions of Contract (TCC)—Volume-1A
- Special Conditions of Contract (SCC) —Volume-1B

- f. General Conditions of Contract (GCC) —Volume-1C
- g. Forms and Procedures —Volume-1D

for BHARAT HEAVY ELECTRICALS LTD

(SCT)

Enclosure

- 01. Annexure-1: Pre Qualifying criteria.
- 02. Annexure-2: Check List.
- 03. Annexure-3: Chartered Accountant certificate for MSMED
- 04. Annexure-4: GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION (RA)
- 05. Annexure-5: Authorization of representative who will participate in the online Reverse Auction Process
- 06. Annexure-6: Integrity Pact
- 07. Other Tender documents as per this NIT.

ANNEXURE - 1**PRE QUALIFYING REQUIREMENTS**

JOB	"Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Transfer Points, Trestles and Conveyor Galleries and Misc. Civil Works for Unit # 1& Unit # 2 at 2X800 MW NTPC Gadawara Super Thermal Power Station".
TENDER NO	BHEL/ NR/SCT/GADARWARA / BUNKER/PACKAGE-A&B/993

SL NO	PRE QUALIFICATION CRITERIA	Bidders claim in respect of fulfilling the PQR Criteria
A	Submission of Integrity Pact duly signed	Applicable
B	Assessment of Capacity of Bidder to execute the work as per sl. no. 9 of NIT	Applicable
C	<u>Technical</u>	Applicable
C1	Bidder who wish to participate should have Executed, during last seven years ending last day of month previous to the one in which applications are invited: One Work of Bunker Structure of one unit of above 400 MW or higher. OR One job of PF Boiler of above 400 MW or higher.	
C2	AND Bidder who wish to participate should have executed, during last seven years ending last day of month previous to the one in which applications are invited, Similar Work as covered in this tender as per the following: One single work of valuing Rs. 1744 Lacs or above. OR Two works of valuing each of Rs. 1090 Lacs or above. OR Three works of valuing each of Rs. 872 Lacs or above..	
D	<u>Financial</u>	Applicable
D-1	<u>TURNOVER:</u> Bidders must have achieved an average annual financial turnover (Audited) of Rs. 654 Lakhs or more over last three Financial Years (FY) i.e. 2011-2012, 2012-2013, 2013-2014.	
D-2	<u>Net worth:</u> Net worth of the Bidder based on the latest Audited Accounts as furnished for 'D-1' above should be positive.	
D-3	<u>Profit:</u> Bidder should have earned cash profit in any one of the three financial years as applicable in the last three financial years defined in 'D-1' above based on latest audited accounts. (Relevant documents, meeting above requirements at C & D, shall be submitted by bidders.)	
E	Approval of Customer	Applicable
F	Consortium criteria	Not Applicable

Explanatory Notes for QR 'C'

- For QR 'C' above the word 'Executed' means the bidder should have achieved the Technical Criteria, specified in the QR (as in 'C' above), even if the total contract has not been completed or closed.
- 'Executed' means "Readiness for Coal Filling" in respect of Bunker Structure Work.
- 'Executed' means "Boiler Light Up" in respect of Boiler & Aux and ESP.

(The Bidder shall submit the work completion certificate issued by Customer / Contractor.)

- Boiler means Pulverized Fuel (PF) Boiler.
- For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5 TPH where ever rating of HRSG / BOILER is not mentioned in MW.
- For QR 'C' value of work is to be updated as per the PVC formula of GCC with Indices for "All India Avg. Consumer Price Index for Industrial Workers" with base month as date of execution and indexed up to two months prior to the bid opening month. This condition will be applicable only for the completed jobs and not for the jobs in progress as on date of technical bid opening.
- If the Qualifying work is executed in the last seven years period, as specified above, even if it has been started earlier, the same will also be considered meeting the qualifying requirements.
- "Similar Work" means: Erection Work of "Bunker Structure" / "Boiler" for a Power Project of 400 MW or higher.

ANNEXURE - 2**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

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

DATE :

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

ANNEXURE - 3**Certificate by Chartered Accountant on letter head**

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

Further verified from the Books of Accounts that the investment of the company
as on date..... 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

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.

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant

ANNEXURE - 4**GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION (RA)**

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

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.
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 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” like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.
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, 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(s) bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

ANNEXURE - 5**Authorization of representative who will participate in the on line Reverse Auction Process;**

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

INTEGRITY PACT

Between

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

and

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

Preamble

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

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

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

Section 1 – Commitments of the Principal

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

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

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

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

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

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

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved

in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

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

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

Section 4 – Compensation for Damages

- 4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

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

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

- 6.1 The Bidder(s)/ Contractor(s) undertake(s) to obtain from all subcontractors a commitment consistent with this Integrity Pact and report Compliance to the Principal. This commitment shall be taken only from those sub-contractors whose contract value is more than 20 % of Bidder's/ Contractor's contract value with the Principal. The Bidder(s)/ Contractor(s) shall continue to remain responsible for any default by his Sub-contractor(s).
- 6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.
- 6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

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

Section 8 –Independent External Monitor(s)

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.
- 8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.
- 8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.
- 8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.
- 8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.
- 8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the

Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins and shall be binding on and from the submission of bid(s) by bidder(s). It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 – Other Provisions

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

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

For & On behalf of the Principal

(Office Seal)

For & On behalf of the Bidder/ Contractor

(Office Seal)

Place-----

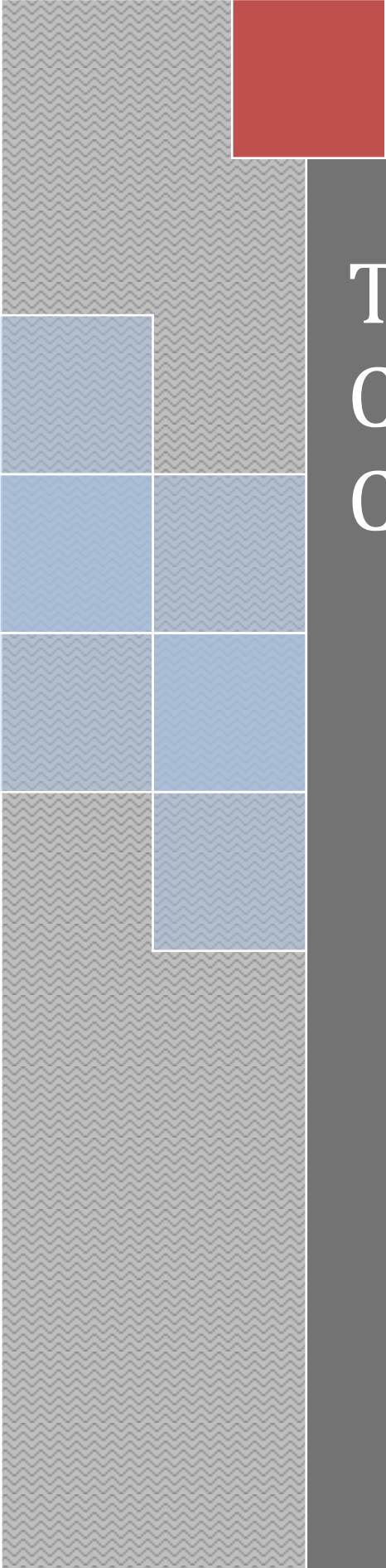
Date-----

Witness: _____

(Name & Address) _____

Witness: _____

(Name & Address) _____



TECHNICAL CONDITIONS OF CONTRACT (TCC)



TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-II: SCOPE OF WORKS

Sl. No.	DESCRIPTION	Chapter	PAGE No.
Volume-IA	Contract specific details		
1	PROJECT INFORMATION	Chapter-I	4
2	SCOPE OF WORKS	Chapter-II	5-16
3	FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)	Chapter-III	17-31
4	T&Ps AND MMDs TO BE DEPLOYED BY CONTRACTOR	Chapter-IV	32-35
5	T&Ps AND MMDs TO BE DEPLOYED BY BHEL ON SHARING BASIS	Chapter-V	36
6	TIME SCHEDULE	Chapter-VI	37-38
7	TERMS OF PAYMENT	Chapter-VII	39-42
8	TAXES AND OTHER DUTIES	Chapter-VIII	43-46
9	WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT	Chapter-IX	47-49
10	PRESERVATION AND PROTECTION OF COMPONENTS	Chapter-X	50
11	OTHER IMPORTANT CONDITIONS	Chapter-XI	51-62
12	BOQ CUM RATE SCHEDULE	Chapter-XII	63

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-II: SCOPE OF WORKS

Volume-II B	TECHNICAL SPECIFICATIONS		
	Section - Title	Specification no.	Rev. No.
13	SECTION C: TECHNICAL REQUIREMENTS FOR CIVIL STRUCTURAL & ARCHITECTURAL WORKS FOR 2X800 MW, NTPC GADARWARA (STAGE-I) SUPER THERMAL POWER PROJECT	PE-TS-392-600-C001	00
14	SECTION – D SUB- SECTION – D5: Metal doors, windows, ventilators, louvers etc	PE-TS-392-600-C005	00
15	SECTION – D SUB- SECTION – D6: Glass and glazing	PE-TS-392-600-C006	00
16	SECTION – D SUB- SECTION – D7: Rolling steel shutters & grills	PE-TS-392-600-C007	00
17	SECTION – D SUB- SECTION – D8: Miscellaneous metals	PE-TS-392-600-C008	00
18	SECTION – D SUB- SECTION – D11: Painting, white washing, polishing	PE-TS-392-600-C011	00
19	SECTION – D SUB- SECTION – D13: Sheet work in roof & siding	PE-TS-392-600-C013	00
20	SECTION – D SUB- SECTION – D15: Drainage & sanitation	PE-TS-392-600-C015	00
21	SECTION – D SUB- SECTION – D17: Fabrication of structural steel work	PE-TS-392-600-C017	00
22	SECTION – D SUB-SECTION - D18: Erection of structural steel work	PE-TS-392-600-C018	00

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-I: PROJECT INFORMATION

Sl. No.	Title	Description
1.1	Name of the Owner	NATIONAL THERMAL POWER CORPORATION LTD. (NTPC)
1.2	Address	Gadarwara Thermal Power Station, near Chichli & Umaraiya villages, Tehsil – Gadarwara, District– Narsinghpur Madhya Pradesh, Pin- 487551
1.3	New Installation	2 x 800 MW
1.4	Nearest Railway station	Gadarwara Railway Station
1.5	Nearest Road	Gadarwara is located on the MP SH 22
1.6	Nearest City	Jabalpur- 140 Kms from Gadarwara
1.7	Nearest Airport	Nearest Airport is Dumna Airport, Jabalpur-129 KM and Raja Bhoj Airport, Bhopal -209 KM
1.8	Highest Temperature	45 deg C
1.9	Lowest Temperature	1 deg C
1.10	Elevation	354.77 metres

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-II: SCOPE OF WORKS

2.0	GENERAL SCOPE OF WORK
2.1	BHEL has been awarded the work of Design, Engineering, Supply, Erection, Testing, Commissioning & Handing Over BTG Package and Mill bay Structures & Bunkers of 2X800 MW Super Critical Thermal Power Plant at Gadarwara, M.P. by National Thermal Power Corporation (NTPC). Scope of this tender covers the work of "Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its supporting Trestles of Bunker Structures, Miscellaneous Platform Structures and Other Miscellaneous Civil Works including supplying materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. and Misc. Fabrication works for Unit # 1 & Unit # 2 at 2X800 MW NTPC Gadarwara Super Thermal Power Station." The work involves Structural Fabrication & Erection Works / Construction Works including supply of all materials except materials specifically mentioned to be provided by BHEL as Free of Cost (FOC), all finishing materials, consumables (inclusive of loading, unloading), complete for all buildings, equipment and facilities, providing all construction equipment, tools & plants, labour, transportation and storage, sample testing etc. all complete. However, there will be two separate packages for the two units, as follows: 1. Package-A -- Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its supporting Trestles of Bunker Structures, Miscellaneous Platform Structures and Other Miscellaneous Civil Works including supplying materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-II: SCOPE OF WORKS

	Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. and Misc. Fabrication works for Unit No. 1 at 2X800 MW NTPC Gadawara Super Thermal Power Station. 2. Package-B -- Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its supporting Trestles of Bunker Structures, Miscellaneous Platform Structures and Other Miscellaneous Civil Works including supplying materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. and Misc. Fabrication Works for Unit No. 2 at 2X800 MW NTPC Gadawara Super Thermal Power Station. The above two packages shall be awarded to two separate contractors as per NIT.
Note:	The Scope of Work in each package (Package A & B) is split into following two Parts and Separate Order shall be issued for Supply Part and E&C Part.
2.1.1	<u>SECTION A: Supply Part</u>
2.1.1.1	<u>Scope of Work for Supply Part:</u> Supply of Materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. for Bunker Structures, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures, Miscellaneous Platform Structures, Other Miscellaneous Civil Works including procurement of Raw Material, loading, transportation and handling etc. & receipt of the same at site all complete as per specifications, drawings and as directed by BHEL Engineer for Unit # 1 & Unit#2 of 2X800 MW NTPC GADARWARA STPP.

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2.1.1.2	Note: - Materials will be supplied by the contractor as per BOQ cum rate Schedule (Section A: Supply Part) for which separate order shall be issued. Price for supply items as per BOQ cum rate Schedule (Section A: Supply Part) shall remain firm throughout the contract period / extended period (if any) i.e. Price Variation Compensation (PVC) clause mentioned in clause 2.17 of General Conditions of Contract and the Over-run Compensation (ORC) mentioned in clause 2.12 of General Conditions of Contract shall not be applicable for separate order of Supply Part.
2.1.2	<u>Section B: E&C Part</u>
2.1.2.1	<u>Scope of Work for E&C Job:</u> Receipt, loading, transportation, unloading, preservation and handling at site etc. of finished materials of Bunker Structures, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures supplied by BHEL units, raw materials supplied by BHEL from BHEL stores / yard and materials supplied by the contractor. Pre assembly, Erection, Alignment, Bolting/ Welding/ Fastening, Grouting, Testing, Painting and Handing Over of Bunker Structures, Raw coal bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures, Miscellaneous Platform Structures including Miscellaneous Civil Works etc. at site all complete as per Specifications, Drawings and as directed by BHEL Engineer for Unit # 1 & Unit # 2 of 2X800 MW NTPC GADARWARA STPP.
2.2	<u>SCOPE OF WORK:</u> The work to be carried out under the scope of this contract is broadly as under: 1. Collection of materials from BHEL store/yards/other designated places and transportation to erection site/ floor, their preservation, safe keeping, watch and ward. 2. Supplying, except BHEL supplied Free of Cost (FOC) materials, including transportation, transit insurance, loading, unloading, receipt and storage at site. 3. Fabrication, Erection, Alignment, Welding, Bolting, Fastening, Grouting, Painting etc. as applicable.

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	4. Arrangement for fixing of Level Monitoring System and other C&I/Electrical items in raw coal bunkers as directed by BHEL Engineer. 5. Destructive, non-destructive and any other tests as per requirement. 6. Completion of facility and handing over. 7. BHEL supplied FOC items are:- i) Vibration Isolation Springs (Item no. B 703) ii) Raw material for Structure Steel Fabrication (Item no. B 2301) iii) Fabricated Structure Steel for Bunker, TPs & Conveyor Galleries etc. (Item no. B2302 & B2303) iv) M.S. Seal Plates 12 gauge thick (Item no. B 2304). v) Stainless Steel Liner 4 mm thick (Item No. B 2314).
2.2.1	Technical Specifications: The technical requirements for work to be executed under this contract shall be as per Specifications No PE-TS-392-600-C001A (Section C) & PE-TS-392-600- C005 to C008, C011, C013, C015, C017, C018 (Section D), enclosed at Volume- IIB with this tender document. In case of any discrepancy / omission, relevant IS codes shall be followed. Section C will prevail over Section D.
2.2.2	The Customer (NTPC) may depute their representative for checking and supervision of important stages of work. The contractor shall be required to provide all facilities for inspection of works at no extra cost to BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the contractor in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.
2.2.3	Any activity which is necessarily required for satisfactory execution of any item of BOQ in line with technical specifications shall be deemed to be included in BOQ item even if it is not described in the item description and no extra payment shall be made against such activity.
2.2.4	The work under this contract shall be carried out as per BOQ Cum Rate Schedule. In case the description / specifications as per BOQ are found to be incomplete, Indian Standard Codes (IS Codes) specifications shall be followed. Quantities mentioned in the BOQ cum Rate Schedules, are approximate only and liable for variation due to change of scope of work / variation in schedule of quantities, changes in design etc. The tenderers shall undertake to execute actual quantities as per advice of BHEL

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	Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually executed at site and payments will also be regulated for the same.
2.2.5	The complete works shall be carried out as per BOQ cum Rate schedule. If any work covered in the scope of contract cannot be executed using items available in BOQ, additional / extra items shall be made and rates for such items shall be worked out as per GCC clause 2.15.7 . However contractor shall be bound to execute all the works under the scope of the contract and decision whether an extra item is applicable or not, shall be taken by BHEL Engineer which will be binding on the contractor.
2.2.6	The scope of work includes but not limited to the following:
2.2.6.1	Furnishing all labour, materials (except those specified in BHEL scope), supervision, construction plans, equipment, supplies, transport to and from the site, fuel, electricity, compressed air, water, transit and storage insurance and all other incidental items and temporary works not shown on specified but reasonably implied or necessary for the proper completion, maintenance and handing over the works, in accordance with the stipulations and/or specifications laid down in the contract documents and additional stipulations as may be provided by the BHEL Engineer during the course of works.
2.2.6.2	Furnishing samples of all materials required by the BHEL Engineers for testing / inspection and approval, for use in the works. The samples may be retained by the BHEL Engineer for final incorporation in the works.
2.2.6.3	Furnishing test reports for the products used or intended to be used, if called for the specifications or if so desired by the BHEL Engineer.
2.2.6.4	Giving all notices, paying all fees, taxes etc., in accordance with the General conditions of contract that is required for all works including temporary works.
2.2.6.5	Arranging manufacturer's supervision for items of work done as per manufacturer's specifications when so specified.
2.2.6.6	Carrying out survey of the work area to establish levels and coordinates at suitable intervals from existing grid levels and coordinates furnished by the owner established bench marks, setting out the locations and levels of proposed structures, constructions and marking of reference pillars and other identification works etc. as

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	required, The contractor shall provide the owner/BHEL such assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used.
2.2.6.7	Resolving any deficiencies observed during unit trial operation of equipment, systems, of 800 MW Unit (s) as a whole, and handing over of Unit No. 1 (Package A) and Unit No.2 (Package B) of 2X800 MW, NTPC GADARWARA STPP at Narsinghpur, M.P.
2.2.7	<u>Volume II B:</u> The documents mentioned in Index Sl. No. 13 to 22 (Technical Specifications) are attached as reference documents and form an integral part of TCC. Section C shall prevail over Section D.
2.2.7.1	Contractors shall take note of and account for the contents of above document's while submitting their offer. These documents are for reference purpose only and in case of any ambiguity, this Volume- IA (Contract Specific Details) / Approved drawing / BHEL Engineer instruction shall prevail over these reference documents.
2.2.7.2	Specific attention is drawn to the clauses and sub-clauses. For e.g. serial number 6.00.00 entitled " Rates and Measurements " of sub-section-D17.
2.2.7.3	With respect to clause no. 6.02.23 sub-section D-17 regarding payment of PTFE bearing it is clarified the payment will be made based on actual quantity in numbers executed and so certified by BHEL Engineer.
2.3	<u>Specific for E & C Contract (Service Portion)</u>
2.3.1	Field Quality Plan:
	All works shall be carried out by the Vendor as per the BHEL / NTPC approved Field Quality Plan (FQP). The Field Quality Plan shall include specific Quality Control Procedure covering but not limited to the following activities:
(i)	Receipt of Materials and handling at site.
(ii)	Storage and preservation

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(iii)	Pre erection.
(iv)	Erection & Alignment
(v)	Primer & Painting.
(vi)	Readiness for Coal Filling
(vii)	Handing Over
2.3.2	Relevant Log sheets to be filled at site and check lists for Erection and Commissioning prepared by Vendors shall be submitted for BHEL / NTPC's approval.
2.4	General requirements – Common to all work.
2.4.1	The terminal points decided by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.
2.4.2	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's customer (NTPC), customer's consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole.
2.4.3	All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory / local authorities are to be arranged by the contractor at his cost in time to ensure timely supply & smooth progress of work. No Extra payment shall be made by BHEL for this.
2.4.4	The contractor shall perform any supply / services, tests etc., which may not be specified but nevertheless, required for the completion of work, within quoted rates.
2.4.5	The contractor shall execute the work in the most substantial and workmanlike manner. The stores shall be handled with care and diligence.
2.4.6	BHEL reserves right to recover from the contractor any loss which arises out of undue delay / discrepancy / shortage / damage / theft at project site or any other

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	causes due to contractor's lapse during any stage of work. Any loss to BHEL due to contractor's lapse shall have to be made good by the contractor.
2.4.7	All cranes, transport equipment, handling equipment, tools, tackles, fixtures, equipment, manpower, supervisors / engineers, consumables etc., except those otherwise specified as BHEL scope or free issue in Technical Conditions, required for this scope of work shall be provided by the contractor. All expenditure including taxes & duties and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies.
2.4.8	All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipment / components for checking and cleaning, surface preparation, fabrication of structures, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions, cutting, gouging weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc. as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rates.
2.4.9	The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work. Contractor shall arrange necessary steel for such usage at his own cost.
2.4.10	Contractor shall plan and transport finished materials from works / factory / BHEL Stores to erection site and erect them in such a manner and sequence that material accumulation at such locations does not lead to congestion in these areas. Materials shall be stacked neatly, preserved and stored in the contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas / site to enable other agencies to carry out their work or for any other reason, same shall be done by contractor most expeditiously. No claim for extra payment for such work will be entertained.

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2.4.11	Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.
2.4.12	The quantities of various items of work to be executed under this contract are generally as per the BOQ cum Rate Schedule. These quantities are approximate and meant only to give a general idea to the bidders about the magnitude of the work involved. Actual quantum and type of structure / works will be based on the relevant erection documents / drawings which will be furnished to the contractor in due course of work and the weight and quantity as per the relevant engineering documents will only be admissible for the billing purpose.
2.4.13	The work shall be carried out strictly in accordance to the "Field Quality Plan" (FQP) approved by BHEL / NTPC. Contractor, jointly with BHEL, shall prepare all necessary records of measurements / readings / protocols etc.
2.5	General responsibility of the contractor:
2.5.1	The contractor shall have total responsibility for all equipment and materials (loose, semi-fabricated, and fabricated) in his custody at contractor's stores / works / factory, or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL Engineer's instructions. The machine surfaces / finished surfaces should be greased and covered.
2.5.2	Preservation & protection of components at all stages of work. Equipment / Materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL. The contractor shall provide necessary preservation agents including the primer & paint for the above work.
2.5.3	The contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials / equipment in their custody and installed structure / work / equipment from theft / fire / pilferage and any other damages and losses.

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2.5.4	Contractor shall collect all scrap / wastage materials periodically from various area of work site, deposit the same at one place earmarked at site or shift the same to a place earmarked in BHEL / client's stores. In case of failure of contractor in compliance of this requirement, BHEL will make suitable arrangement at contractor's risk and cost.
2.5.5	For any work for which no specifications have been laid down in these Tender Conditions, work shall be executed as per the instructions of BHEL.
2.5.6	BHEL is operating web based computerized site operation management system (SOMS) / e-store / SCMS that includes, inter-alia, issue of materials, daily progress reporting, contractor's running monthly billing and material reconciliation through a computerized data management system. Contractor shall install necessary hardware to hook-up with the BHEL's system and use the same for his scope of work.
2.6	MATERIAL HANDLING AT SITE :
2.6.1	All finished materials unloaded by the contractor shall be stacked, stored above ground level by use of concrete or wooden sleepers / structural beams. No materials shall remain on ground at any time. All other equipment like winches, d-shackles, slings of various sizes, max puller, pulley blocks, jacks, trucks, trailers etc. required for such handling of material at storage / erection site shall be arranged by contractor within quoted / accepted rates.
2.6.2	Contractor will have to make his own arrangement at his own cost for procurement of any other material as required for the safe and proper material handling works and of such quality as acceptable to BHEL.
2.7	Specific Requirements:
2.7.1	Raw Materials shall be procured from manufacturers / vendors approved by NTPC, directly.
2.7.3	All welders shall be qualified (WQT) by BHEL and NTPC.
2.7.4	In the event of offloading NDT and heat treatment services, only BHEL approved

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	agencies shall be deployed. No other process for offloading is permissible.
2.7.5	Fabrication, assembly and inspection shall be as per BHEL drawings, Project Technical specification and FQP approved by NTPC.
2.7.6	Only NTPC/BHEL approved welding consumables shall be used for Fabrication.
2.7.7	BHEL's NDT procedures, Heat Treatment (HT) procedures and accepted norms shall be strictly followed.
2.8	SITE VISIT The bidder must visit site, to acquaint themselves with the conditions prevailing at site and in & around the plant premises, together with all statutory, obligatory, mandatory requirements of various authorities before submission of bid.
2.9	SITE ORGANIZATION
2.9.1	The contractor shall provide adequate staffing in the following areas in addition to the staffing requirements of execution as instructed/informed by BHEL. 1. Overall planning, monitoring & control. 2. Quality control and quality assurance. 3. Materials management. 4. Safety, fire & security. 5. Industrial relations and fulfillment of labour laws and other statutory obligations.
2.9.2	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organization shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent Construction Manager having sufficient authority to take decisions at site.
2.9.3	On award of contract, the contractor shall submit to BHEL site organization chart indicating the various levels of experts to be deployed on the job. BHEL reserves the right to reject or approve the list of personnel proposed by the Contractor. The

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	persons, whose bio-data have been approved by BHEL, will have to be posted at site and deviations in this regard will not generally be permitted.
2.9.4	The contractor should also submit to BHEL for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackles shall not be removed from site without written permission of BHEL.
2.9.5	The organization chart for site should indicate the various levels of experts to be posted for supervision in the various fields in erection, commissioning etc as applicable. For proper supervision of the work, the contractor shall ensure providing one qualified supervisor against deployment of 15 workmen.
2.10	SCHEDULE
2.10.1	Contractor shall submit within 30 days of LOI date, detailed program (L2 schedule) of construction / fabrication / erection / handing over etc., for approval to Site In-Charge/Project Manager-Noida. L2 schedule shall be the working level document demonstrating contractor's ability and methods of completing the work within the key milestones identified in the tender specification. These program would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring, The three monthly rolling program with the first month's program being tentative based on the site conditions would be prepared based on these program. The Contractor shall also be involved along with the Customer/BHEL to tie up detailed resource mobilization plan over the period of time of the contract matching with the performance targets. Other requirements are as per Clause No. 2.9 of GCC.

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3.1	Facilities in the Scope of CONTRACTOR / BHEL (Scope Matrix)			
Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
PART- I	<u>ESTABLISHMENT</u>			
3.1.1	<i>FOR CONSTRUCTION PURPOSE:</i>			
A	<i>OPEN SPACE FOR OFFICE (AS PER AVAILABILITY)</i>	Yes		OPEN SPACE WILL BE PROVIDED FOR PRE-ASSEMBLY / STORAGE ETC. LOCATION OF OFFICE AND STORAGE SPACE WILL BE FINALIZED AFTER JOINT SURVEY WITH OWNER (NPTC).
B	<i>OPEN SPACE FOR STORAGE AS PER AVAILABILITY)</i>	Yes		
C	<i>CONSTRUCTION OF CONTRACTOR'S OFFICE, CANTEEN AND STORAGE BUILDING INCLUDING SUPPLY OF MATERIALS AND OTHER SERVICES.</i>		Yes	
D	<i>CONTRACTOR'S ALL OFFICE EQUIPMENT, OFFICE / STORE / CANTEEN CONSUMABLES</i>		Yes	
E	<i>CANTEEN FACILITIES FOR THE CONTRACTOR'S STAFF, SUPERVISORS AND ENGINEERS ETC.</i>		Yes	

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Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
F	<i>FIRE FIGHTING EQUIPMENT LIKE BUCKETS, EXTINGUISHERS ETC.</i>		Yes	
G	<i>FENCING OF CONTRACTOR'S STORAGE AREA, OFFICE, CANTEEN ETC.</i>		Yes	
3.1.2	<u>FOR LIVING PURPOSES OF THE CONTRACTOR</u>			
A	<i>OPEN SPACE FOR LABOUR COLONY (AS PER AVAILABILITY)</i>		Yes	CONTRACTOR HAVE TO MAKE THEIR OWN ARRANGEMENT
B	<i>LIVING ACCOMMODATION FOR CONTRACTOR'S STAFF, SUPERVISOR, ENGINEERS ETC.</i>		Yes	
C	<i>LABOUR COLONY WITH INTERNAL ROADS, SANITATION COMPLYING WITH STAUTORY REQUIREMENTS</i>		Yes	
3.1.3	<u>ELECTRICITY</u>			
3.1.3.1	<u>ELECTRICITY FOR CONSTRUCTION PURPOSES</u> <u>(VOLTAGE 415/440 V)</u>	Yes		FREE OF COST

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
A	<i>SINGLE POINT SOURCE</i>	Yes		
B	<i>FURTHER DISTRIBUTION FOR THE WORK TO BE DONE WHICH INCLUDE SUPPLY OF MATERIALS, ENERGY METER, PROTECTION DEVICES AND IT'S EXECUTION, OPERATION, MAINTANANCE AND SERVICES</i>		Yes	THE CONTRACTOR SHALL MAKE HIS OWN FURTHER DISTRIBUTION ARRANGEMENT AND SHALL MAINTAIN A MINIMUM DRAW-ABLE POWER FACTOR OF 0.8, AND ALL SUCH DEVICES FOR MAINTAINING POWER FACTOR OF 0.8 OR BETTER SHALL BE UNDER THE SCOPE OF CONTRACTOR. ALL TEMPORARY WIRING MUST COMPLY WITH LOCAL REGULATIONS AND WILL BE SUBJECT TO EMPLOYER'S (NTPC) INSPECTION AND APPROVAL BEFORE CONNECTION TO SUPPLY. .
C	<i>DUTIES AND DEPOSITS INCLUDING STATUTORY CLEARANCES AS APPLICABLE</i>		Yes	
3.1.3.2	<u>ELECTRICITY FOR THE OFFICE, STORES, CANTEEN ETC. OF THE CONTRACTOR WHICH INCLUDE:</u>	Yes		FREE OF COST
A	<i>SINGLE POINT SOURCE</i>	Yes		

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
B	<i>FURTHER DISTRIBUTION FROM SINGLE POINT INCLUDING SUPPLY OF MATERIALS, ENERGY METER, PROTECTION DEVICES AND IT'S EXECUTION, OPERATION, MAINTENANCE AND SERVICES.</i>		Yes	
C	<i>DUTIES AND DEPOSITS INCLUDING STATUTORY CLEARANCE AS APPLICABLE</i>		Yes	
3.1.3.3	<u>ELECTRICITY FOR LIVING ACCOMMODATION OF THE CONTRACTOR'S STAFF, ENGINEERS, SUPERVISORS ETC.</u>		Yes	CONTRACTOR HAS TO MAKE THEIR OWN ARRANGEMENT.
A	<i>FURTHER DISTRIBUTION FROM SINGLE POINT INCLUDING SUPPLY OF MATERIALS, ENERGY METER, PROTECTION DEVICES AND IT'S EXECUTION, OPERATION, MAINTENANCE AND SERVICES</i>		Yes	IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO TAKE THE POWER SUPPLY UP TO THE POINT OF HIS USE.
B	<i>DUTIES AND DEPOSITS INCLUDING STATUTORY CLEARANCE AS APPLICABLE</i>		Yes	
3.1.3.4	<i>LIVING FACILITIES FOR OFFICE USE INCLUDING CHARGES</i>		Yes	

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
3.1.4	<u>WATER SUPPLY</u>			
3.1.4.1	<u>FOR CONSTRUCTION PURPOSES:</u>			
A	MAKING THE WATER AVAILABLE AT SINGLE POINT		Yes	CONTRACTOR HAS TO ARRANGE FOR CONSTRUCTION WATER AT HIS OWN BY RESORTING TO THE METHODS LIKE BORE WELL, WATER TANKERS ETC.
B	<i>FURTHER DISTRIBUTION AS PER THE REQUIREMENT OF WORK INCLUDING SUPPLY OF MATERIALS AND EXECUTION</i>		Yes	
3.1.4.2	<u>WATER SUPPLY FOR CONTRACTOR'S OFFICE, STORES, CANTEEN ETC.</u>		Yes	
A	<i>MAKING THE WATER AVAILABLE AT SINGLE POINT</i>		Yes	CONTRACTOR HAS TO ARRANGE FOR SAFE DRINKING WATER FOR STAFF AND LABOUR AT HIS OWN.
B	<i>FURTHER DISTRIBUTION AS PER THE REQUIREMENT OF WORK INCLUDING SUPPLY OF MATERIALS AND EXECUTION</i>		Yes	
3.1.4.3	<u>WATER SUPPLY FOR LIVING PURPOSE:</u>			

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Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
A	<i>MAKING WATER AVAILABLE AT SINGLE POINT</i>		Yes	
B	<i>FUTHER DISTRIBUTION AS PER THE REQUIREMENT OF WORK INCLUDING SUPPLY OF MATERIALS AND EXECUTION</i>		Yes	
3.1.5	<u>LIGHTING</u>			
3.1.5.1	<i>FOR CONSTRUCTION WORK (SUPPLY OF ALL THE NECESSARY MATERIALS)</i> 1. AT OFFICE / STORAGE AREA 2. AT THE PREASSEMBLY AREA 3. AT THE CONSTRUCTION SITE / AREA		Yes	
3.1.5.2	<i>FOR CONSTRUCTION WORK (EXECUTION OF THE LIGHTING WORK / ARRANGEMENTS)</i> 1. AT OFFICE STORAGE AREA 2. AT THE PREASSEMBLY AREA 3. AT THE CONSTRUCTION SITE / AREA		Yes	

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Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
3.1.5.3	<i>PROVIDING THE NECESSARY CONSUMABLES LIKE BULBS, SWITCHES, ETC. DURING THE COURSE OF CONSTRUCTION</i>		Yes	
3.1.5.4	<i>LIGHTING FOR THE LIVING PURPOSES OF THE CONTRACTOR AT THE COLONY / QUARTERS.</i>		Yes	
3.1.6	<u>COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE CONTRACTOR</u>			
3.2.6.1	<i>TELEPHONE, FAX, INTERNET, INTRANET, E-MAIL ETC.</i>		Yes	
3.2.7	<u>COMPRESSED AIR SUPPLY</u>			
3.2.7.1	<i>SUPPLY OF COMPRESSOR AND ALL OTHER EQUIPMENT REQUIRED FOR COMPRESSOR AND COMPRESSED AIR SYSTEM INCLUDING PIPES, VALVES, STORAGE SYSTEMS ETC.</i>		Yes	
3.2.7.2	<i>INSTALLATION OF THE ABOVE SYSTEM AND OPERATION AND MAINTENANCE OF THE SAME.</i>		Yes	

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
3.2.7.3	<i>SUPPLY OF THE ALL THE CONSUMABLES FOR THE ABOVE SYSTEM DURING THE CONTRACT PERIOD.</i>		Yes	
3.2.8	<u>DEMOBILIZATION OF THE FACILITIES AFTER COMPLETION OF WORKS</u>		Yes	
3.2.9	<u>TRANSPORTATION</u>			
A	<i>FOR SITE PERSONNEL OF THE CONTRACTOR</i>		Yes	
B	<i>FOR CONTRACTOR'S EQUIPMENT AND CONSUMABLES (T&P, CRANES ETC.)</i>		Yes	
PART- II	<u>ERECTION FACILITIES:</u>			
3.2.10	<u>ENGINEERING WORKS FOR CONSTRUCTION:</u>			
A	<i>PROVIDING THE CONSTRUCTION DRAWINGS / DESIGN DRAWINGS FOR ALL THE STRUCTURES COVERED UNDER THIS SCOPE.</i>	Yes		
B	<i>DRAWINGS FOR CONSTRUCTION METHODS</i>		Yes	In consultation with BHEL

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
C	<i>AS-BUILT DRAWINGS – WHERE EVER DEVIATIONS OBSERVED AND EXECUTED AND ALSO BASED ON THE DECISIONS TAKEN AT SITE.</i>		Yes	In consultation with BHEL
D	<i>PACKING LISTS ETC. FOR REFERENCE AND PLANNING THE ACTIVITIES</i>	Yes	Yes	In consultation with BHEL
E	<i>PREPARATION OF SITE CONSTRUCTION SCHEDULES AND OTHER INPUT REQUIREMENTS.</i>		Yes	In consultation with BHEL
F	<i>REVIEW OF PERFORMANCE AND REVISION OF SITE CONSTRUCTION SCHEDULES IN ORDER TO ACHIEVE THE END DATES AND OTHER COMMITMENTS</i>	Yes	Yes	In consultation with BHEL
G	<i>WEEKLY CONSTRUCTION SCHEDULES BASED ON SL. No. E</i>		Yes	In consultation with BHEL
H	<i>DAILY CONSTRUCTION / WORK PLAN BASED ON SL. No. G</i>		Yes	In consultation with BHEL

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No	Description	Scope / to be taken care by		Remarks
		BHEL	Contractor	
I	<i>PERIODIC VISIT OF THE SENIOR OFFICIAL OF THE CONTRACTOR TO SITE, REVIEW THE PROGRESS SO THAT WORKS ARE COMPLETED AS PER SCHEDULE. IT IS SUGGESTED THIS REVIEW BY THE SENIOR OFFICIAL OF THE CONTRACTOR SHOULD BE DONE ONCE IN EVERY TWO MONTHS.</i>		Yes	
J	<i>PREPARATION OF PREASSEMBLY BAY / BED</i>		Yes	STRUCTURE, T&P, LABOUR ETC. REQUIRED FOR PREPARATION OF PRE-ASSEMBLY BED SHALL BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST.
K	<i>ARRANGING THE MATERIALS REQUIRED FOR PRE-ASSEMBLY</i>		Yes	
L	<i>LAYING OF RACKS FOR GANTRY CRANE IF PROVIDED BY BHEL OR BROUGHT BY THE CONTRACTOR / CONTRACTOR HIMSELF</i>		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

3.3	<u>CONSTRUCTION FACILITIES:</u> The Following are also in Contractor's / Bidder's Scope of Work:
3.3.1	Providing drinking and service water for Contractor's labour, staff and other personnel working for Contractor at the work site and in his staff / labour colony. He shall install necessary bore wells with associated pumping or water tankers and treatment facilities to supply quality water as per standards.
3.3.2	Developing temporary staff colony and labour colony along with fencing etc. Land if required shall be arranged by the Contractor himself. However space required for contractor's office storage, pre-assembly and fabrication areas shall be provided by the owner (NTPC) free of charge within the plant premises. The area to be allocated to the Contractor shall be discussed & finalized with the Contractor after the award, keeping in view the availability of free space & similar requirement of other agencies.
3.3.3	Providing all arrangement for distribution of construction power at various locations as per his requirements from the supply point of the Employer (NTPC).
3.3.4	Providing all arrangements for the supply of construction water including bore-wells, water tankers etc.
3.3.5	Providing temporary construction office, construction stores (open / covered), workshops, material / field testing laboratory, any other temporary buildings.
3.3.6	Providing all construction equipment, labour and materials. The Contractor shall provide all the tools and tackles required for the work.
3.3.7	Development of the pre-assembly and storage yard with fencing, drainage, internal roads, boulder soling etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

3.3.8	Area Lighting at the construction / erection site, pre-assembly and storage yard, office areas and labour / staff colony.
3.3.9	Providing all necessary fire fighting devices / equipment / fire tender etc. required during the project execution stage. He shall maintain all such equipment / devices in proper working conditions throughout the period of work.
3.3.10	Providing first aid facilities at the construction / erection sites, workshops, laboratories, pre-assembly and storage yard and other places of work as per the requirement.
3.3.11	The contractor shall arrange skilled / semi-skilled / un-skilled manpower from local source(s) as far as available. He shall also arrange supervisory staff for quality execution of all works in his scope.
3.3.12	<u>Contractor's office, store, workshop, laboratory or any other temporary building:</u> The contractor shall adopt pre-engineered/ pre-fabricated constructions made of steel with single / double skin, insulated for un-insulated roof and wall coverings (fabricated out of permanently colour coated metal sheets) for his site office, covered store workshop, laboratory or any other temporary buildings. Alternatively Contractor can adopt readymade "Porta-Cabin" for similar construction. Contractor shall ensure that all such constructions are well-engineered, neatly constructed and overall present a pleasing look. The above requirements shall be applicable to his sub-vendors also and Contractor shall be responsible for enforcing the same on his sub-vendor. Any other type of construction if proposed by the Contractor shall be subject to approval of the Owner (NTPC). However, such construction shall be based on proper design and shall have aesthetic look.
3.3.13	Use of ash and ash based products: In line with Gazette notification on Ash utilization issued by MOEF and its amendment thereafter, Contractor shall use ash and ash based products in construction of his offices, stores, staff quarters and labour

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

	huts etc. He shall furnish a compliance report along with all details of use of ash and ash based products along with each bill. The above requirements shall be applicable to his sub-vendor also and Contractor shall be responsible for enforcing the same on his sub-vendor.
3.3.14	Repair and Maintenance Facilities by the Contractor: Contractor shall establish / set up at site suitable repair facilities for construction plant, equipment and machinery (like cranes, hydra, forklifts, welding equipment etc.) He will also make arrangements / tie up with manufacturers / suppliers of such construction plant, equipment & machinery, for periodic overhaul / maintenance and for major breakdown, if any. He shall also keep adequate spares at site for various construction plant, equipment and machinery to meet day to day requirements as recommended by equipment manufacturer / supplier or as instructed by BHEL Engineer. Contractor shall deploy dedicated qualified, full time mechanical / electrical foreman / supervisors for manning the repair facilities as specified above.
3.4	Provision of distribution lines of both electrical power and water from the central points to the required place with proper distribution boards observing the safety rules laid down by the electrical authorities of the state shall be done by the contractor, supplying all the materials like cables, distribution board, switch boards, TPN, CBS, ELCBS/ MCCBS/ Copper / Brass clamps, copper conductor, change over switches pipes etc. at his own cost. If any failure is caused in supply of the power and water, it is the responsibility of the contractor to make alternate arrangements at his cost. The contractor shall adjust his working shifts / hours accordingly and deploy additional manpower if necessary so as to achieve the targets. The energy meter is to be installed by the contractor & shall be tested and certified by State Electricity Board or any other agency approved by the Customer.
3.5	The contractor while drawing construction power supply from Distribution Board should strictly adhere to following points:
3.5.1	All electrical installations should be as per Indian Electricity rules.

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CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

3.5.2	All distribution Boards installed by the contractor should be constructed with fireproof materials viz. Steel frames, Bakelite sheets etc.
3.5.3	Connection for single phase should be taken from phase and neutral. Nowhere the connection should be taken with earth as neutral.
3.5.4	All electrical connections should be made through connectors, nuts and bolts, switches, plug and sockets. Loose connections or hooking up of wires shall not be permitted.
3.5.5	Contractor has to make their own earthing arrangement for their equipment / DB earthing.
3.5.6	All electrical equipment / tools and plants should be properly earthed. DBs to be earthed diagonally opposite at two points.
3.5.7	Contractor should use "MCCB" and "ELCB" either on incoming or outgoing connections to the DBs.
3.5.8	Contractor should ensure that all the CBs / TPNs/ Fuses/ MCCB / ELCB cables etc. should be of adequate rating/ capacity.
3.5.9	For permission of supply connections contractor has to submit a test report of their installations with a single line diagram of connected/ proposed loads.
3.5.10	ELCB will be tested once in a week or as directed by BHEL by actually simulating the earth leakage for all installations and the same shall be recorded in the logbook to be maintained by the contractor.
3.5.11	In case of power cuts / load shedding no compensation for idle labor / T&Ps for completion of work will be given to contractor.
3.5.12	On completion of work or as and when required by BHEL, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled, Area shall be leveled and debris shall be removed, as per instructions of BHEL, by the contractor at his cost. In

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-III: FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

	the event of his failure to do so, the BHEL Engineer will get it done and expenses incurred shall be recovered from the contractor along with prevailing overheads. The decision of BHEL Engineer in this regard shall be final.
3.5.13	Compressor of required capacity for construction purposes shall be arranged by Contractor.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER-IV: T&Ps AND MMDs TO BE DEPLOYED BY CONTRACTOR

4.0	<u>LIST OF TOOL & PLANTS TO BE DEPLOYED BY THE CONTRACTOR -</u>		
4.1	<u>List (A)- LIST OF T&P TO BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST</u>		
Sl. No.	Description	Capacity	Quantity
4.2.1	CRAWLER CRANE	100 MT	02 No.
4.2.2	TYRE MOUNTED MOBILE CRANE / HYDRA	Minimum 14 MT	04 Nos.
4.2.3	TRAILER- FLATBED	20 MT	01 No.
4.2.4	3 PHASE DISTRIBUTION BOARD (800 AMP, 415 VOLT) WITH COMPLETE SET UP FOR WITHDRAWAL OF CONSTRUCTION POWER	800 amp, 415 volt	Minimum 01 No. (Further to be augmented as per site requirement.)
Notes:			
1.	T & Ps mentioned in above list (A) shall be necessarily deployed by the contractor, starting from the actual date of start of work. A proper record of all T&Ps shall be maintained by the contractor. In case of delayed deployment / short deployment, BHEL shall impose recovery equivalent to the BHEL approved hiring rates applicable during the period of absence for the period the T&P is not available at site. Further for recovery the hiring rate approved for 'Outside Agencies' shall be applicable & 6 hours per day shall be considered for recovery for per day of absence. For the T&Ps / Items for which BHEL hiring rates are not available, recovery shall be made equivalent to market rent plus 20% (additional charges) as applicable during the period of absence and for the period T&P is not available at site. BHEL Engineer's decision regarding applicability of hiring charges and market rent shall be final and binding on the contractor.		
2.	Other terms and conditions regarding above items please also refer clause for		

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER-IV: T&Ps AND MMDs TO BE DEPLOYED BY CONTRACTOR

	T&P/IMTEs in SCC.
3.	100 MT, Crawler Cranes (02 Nos.) as mentioned in the above list may be released after completion of the "Readiness for Coal Filling" of all bunkers and after approval of the BHEL Construction Manager.
4.	If the work related to T&Ps mentioned in the above list - (A) is completed then, BHEL Engineer I/C can release the T & P during contract period / extended period (if any). However, written permission shall be taken by contractor from BHEL Construction Manager before releasing T&P.
4.2	<u>List (B)- List of T&P Required:</u>
4.2.1	Pick and carry mobile crane (14-18MT)
4.2.2	Trailer with pulling unit - to handle heavy and long components etc. (20 MT)
4.2.3	Tractor trolley - to handle regular components of bunker etc. 40 MT
4.2.4	Trailer- Flatbed 60 MT
4.2.5	Drilling machines: assorted types and sizes
4.2.6	Grinding machines: assorted types and sizes.
4.2.7	Welding Machine
4.2.8	MIG welding M/c
4.2.9	Welding Recti former
4.2.10	Baking oven and holding oven with thermostat and temperature gauge for baking coated welding electrodes
4.2.11	Portable oven for coated welding electrodes
4.2.12	Pre heating / stress relieving set (heating control panel, cables, heating elements etc.)
4.2.13	Electric winches (3-5MT)
4.2.14	Hand winches (1MT)
4.2.15	Hoisting & pulling devices/ pulleys etc

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER-IV: T&Ps AND MMDs TO BE DEPLOYED BY CONTRACTOR

4.2.16	Mechanical & hydraulic jacks
Notes:	
1.	The above list - (B) is only indicative and these T&Ps may not be required for entire contract period but contractor will ensure that these T & Ps are provided as per need. Contractor will assess actual quantity and period of requirement based on his experience.
2.	Other terms and conditions regarding above items please also refer clause for T&P/IMTEs in SCC.
3.	All the tools and plants required for this scope of work, except the Tools & Plants provided by BHEL are to be arranged by the contractor within the quoted rates. The list is suggestive in nature. Any additional T&P required to meet BHEL's commitments/schedule shall be arranged without any extra cost by the contractor.
4.3	<u>List (C)- List of MMDs required:</u>
4.3.1	THEODOLITE / TOTAL STATION
4.3.2	AUTO LEVEL AND STAFF
4.3.3	RADIOGRAPHY ARRANGEMENT INCLUDING THE SOURCE (IR 192, COBALT 60), FILM DEVELOPMENT FACILITY, DARK ROOM, STORAGE ETC.
4.3.4	RADIOGRAPHY FILM VIEWER (HI INTENSITY)
4.3.5	ARRANGEMENT FOR UT OF HIGHER THICKNESS JOINTS WITH RECORDING FACILITY
4.3.6	HSFG BOLT TORQUE WRENCH & CALIBRATOR
4.3.7	COMPRESSION STRENGTH TESTING EQUIPMENT
4.3.8	CONSTRUCTION MATERIAL TEST EQUIPMENT
4.3.9	CONCRETE CUBE MOULD (150 X 150 X 150) mm
4.3.10	CONCRETE SLUMP CONE
4.3.11	COARSE AGGREGATE SIEVES & SAND SIEVER
4.3.12	SIEVE SHAKER

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER-IV: T&Ps AND MMDs TO BE DEPLOYED BY CONTRACTOR

4.3.13	AGGREGATE IMPACT TEST MACHINE
4.3.14	HEATING OVEN
4.3.15	PHYSICAL BALANCE FOR LAB WORK
4.3.16	RAPID MOISTURE METER
4.3.17	VICAT APPARATUS WITH PLUNGERS FOR CEMENT TESTING
4.3.19	DUMPY LEVEL UP TO 350 MM
4.3.20	CORE CUTTER TEST APPARATUS
4.3.21	CUBE MOULDS (70MM SIZE)
Notes:	
1	The above list is only indicative and these IMTEs may not be required for entire contract period and will be provided as per need. Contractor will assess actual quantity and period of requirement based on his experience.
2	Other terms and conditions regarding above items please also refer clause for T&P/IMTEs of SCC.
3	All the IMTEs /MMEs required for this scope of work, except the IMTEs / MMEs provided by BHEL, are to be arranged by the contractor within the quoted rates. The list is suggestive in nature. If Any additional IMTEs / MMDs may be required to be arranged by the contractor, then these shall be arranged at no extra cost to BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-V: T&P AND MMDs TO BE DEPLOYED BY BHEL ON SHARING BASIS

List of T&Ps and MMDs to be deployed by BHEL on sharing basis:

Sl.no.	Description & capacity of T & P	Quantity	Remarks
01	High capacity Crane- 600 MT	01 No.	On sharing basis
02	Mid Range Crawler / Tyre Mounted Crane – 250 MT	01 No.	On sharing basis
03	Crawler /Tyre Mounted General Purpose Crane – 135 MT	01 No.	On sharing basis
NOTES:			
1	These Cranes (S. No.1, 2 & 3) will be provided on sharing basis on specific instruction of the BHEL Engineer as per the work requirement.		
2	The contractor shall make necessary arrangement like lying of steel plates, assembly & dismantling of heavy lift attachment, boom, jib etc. for movement and operation of crane.		
3	In case of other T&P, mentioned above, the Contractor shall transport from BHEL stores, install, operate, carry out maintenance, dismantle after use and return to BHEL stores.		
4	Other terms and conditions regarding above items please also refer clause 4.2.2 of SCC.		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VI: TIME SCHEDULE

6	Time Schedule & Mobilization (APPLICABLE FOR UNIT NO.1 –PACKAGE A & UNIT NO. 2- PACKAGE B)	
1	Initial Mobilization, Zero Date / Schedule Commencement Date	The contractor should mobilize within 15 days of issue of LOI. However, the construction manager shall inform contractor regarding Actual / Zero date of start of work. Zero date of start of work shall be considered as the date up-to which Contractor has mobilized all the T&P as per List (A). Delay attributable to contractor in this regard, shall be taken into account for LD Calculation. Contractor shall necessarily mobilize all T&Ps as per list – (A) before Actual date of start of work.
2	Duration / Period	Entire work as detailed in the tender specifications shall be completed within 20 months from the Zero date as per programme / milestones indicated by BHEL Engineer. Contractor has to mobilise adequate resources to meet BHEL's commitments to their customer as indicated from time to time.
3	Readiness of Feeder Floor & handing over to NTPC for casting	Within 10 th Month from Zero date
4	Readiness of Tipper Floor for handing over to NTPC for casting	Within 14 th Month from Zero date
5	Readiness for Coal Filling	Within 18 th Month from Zero date
6	Completion of all works as per the scope, specifications and handing over.	Within 20 th Month from Zero date

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CHAPTER-VI: TIME SCHEDULE

Note:	The above Time Schedule is for Unit # 1. Tentative Phase Difference between Unit # 1 & Unit # 2 will be Four Months.
6.1	The contractor has to ensure that work is completed in all respects leaving no pending points. However the punch list/ pending points, which are possible to be attended at site, shall be fully liquidated before handing over the works to Customer (NTPC), to the complete satisfaction of BHEL and Its Customer. BHEL may withheld/deduct a suitable amount from the RA Bills/Final Bill in-case the pending points/punch points are not being rectified by the contractor. Any deductions imposed on BHEL by Customer due to any faulty work/ pending points/ punch points, the same shall be recovered from contractor after applying applicable BHEL overheads.
6.2	The work under the scope of this contract is deemed to be complete in all respects, only when the contractor has discharged all the responsibilities laid down in the contract. The decision of BHEL on completion date shall be final and binding on the contractor.
6.3	In case due to reasons not attributable to the contractor, the work gets delayed and scheduled completion gets extended, time extension will be granted by BHEL as per clause no. 2.11 of GCC.
6.3	In order to meet above schedule in general, and any other intermediate targets set, to meet the customer/ project schedule requirements, contractor shall arrange & augment all the necessary resources from time to time on the instructions of BHEL.
6.4	T&P and Manpower Deployment Schedule and Detailed Work completion Schedule (L2-schedule) should be submitted to BHEL for approval by the successful Bidder within 2 weeks of issue of LOI. Further Contractor shall necessarily submit the Monthly Plan and Review Form No. F-14, along with RA Bills for effective monitoring and implementation of Completion Schedule (L2 Schedule).
6.5	CONSEQUENCE OF DELAY: In case of delay in completion is attributable to the contractor, BHEL may impose LD on the contractor as per GCC.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VII: TERMS OF PAYMENT

7.0	TERMS OF PAYMENT
7.1	The progressive payment for SUPPLY and E&C Part on accepted price of contract value will be released as per the break up given hereinafter:-
7.2	Stages of progressive pro-rata payments.
7.2.1	For Supply Part
(i)	<u>At receipt of materials at site:</u> 70% of quoted rate shall be released on pro- rata basis against actual quantities supplied of scope as per approved drawing. Note: Payment against Supply of Raw Materials for Concreting, Grouting, Primer and Painting Work shall be released only after actual execution of work at site as per BOQ cum Rate Schedule.
(ii)	<u>E&C work of supplied materials:</u> 15 % of quoted rate shall be released on pro-rata basis after satisfactory completion of E&C work of supplied materials at site.
(iii)	<u>Completion and handing Over to Customer / Owner (NTPC):</u> 10% of quoted item rate shall be released on pro-rata basis after successful completion and handing over the works to customer (NTPC).
(iv)	<u>On liquidation of Pending Points/ Punch Points:</u> 5% of quoted item rate shall be paid on liquidation of Pending Points/ Punch Points.
(v)	Contractor shall be fully responsible for loading/unloading, transport, storage, insurance, extra supplies, removal of extra supplied material from site (with BHEL/Customer written permission), loss due to damage/theft etc. for the supplied materials. The RA Bill payments against supply shall be done as mentioned above. The reconciliation of the material Supplied vs. Consumed as per approved drawings shall be done with each R.A. Bill and any deduction/payment shall be done accordingly. Final reconciliation shall be done along-with Final Bill as per approved drawings and any deduction/payment shall be made accordingly. BHEL Engineer-In-charge decision in this regards shall be final & binding on the contractor.
7.2.1.1	The RA bill payment shall be made as per Cl. No. 10.0 of chapter – X of SCC and as per Cl. No. 2.6 of GCC.

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CHAPTER-VII: TERMS OF PAYMENT

7.2.2	For E&C (Service) Portion
7.2.2.1	For item no. B 2302 & B 2303 payment (85%) on pro-rata basis shall be done as per following breakup:-
(i)	<u>Completion of Pre-Assembly, (If not applicable this portion shall be clubbed with Erection):</u> 20% of quoted rates under Item Nos. B 2302 & B 2303 shall be released on pro-rata basis after successful completion of Pre-assembly.
(ii)	<u>Erection:</u> 25% of quoted rates under Item Nos. B 2302 & B 2303 shall be released on pro-rata basis after successful completion of Erection.
(iii)	<u>Alignment:</u> 20% of quoted rates under Item Nos. B 2302 & B 2303 shall be released on pro-rata basis after successful completion of Alignment.
(iv)	<u>Welding / Bolting / Fixing as required:</u> 15% of quoted rates under Item Nos. B 2302 & B 2303 shall be released on pro-rata basis after successful completion of Welding /Bolting / Fixing as required.
(v)	<u>Completion of Non Destructive Examination & Stress Relieving / Heat Treatment, (if not applicable, then this portion to be paid along with welding):</u> 5% of quoted rate under Item Nos. B 2302 & B 2303 shall be released on pro-rata basis after successful completion of NDT/Other Testing.
7.2.2.2	For item no. B 2302 & B 2303 payment (15%) on achievement of Mile Stones shall be done as per following breakup:-
(i)	<u>On completion of Readiness for Coal Filling:</u> 2.5% of quoted rates under Item Nos. B 2302 & B 2303 shall be released.
(ii)	<u>On completion of Roofing and Side cladding work:</u> 2.5% of quoted rates under Item Nos. B 2302 & B 2303 shall be released.
(iii)	<u>On successful handing over to customer:</u> 5% of quoted rates under item B 2302 & B 2303 shall be released.
(iv)	<u>On Liquidation of Pending Points/ Punch Points:</u> 5% of quoted rates under item B 2302 & B 2303 shall be released.

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CHAPTER-VII: TERMS OF PAYMENT

7.2.2.3	For other item numbers:-
	<u>On Monthly Basis:</u> 85% of quoted item rate on pro rata basis against monthly RA bills for the actual executed quantities as per Rate Schedule.
	<u>Completion and Handing Over to Customer/Owner (NTPC):</u> 10% of quoted item rate on pro-rata basis shall be released after successful completion and handing over to Customer / Owner (NTPC).
	<u>On Liquidation of Pending Points/ Punch Points:</u> 5% of quoted item rate shall be released on liquidation of Pending Points/ Punch Points.
Note:	1. The RA bill payment shall be made as per Cl. No. 10.0 of chapter – X of SCC and as per Cl. No. 2.6 of GCC.
7.3	GENERAL
7.3.1	MEASUREMENT OF THE WORK COMPLETED
7.3.1.1	Where payment is to be made on the basis of weight, the weight per unit given in the BHEL document only shall be taken in to consideration. In case such information is not available in BHEL documents, then the latest relevant Indian standards in this regard may be applied.
7.3.1.2	Spares, surplus quantity, erection contingency materials will not be paid for unless the same has been consumed in place of regular item of measurable work as per the rate schedule.
7.3.1.3	Where the payment is made on the basis of item rate, actual executed quantity measured jointly shall only be paid for. The quantities shall be calculated on the basis of latest approved drawings issued by BHEL.
7.3.1.4	It is clarified that as far as weight constituted by welding consumables and other consumables supplied by BHEL as well as by the contractor, shall not be considered for payment.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VII: TERMS OF PAYMENT

7.3.1.5	BHEL engineer's decision regarding stage of payment corresponding to progress of work, calculation of weight etc. will be final and binding on the contractor.
7.3.1.6	Weight of packers and shims fabricated at site which becomes permanent part of equipment / Work will be paid for based on actual weight.
7.3.1.7	The quantities mentioned in the BOQ cum Rate Schedule are tentative only. The payments shall be made only for the actual quantities consumed/executed at site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VIII: TAXES AND DUTIES

8.0	TAXES & DUTIES (SERVICE PORTION)
8.1	The contractor shall pay all (save the specific exclusions as enumerated in this contract) taxes, fees, license charges, deposits, duties, tools, royalty, commissions or other charges which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit. However, provisions regarding Service Tax and Value Added Tax (VAT) on output services and goods shall be as per following clauses.
8.2	Service Tax & Cess on Service Tax
8.2.1	Service Tax and Cess on Service Tax as applicable on output Services are excluded from contractor's scope; therefore contractor's price/rates shall be exclusive of Service Tax and Cess on Output Services.
8.2.2	Contractor shall obtain prior written consent of BHEL before billing the amount towards such taxes. The Service Tax Rules permit more than one option or methodology for discharging the liability of tax/levy/duty and BHEL will have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor. Contractor shall submit to BHEL documentary evidence of Service Tax registration certificate specifying name of services covered under this contract.
8.2.3	For the purpose of claiming any Service Tax from BHEL, the following procedure shall be adopted :

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CHAPTER-VIII: TAXES AND DUTIES

8.2.3.1	Contractor shall submit serially numbered Service Tax and Cess Invoices, signed by him or a person authorized by him in respect of taxable service provided, and shall contain the following, namely:
8.2.3.1.1	The name, address and registration number of the contractor
8.2.3.1.2	The name and address of the party receiving taxable service (BHEL)
8.2.3.1.3	Description, classification and value of taxable service provided and
8.2.3.1.4	The Service Tax payable thereon.
8.2.4	All the four conditions shall be fulfilled in the invoice for payment of Service Tax by BHEL. Where more than one nature of Service under Service Tax Rules is involved, the invoice mentioned above shall contain the break-up of all values for each nature of Service.
8.2.5	Name and address of the contractor should be same in the service tax invoice and monthly bill. Any change in the name and address in past should be supported by documentary evidence duly certified by the registering authority.
8.2.6	Purpose of above requirements, inter-alia, is to enable availment of CENVAT credit by BHEL. As per recent amendments, Time restrictions for taking Cenvat credit is within six months from date of invoice. Wherever Cenvat credit could not be availed by BHEL within statutory time limit of 6 months due to delay in submission of invoices or for any other reasons attributable to contractors, Liability towards loss of such Cenvat credit shall be passed on to contractors.
8.3	VAT (Sales Tax /WCT)
8.3.1	The rates quoted by the Contractor shall be inclusive of VAT/Sales Tax and BHEL shall not reimburse any amount on this account due to any reason whatsoever.
8.3.2	The Contractor shall register himself with the respective Sales Tax authorities of the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VIII: TAXES AND DUTIES

	state and submit proof of such registration to BHEL along with the first RA bill. Deduction of tax at source shall be made as per the provisions of law unless otherwise found exempted. In case tax is deducted at source as per the provisions of law, this is to be construed as an advance tax paid by the contractor and no reimbursement thereof will be made unless specifically agreed to. Contractor has to make his own arrangement at his cost for completing the formalities, if required, with Sales Tax/VAT Authorities, for bringing all their material, plant and equipment etc at site for the execution of the work, including arrangement of Road Permits if and as applicable under the relevant VAT Act.
8.4	Modalities of Tax Incidence on BHEL
8.4.1	Wherever the relevant tax laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL will have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor.
8.5	New Taxes/Levies
8.5.1	In case the Government imposes any new levy/tax on the output service/ goods/work after award of the contract, the same shall be reimbursed by BHEL at actual.
8.5.2	In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of Price Bid. Claim for any such impact after opening the Price Bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.
8.5.3	No reimbursement/recovery on account of increase/reduction in the rate of taxes, levies, duties etc. on input goods/services/work shall be made. Such impact shall be

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CHAPTER-VIII: TAXES AND DUTIES

	taken care of by the Price Variation/Adjustment Clause (PVC) if any. In case PVC is not applicable for the contract, Bidder has to make his own assessment of the impact of future variation if any, in rates of taxes/duties/ levies etc. in his price bid.
8.6	TAXES & DUTIES (SUPPLY PORTION)
8.6.1	Price quoted should be inclusive of all the applicable charges, taxes and duties, including entry tax. However rates of sales tax, excise duty & other statutory levies should be indicated separately. Variation in excise duty, sales tax/ VAT or any other statutory levies during contractual delivery period should be to BHEL's account. No "C" form will be issued for this supply. Contractor should arrange own road permit, if any, himself for arranging material and they have to arrange cenvatable invoice. In case of material purchased within the state, VAT shall be payable only if submission of VAT invoices/ documentary evidence by the vendor.

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CHAPTER-IX: WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING,
POST WELD HEAT TREATMENT

9.0	WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT
9.1	WELDING:
9.1.1	Installation of materials / structures involves Good Quality Welding, NDE Checks, and Post Weld Heat Treatment etc. Contractor's personnel engaged should have adequate qualification on the above works.
9.1.2	The method of welding will be indicated in the detailed drawing / documents. BHEL Engineer will have the option of changing the method of welding as per site requirement.
9.1.3	Before any welder is engaged on work, he shall be tested and qualified by BHEL / Customer, though they may possess the previous certificate. BHEL reserves the right to reject any welder without assigning any reason. All the expenditure in testing / qualification of the contractor's welder shall be borne by contractor.
9.1.4	Unsatisfactory and continuous poor performance may result in discontinuation of concerned welder.
9.1.5	The welded surface shall be cleaned of slag and painted with primer paint to prevent rusting, corrosion. For these consumables like paint / primer etc. will be in the contractor's scope.
9.1.6	Welding electrodes have to be stored in enclosures having temperature and humidity control arrangements. This enclosure shall meet BHEL specifications.
9.1.7	Welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the welding electrodes have to be carried in portable ovens.
9.2	NON DESTRUCTIVE EXAMINATION:
9.2.1	Contractor shall provide all resources and make all arrangements for the radiographic examination of welds for this work. For reasons of safety, invariably the radiography work will be carried out after the normal working hours and closure of other site activities only. In this regard, the contractor has to adhere to the safety rules /

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CHAPTER-IX: WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT

	regulations laid by BARC authorities from time to time.
9.2.3	Radiography inspection of welds shall be performed in accordance with requirements and recommendation of BHEL engineer. The minimum quantum of radiographic inspection shall be as per provision of BHEL's Erection Documents. They may, however be increased depending upon the performance of the individual welder at the discretion of BHEL engineer/boiler inspecting authority. Contractor shall also arrange the UT equipment with recording facility at his own cost. UT shall be done as per requirement of BHEL / client. Records of UT shall be produced & submitted to as per site requirement.
9.2.4	All x-ray / gamma ray films of weld joints shall be preserved properly and be handed over to BHEL.
9.2.5	The field welded joints shall be subject to dye-penetrant / MPT / RT / other non-destructive examination as specified in the respective engineering documents / as instructed by BHEL.
9.2.6	Where required, surface preparation, like smooth grinding of welded area, prior to radiography shall be done. It may also become necessary to adopt inter-layer radiography/MPT/UT depending upon the site/ technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The contractor shall take all this into account in his offer. The required NDT method / procedure will be decided by BHEL Engineer at site.
9.2.7	For carrying out ultrasonic testing of welding joints of large size, it will be necessary to prepare surface by grinding and buffing a smooth finish and contour as necessary. The contractor's scope of work includes such preparation as incidental to work.
9.2.8	No separate payment for any NDE activities is envisaged. Accordingly the offered rate shall be inclusive of cost of all NDE.
9.3	HEAT TREATMENT:

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CHAPTER-IX: WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT

9.3.1	For the purpose of temperature recording of stress relieving process, thermocouples have to be attached to the weld joint. The number of temperature measuring points and locations shall be as per the standards of BHEL. Thermocouples have to be attached using capacitor discharge type portable thermocouple attachment unit. Contractor shall arrange sufficient number of thermocouple attachment units.
9.3.2	Contractor should provide temperature indicator / temperature recorder for measuring temperature during pre-heating for welding or for controlling temperature of metal for hot correction etc. the temperature recorders should be preferably of solid state type.
9.3.3	Heat treatment may require to be carried out at any time (day or night) to ensure the continuity of the process. The contractor shall make all necessary arrangements including labourer required for the same as per directions of BHEL.
9.3.4	In certain cases only the pre-heating of weld joints may be called for.
9.3.5	For weld joints of heavy structural sections, if heat treatment is required, the same shall be carried out as part of the work.
9.3.6	Checking effectiveness of stress relieving by hardness tests (by digital hardness tester or other approved test methods as per BHEL Engineer's instruction) including necessary testing equipment's is within the scope of the work / specification.
9.3.7	Preheating, inter-pass heating, post weld heating and stress relieving after welding are part of erection work and shall be performed by the contractor in accordance with BHEL Engineer's instructions. where the electric resistance heating method is adopted contractor shall make all arrangement including heating equipment with automatic recording devices, all heating elements, thermocouples and attachment units, graph sheets, thermal chinks, & insulating materials like mineral wool, asbestos cloth, ceramic beads, asbestos ropes etc., required for all heating and stress relieving works.
9.3.8	All the recorded graphs for heat treatment shall be handed over to BHEL / IBR authorities and due clearances obtained.
9.3.9	Results of these processes shall be verified / validated as per requirements of BHEL / Customer (NTPC).

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CHAPTER-X: PRESERVATION AND PROTECTION OF COMPONENTS

10.0	Preservation & Protection of Components: At all stages of work, equipment / materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL. Necessary preservation agents including the primer & paint, for the above work shall be provided by the contractor.
10.1	The contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipment from theft / fire / pilferage and any other damages and losses.
10.2	Contractor shall collect all scrap materials periodically from various area of work site, deposit the same at one place earmarked at work site or shift the same to a place earmarked in BHEL/ client's stores. In case of failure of contractor in compliance of this requirement, BHEL will make suitable arrangement at contractor's risk and cost.
10.3	The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc. for the materials issued by BHEL shall be returned to BHEL stores by the contractor.
10.4	The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/excess utilization of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.
10.5	For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL.

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CHAPTER-XI: OTHER IMPORTANT CONDITIONS

11.1	OTHER IMPORTANT CONDITIONS
11.1.1	In the event of any ambiguity or conflict between the Tender Documents, the order of precedence shall be as mentioned in Notice Inviting Tender (NIT).
11.1.2	Modification/ deletion of GCC Clauses for Section –A (SUPPLY PART):
11.1.2.1	Clause No. 2.12 (ORC) shall not be applicable.
11.1.2.2	Clause No. 2.13 (Interest bearing recoverable advance) shall not be applicable.
11.1.2.3	Clause No. 2.17 (PVC) shall not be applicable
11.1.3	Modification/ deletion of GCC Clauses for Section –B (E&C PART):
11.1.3.1	Clause No. 2.13 (Interest bearing recoverable advance) shall not be applicable.
11.1.3.2	Clause No. 2.17.5 of GCC (PVC) shall be modified as:- Base date shall be the calendar month of the schedule completion date of the contract. Schedule Completion date shall be the actual start date plus delivery period as defined in clause no 6.0 of TCC (Part-I).
11.1.3.3	Clause No. 2.17.9 of GCC shall be modified as:- PVC shall be applicable only for the extended period of contract (if any) after the schedule completion date. However, the total Quantum of Price Variation amount payable/recoverable shall be regulated as follows: For the portion of backlog attributable to the contractor, no PVC shall be paid. For the period of Force Majeure, the PVC (if applicable) will be limited to the indices applicable at the beginning of the force majeure period. For the portion of backlog attributable to BHEL, the PVC will be as per the indices applicable for the respective months 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. All other terms & conditions of Clause No. 2.17 of GCC shall remain same.
11.1.4	Modification/ deletion of SCC Clauses for Section –A & Section-B (i.e both SUPPLY PART and E&C PART):
	Clause No. 4.1.4, 4.1.9 & 4.1.10 (Consumables & Other Items) shall not be applicable.
11.1.6	Clause No. 8.3.2, 8.3.3 & 8.3.4 (Statutory Inspection of work) shall not be applicable.

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CHAPTER-XI: OTHER IMPORTANT CONDITIONS

11.2	Any other special requirement
11.2.1	THE PROCEDURE FOR SELECTION & FINALIZATION OF CONTRACTORS FOR PACKAGE-A &PACKAGE-B OF THIS TENDER FOR UNIT NO. 1 & 2 AT 2X800 MW, GADARWARA STPS OF NTPC, GADARWARA is as follows:
11.2.2	There will be two units of 800 MW each AT 2X800 MW GADARWARA STPS OF NTPC, GADARWARA, DISTT. NARSINGHPUR, M.P. Package A shall consist of Unit # 1 & Package B shall consist of Unit # 2
11.2.3	The two packages (Pkg A & Pkg B) shall be awarded to two separate contractors i. e. no single bidder shall be awarded more than one package.
11.2.4	Bidders may submit their offer either for both the packages or any one of the packages i.e. Package-A / Package-B given in this tender. However, Bidders shall specifically confirm in their bid that they have quoted for Package-A / Package-B or both of the tender.
11.2.5	Bidders shall submit price bid for each package separately by enclosing each price bid in a separate envelop, clearly indicating on cover of the envelop the respective package number(A/B) besides furnishing other requisite details.
11.2.6	RA/Price Bid opening for Package A shall be done first.
11.2.7	Party who is awarded the job of Package “A” shall not be considered for participating in RA/Price bid opening of package “B”.
11.2.8	There will be two separate Contracts (i.e for Supply part and E& C part) for each Package. All the contracts will individually be treated as a separate contract and Contract Agreement for each part shall be signed separately.
11.3	INSTRUCTIONS TO TENDERERS
11.3.1	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

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CHAPTER-XI: OTHER IMPORTANT CONDITIONS

	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.
11.3.2	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.
11.4	MATERIALS
11.4.1	The contractor shall at his own expenses provide all materials including paints, welding electrodes etc. required for the work. However for permanent works Structural Steel will be issued free of cost as per terms & conditions specified in clause No. 11.5 from BHEL / Customer stores or at a point instructed by BHEL.
11.4.2	All materials to be provided by the Contractor shall be of the best kind in conformity with the specifications laid down in the contract or as per relevant Indian standard and the Contractor shall, if requested by the BHEL Engineer, furnish proof to the satisfaction of Engineer that the materials so comply.
11.4.3	The Contractor shall, at his own expense and without delay, supply to the BHEL Engineer samples of materials proposed to be used in the works. The BHEL Engineer shall within seven days of supply of samples or within such further period as he may require will intimate to the Contractor in writing, whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the BHEL Engineer for his approval fresh samples complying with the specifications laid down in the Contract. Any delay in approval of samples (original or fresh ones) shall not make the contractor eligible for any compensation.
11.4.4	The BHEL Engineer shall have full powers for removal of any or all of the materials brought to site by the Contractor which are not in accordance with the

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CHAPTER-XI: OTHER IMPORTANT CONDITIONS

	Contract specifications or do not conform in character or quality to samples approved by him. In case of default on the part of the Contractor in removing rejected materials, the BHEL Engineer shall be at liberty to have them removed by other means. The BHEL Engineer shall have full powers to procure other proper material to be substituted for rejected materials and in the event of the Contractor refusing to comply, he may cause the same to be supplied by other means. All costs, which may attend upon such removal and / or substitution, shall be borne by the Contractor.
11.4.5	The Contractor shall indemnify BHEL, its representatives or employees against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties or other charges which may be payable in respect of any article or material or part thereof included in the Contract. In the event of any claim being made or action being brought against BHEL or any agent, servant or employee of BHEL in respect of any such matters as aforesaid, the Contractor shall immediately be notified thereof, provided that such indemnity shall not apply when such infringement has taken place in complying with the specific directions issued by BHEL but the Contractor shall pay any royalties or other charges payable in respect of any such use, the amount so paid will be reimbursed to the Contractor only if the use was the result of any drawings and / or specifications issued after submission of the tender.
11.4.6	The BHEL Engineer shall be entitled to have tests carried out as specified in the Contract for any materials supplied by the Contractor other than those for which, as stated above, satisfactory proof has already been furnished, at the cost of the Contractor and the Contractor shall provide at his expense all facilities which the BHEL Engineer may require for the purpose. If no tests are specified in the Contract, and such tests are required by the BHEL Engineer, the Contractor shall provide all facilities required for the purpose and the charges for these tests shall be borne by the Contractor only. The cost of materials consumed in tests shall be borne by the Contractor in all cases except when otherwise provided.
11.4.7	In addition the Contractor shall perform / submit at his own cost such tests / samples as may be required by the BHEL Engineer out of the materials used by

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	the company except for the costs of materials used in such tests / samples.
11.4.8	After acceptance of the Contract, if Contractor desires BHEL to supply any other materials, such material may be supplied by BHEL, if available, at rates to be fixed by the Engineer along with prevailing departmental charges (current rate of 30%). BHEL reserve the right not to issue any material. The non-issue of such material will not entitle the Contractor for any compensation whatsoever either in time or in cost.
11.4.9	Material required for the works, whether brought by the Contractor or supplied by BHEL, shall be stored by the Contractor only at places approved by the Engineer. Storage and safe custody of material shall be the responsibility of the contractor.
11.4.10	BHEL's officials concerned with the Contract shall be entitled at any time to inspect and examine any materials intended to be used in or on the works, either on the Site or at factory or workshop or other place(s) where such materials are assembled, fabricated, manufactured or at any place (s) where these are lying or from which these are being obtained and the Contractor shall give such facilities as may be required for such inspection and examination.
11.4.11	All materials brought to the Site shall become and remain the property of BHEL and shall not be removed off the Site without the prior written approval of the Engineer. But whenever the Works are finally completed and advance, if any, in respect of any such material is fully recovered, the Contractor shall at his own expense forthwith remove from the Site all surplus material originally supplied by him and upon such removal, the same shall re-vest in and become the property of the Contractor.
11.4.12	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 / TIG wires. 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 No. date of expiry etc. and produce test certificate for each lot / batch with correlation of batch / lot no. with respective test certificate. No electrode will be allowed to be used without valid test certificate.

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11.4.13	All charges on account of Octroi, terminal or sales tax and other duties on material obtained for the works from any source shall be borne by the contractor.
11.5	ISSUE AND ACCOUNTING OF STRUCTURAL STEEL (Issued as FOC item by BHEL)
11.5.1	Structural steel will be issued as free issue materials from BHEL stores or other issue points as specified by the BHEL Engineer. Such issues would be only for permanent works. Necessary indents shall be raised by the contractor as per procedure laid down by the BHEL Engineer-in-Charge about 7 days in advance of the actual requirement for incorporation in the works.
11.5.2	Materials will be issued only for permanent works and not for making templates, other temporary works, enabling works etc. and the same shall not be taken into account for purpose of material reconciliation.
11.5.3	The contractor shall bear all other costs including the lifting, carting from issue points to works site/contractor's stores, custody and handling etc. and return of surplus/serviceable materials to Owner's stores to be designated by the BHEL Engineer and all expenditure will be made by the contractor.
11.5.4	All steel shall be issued in available lengths / shapes and no claims for extra payment on account of issue of non-standard lengths/shapes will be entertained.
11.5.5	In the case of steel materials, the same shall be issued generally on the basis of linear measurement and the corresponding weight will be calculated as per Indian Standard. For the purpose of billing & accounting, only linear measurement will be taken and any difference in weight based on linear measurement & actual weight shall be to contractor's account. Quoted price shall be deemed to include the above & the permissible wastage mentioned. No claim whatsoever shall be entertained on account of wastage & difference in weight as referred to above.
11.5.6	Issue of stores material is subject to availability and the contractor shall not be entitled to any claim or compensation for non-supply or delay in the supply under any circumstances. The material will be issued generally during the working hours.
11.5.7	The Contractor shall bear all incidental costs including site lifting, carting from issue points to site / contractor's store, custody and handling etc., and return of

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	surplus / serviceable / scrap materials to Owner's Storage points designated by the Owner etc. and no separate payment for such expenditure shall be made
11.5.8	The contractor shall submit proper account of material / material reconciliation statement for the material drawn by him from stores with every Running Account (RA) Bill. Failing compliance of this requirement further issue of steel to the contractor may be suspended and no claim of compensation for delay in execution on this account shall be entertained.
11.5.9	The Structural steel (Raw Materials) thus issued for Fabrication shall be properly accounted for as per the permissible maximum allowable wastage of 4% over the theoretical quantity / consumption incorporated in the works.
11.5.10	Any unused / serviceable quantity of Structural Steel not returned in good condition & wastages / loss / consumption beyond specified / agreed limit shall be charged at penal rate of Rs. 70,000 per MT for structural steel at the time of preparing final bill, during finalization of the contract. The decision of BHEL Engineer with regard to applicability of penal rates shall be final & binding upon the contractor.
11.5.11	Since the Structure Steel is being issued free of cost, the scrap generated shall belong to BHEL. All Structural steel of length above 2 Metre shall be considered as serviceable materials provided the materials are in good and acceptable condition. Structural Steel in length less than 2 Metre shall be treated as scrap.
11.6	SETTING OUT
11.6.1	All the works shall be set out to the true lines, grades and elevation indicated on the drawing. The contractor shall be responsible to locate and set out the works. Only one grid reference line and bench mark shall be made available for setting out the works under the contract. This reference lines shall be used as datum for the works under the contract and the contractor has to establish for his work area at available points horizontal and vertical control points. The contractor shall inform BHEL well in advance of the times & places at which he wishes to do work in the area allotted to him so that suitable datum points established by him are checked by BHEL / Customer to enable the contractor to proceed with the works. Any work done without being properly located may be removed and / or

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	dismantled by BHEL / Customer at contractor's expense.
11.6.2	The contractor shall at his own expense take all proper and reasonable precautions to preserve and maintain these datum marks to its true position. In the event of these marks being disturbed or obliterated by accident or due to any other cause whatsoever, the same may be deemed necessary placed by BHEL / Customer at contractor's expenses.
11.7	SITE DRAINAGE
11.7.1	All water including sub-soil water which may accumulate on the Site during the progress of the works or in trenches and excavations, including monsoon period shall be removed by the contractor from the Site to the satisfaction of the BHEL Engineer.
11.8	INSPECTION AND STAGE APPROVAL OF THE WORK
11.8.1	The owner or his duly authorized representative shall have at all reasonable times access to the contractor's premises or works and shall have the power to inspect drawings or any portion of the work, examine the materials and workmanship and shall have the authority to reject any work. This would be implemented through joint inspection by the representative of the owner and BHEL and in the form of joint protocols without any extra claims and loss of time and amount.
11.8.2	All work embracing more than one process shall be subject to examination and approval at each stage thereof and the Contractor shall give due notice in writing to the BHEL Engineer when each stage is ready. In default of such notice being received, the Engineer shall be entitled to approve the quality and extent thereof at any time he may choose and in the event of any dispute, the decision of the Engineer thereon shall be final and conclusive.
11.9	NUISANCE
11.9.1	The Contractor shall not at any time do, cause or permit any NUISANCE on Site or do anything which shall cause unnecessary disturbance or inconvenience to owners, tenants or occupiers of other properties near the Site and to the public generally.
11.10	TREASURE , TROVE , FOSSILS etc.

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11.10.1	All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall be the absolute property of BHEL / BHEL's client and the Contractor shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing, shall immediately upon discovery thereof and before removal acquaint the BHEL Engineer with such discovery and carryout the BHEL Engineer's directions as to the disposal of the same.
11.11	PROTECTION OF WORKS
11.11.1	Trees designated by the BHEL Engineer shall be protected from damage during the course of the Works and earth level within 1 meter of each such tree shall not be charged. Where necessary, such trees shall be protected by providing temporary fencing.
11.11.2	The contractor shall provide and maintain at his own expense all lights, guards, fencing and watching when and where necessary or required by the BHEL Engineer for the protection of the Works or for the safety and convenience of those employed on the Works or the public.
11.11.3	The contractor shall have total responsibility for protecting his works till it is finally taken over by the BHEL Engineer. No claim will be entertained by the BHEL Engineer for any damage or loss to the contractor's works and the contractor shall be responsible for the complete restoration of the damaged works to its original condition to comply with the specifications and drawings. Should any such damage to the contractor's works occur because of other party not under his supervision or control, the contractor shall make his claim directly with the party concerned. The contractor shall not cause any delay in the repair of such damaged works because of any delay in the resolution of such disputes. The contractor shall proceed to repair the work immediately and no cause thereof will be assigned pending resolution of such disputes.
11.12	RECORD FOR MATERIALS CONSUMED
11.12.1	The contractor shall maintain and furnish to the BHEL Engineer the RECORD OF

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	MATERIALS consumed in the works for each activity. The statement showing the theoretical vis-à-vis actual consumption of specified materials, such as structural /reinforcement steel, cement, bitumen, lead, paint etc., shall be enclosed along with the running bills submitted by the contractor. Contractor has to also furnish the test results of the materials used in the work as per IS specifications.
11.13	PROTECTION OF EMBEDMENTS, BOLTS ETC.
11.13.1	The contractor shall ensure proper protection to the satisfaction of the BHEL Engineer, of all bolts, inserts, embedment etc. from weather etc / by greasing, rapping them with gunny bags or canvas or by any other means as directed by BHEL Engineer. Cost of such protections shall be deemed to be included in the rates quoted for the item.
11.14	CLEARANCE OF SITE AND REPAIRS
11.14.1	Contractor has to clear the site / area where mechanical and electrical erection work is to be commenced / or in progress. The contractor shall remove construction materials and equipment lying in the vicinity and causing obstruction in the erection work within 24 hrs. Notice. In case, he fails to clear the site, this will be done at his risk & cost by BHEL.
11.15	QUALITY ASSURANCE
11.15.1	The contractor has to establish / arrange at site the field testing facilities for testing of civil construction materials and concrete cubes for ensuring the proper quality, grade and strength of the materials used in the construction in line with approved field quality check list of BHEL/ its client. Contractor has to submit detailed report for testing of all material used etc. All testing shall be done as per IS code specifications/ BHEL approved quality plan. If further test is required by the BHEL Engineer to be carried from outside laboratory, the cost of the same shall be borne by the contractor.
11.16	COMPLETION OF WORK
11.16.1	The works shall be completed to the entire satisfaction of the Engineer and in accordance with the completion schedule as specified in the Contract, and all unused stores and materials, tools, plant, equipment, temporary buildings, site

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	office, labor hutments and other things shall be removed and the site and work cleared of rubbish and all waste materials and delivered up clean and tidy to the satisfaction of the BHEL Engineer at the Contractor's expenses.
11.16.2	BHEL shall have power to take over from the Contractor from time to time such sections of the work as have been completed to the satisfaction of the BHEL Engineer. Such work however shall not be treated as have been completed until the extra works are executed to the satisfaction of BHEL Engineer. The Guarantee period shall commence only after handing over of the entire works.
11.16.3	The BHEL Engineer shall certify to the contractor the date on which the work is completed and the date thereof.
11.17	DEVIATION
11.17.1	The Contractor shall not make any alteration in, addition to or omission from the work as described in the tender documents except in pursuance of the written instructions of the BHEL Engineer. No such deviation from the work described in the tender documents shall be valid unless the same has been specifically confirmed and accepted by the BHEL Engineer in writing and incorporated in the Contract.
11.17.2	The BHEL Engineer may deviate, either by way of addition or deduction, from the work so described, provided that the Contract sum be not thereby varied on the whole by more than the percentage set out in the tender documents. The value of all additions and deductions shall be added to or deducted from the Contract sum. (Whenever the BHEL Engineer intends to exercise such a right his intentions shall specify the deviations which are to be made, the lump-sum assessment or the proposed basis of payment, the extra time allowed, if any, and the date for completion of the entire contract). Any objection by the contractor to any matter concerning the order shall be notified by him in writing to the BHEL Engineer within seven days from the date of such order, but under no circumstances shall the work be stopped (unless so ordered by the BHEL Engineer) owing to differences or controversy that may arise from such an objection. In the absence

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-XI: OTHER IMPORTANT CONDITIONS

	of such a notification of objection by the Contractor, he will be deemed to have accepted the order and the conditions stated therein.
11.17.3	Valuation of Deviations shall be as per Clause 2.15 & 2.16 of GCC.
11.18	COMPLIANCE TO REGULATIONS AND BYELAWS
11.18.1	The Contractor shall conform to the provisions of any statute relating to the work and regulations and bylaws of any local authority and of any water and lighting Companies or Undertaking with whose system the work is proposed to be connected. He shall, before making any variation from the drawings or the specifications that may be necessitated for such connections, give the BHEL Engineer, notice specifying the variation proposed to be made and the reasons therefore and shall not carryout any such variation until he has received instructions from the BHEL Engineer in respect thereof. The Contractor shall be bound to give all notices required by statute, regulations or bye-laws as aforesaid and to pay all fees and taxes payable to any authority in respect thereof.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CHAPTER-XII: BOQ CUM RATE SCHEDULE

ANNEXURE-A: BOQ CUM RATE SCHEDULE- UNIT# 1

ANNEXURE-B: BOQ CUM RATE SCHEDULE- UNIT#2

RATE SCHEDULE FOR PACKAGE –A (UNIT No. 1)

ITEM NO.	Description of Item	QTY	Total Amount "A" in Rupees (in figures and words)
	PACKAGE-A		
1.0	Lumpsum price for complete scope of work for "Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Transfer Points, Trestles and Conveyor Galleries and Misc. Civil Works for Unit # 1 at 2X800 MW NTPC Gadawara Super Thermal Power Station."	1 set	
	Note: The rates of different items for the entire scope shall be worked out & awarded as per " Annexure A "		
Name -:			
Place -:			
Date-:			
Signature of the Bidder With Stamp			

BOQ CUM RATE SCHEDULE- UNIT# 1

Project: 2X800 MW NTPC GADARWRA Super Thermal Power Project

BOQ cum Rate Schedule for the Works of "Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its supporting Trestles of Bunker Structures, Miscellaneous Platform Structures and Other Miscellaneous Civil Works including supplying materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. and Misc. Fabrication works for Unit # 1 at 2X800 MW NTPC Gadawara Super Thermal Power Station."

SECTION A: SUPPLY PART

Brief description of SECTION A: Supply Part :- Supply of Materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. for Bunker Structures, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures, Miscellaneous Platform Structures, Other Miscellaneous Civil Works including procurement of Raw Material, loading, transportation and handling etc. & receipt of the same at site all complete as per specifications, drawings and as directed by BHEL Engineer for **Unit # 1 of 2X800 MW NTPC GADARWARA STPP.**

A	SUPPLY					
ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 700: MS EMBEDMENTS						
	Embedments including all labour, material, equipment, transportation of finished products (from workshop to site), handling etc. at any level as per specification, drawings and as directed by BHEL-Engineer.					
A 701	Total firm price on FOR basis for Supplying MS Embedments, inserts, pipe sleeves, angle pieces, rungs of various diameters, plates of dimensions as required etc. including painting, complete as per specifications, drawings and as directed by BHEL Engineer.	MT	53	34.084		
A 702	Total firm price on FOR basis for Supplying Fabricated Mild Steel foundation bolt assembly of Grade 4.6 conforming to IS:5624 along with nuts, lock nuts (as per IS:1363, 1364 and IS:3138), washers, anchor plates, stiffner plates, protective tape, pipe sleeves, primer, etc. for columns including pipe sleeves, templates wherever necessary etc. all complete as per specifications and as directed by the BHEL Engineer. All threaded and other surfaces of foundation bolts and its materials, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive measures. Work to include preparation of fabrication detailed drawings.	MT	50	42.262		
A 703	Total firm price on FOR Site basis for Supply of following items for all kind of works, as per specifications, drawings and as directed by BHEL Engineer.			-		
a	MS pipes of all diameters	KG	5350	0.042		
b	PVC pipes / conduits of all diameters	KG	100	0.087		
c	UPVC pipes / conduits of all diameters	KG	100	0.087		
d	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for brick work with expansion sleeve of A6 polyamide:			-		
i)	Upto 250 kg	EACH	15	0.135		
ii)	Beyond 250 Kg and upto 500 kg	EACH	4	0.21		
iii)	Beyond 500 Kg and upto 750 kg	EACH	4	0.337		
e	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for concrete work with expansion sleeve of stainless steel:			-		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
i)	Upto 250 kg	EACH	35	0.16		
ii)	Beyond 250 Kg and upto 500 kg	EACH	31	0.24		
iii)	Beyond 500 Kg and upto 750 kg	EACH	31	0.38		
A 800 GROUTING				-		
	Supplying Grouting material including labour, material, equipment, transportation of material at site as per specification, drawings and as directed by BHEL Engineer.			-		
A 801	Total firm price on FOR Site basis for Supplying the complete grouting material for grouting of pocket holes, pipe sleeves and under base plate of structural steel work / machinery / pipe supporting structures with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture . Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade). (Measurement shall be done after Grouting at Site and payment shall be released as per the actual Quantity of Grouting executed).	CUM	30	7.12		
A 802	Total firm price on FOR Site basis for Supplying the complete grouting material for grouting of pocket holes, pipe sleeves and under base plates of structural steel work / machinery / pipe supporting structures with Conbextra GP-1 or equivalent . (Measurement shall be done after Grouting at Site and payment shall be released as per the actual Quantity of Grouting executed)	CUM	20	26.189		
A 803	Total firm price on FOR Site basis for Supplying the complete grouting material for grouting of pocket holes, pipe sleeves and under base plates of structural steel work/ machinery/ pipe supporting structures with Conbextra GP-2 or equivalent . (Measurement shall be done after Grouting at Site and payment shall be released as per the actual Quantity of Grouting executed)	CUM	8	29.08		
A 900: DOORS, WINDOWS, VENTILATORS, LOUVERS				-		
	Doors, windows, ventilators, louvers, roof ventilators, rolling shutters, partitions including all labour, material, equipments, transportation, handling, preparation of working drawings etc. as per specification, drawings and as directed by BHEL Engineer.			-		
A 901	Total firm price on FOR Site basis for Supplying, Fabricated Single or Double steel door shutters with 45mm thk flush design shutter comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150 mm on centres including void filled with mineral wool (density as per specification), all fittings, Godrej or equivalent make mortice lock with handle on both sides, primer, painting etc. all complete as per specifications.	SQM	30	2.85		
A 902	Total firm price on FOR Site basis for Supplying, Fabricated Fire Proof steel doors (single or double shutter) with panic devices shall be 45 mm thk flush design comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150 mm on centers including all fittings, primer & shop painting with approved post office/signal red color fire resistant paint and mineral wool insulation (64 kg/cum density) complete and shall be fire proof as per IS:3614, TAC requirements and as per specification. Minimum ratings shall be 2 Hrs.	SQM	20	7.216		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 903	Total firm price on FOR Site basis for Supplying Steel Windows/Ventilator with steel sections as per IS:1038, IS:1361 & IS:7452 latest revision including all fittings, metal beadings, hold fasts, shop, primer painting, wire mesh wherever required, glazing etc. all complete. (Glazing shall be paid separately)			-		
a	Openable type	SQM	166	1.369		
b	Fixed type	SQM	111	1.310		
A 904	Total firm price on FOR Site basis for Supplying pressed steel frames , fabricated from 16 gauge M.S sheet mortised , reinforced drilled and tapped for hinges and locks bolts, strikes, hold fasts adjustable floor anchors, floor tiles/weather bars ,paintings etc. all complete as per specifications.	KG	150	0.05		
A 905	Total firm price on FOR Site basis for Supplying glazing of first grade / class in steel/aluminium/wooden frames, where ever required including hardware, gaskets, clips, beadings etc. all complete as per drawing, specifications.			-		
a	6 mm thick wired glass	SQM	40	0.37		
b	6mm thick multi (twin) wall fire retardant (Continuous use under temperature 100 degree C), impact resistant and ultraviolet resistant polycarbonate sheet with sealed open edegs.	SQM	175	1.03		
A 906	Total firm price on FOR Site basis for Supplying Steel Louvered Window with mild steel frames all round including verticals with pressed steel louvers, painting etc. all complete.	KG	5000	0.03		
A 1500: ROOFING / SIDE CLADDING				-		
	Roofing / side cladding including all labour, material, equipment, transportation (from workshop to site), handling, scaffolding, laps, hooks, washers, corner pieces, flashing, capping, trimming, closure for vertical / horizontal joints, ridges, hips etc. at any level as per specification, drawings and as directed by BHEL Engineer.			-		
A 1501	Total firm price on FOR Site basis for Supplying thermally insulated sandwiched metal cladding for roofs with troughed profile permanently colour coated sheet on outside (External sheet) and plain permanently colour coated sheet on inside (Internal Sheet) with 50 mm thick mineral wool insulation in between the two sheets. Outside sheeting of cladding system shall have troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326. Continued..	SQM	3369	1.47		
	Inside sheeting of cladding system shall have plain profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326. Out side and Inside Steel Sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. (SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728) . Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling, transportation. Mineral wool shall conform to IS : 8183, having a density of 32 Kg/Cu.M. for glass wool & 48 Kg/Cu. M. for rock wool. This shall include supply of corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification . Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done .					
A 1502	Total firm price on FOR Site basis for Supplying shear connectors of mild steel studs having 16 mm dia and minimum 75 mm projected length above purlin passing through metal decking as per relevant IS codes and specification.	KG	3000	0.036		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 1503	Total firm price on FOR Site basis for Designing, Supplying Single Sheet Metal Cladding for Roof, External Walls , Internal Walls , ridge, hips, flashing/trimming /closure for vertical/ horizontal joints, capping, etc. with troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 . The troughed profile steel metal sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728. Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling. This shall include supply of corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification . Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done .	SQM	8000	0.64		
A 1504	Total firm price on FOR Site basis for Supplying Side/Roof Cladding with troughed translucent sheets of Polycarbonate material including laps, hooks, washers, corner piece etc. at all elevations complete as per specification, drawing and as directed by the BHEL Engineer for the following.			-		
(i)	2 mm thick fire retardant and ultraviolet resistant translucent polycarbonate clean sheet of GE plastic or equivalent approved make.	SQM	900	0.345		
1700 RAIN WATER DOWN TAKE PIPES				-		
A 1701	Total firm price on FOR Site basis for Supplying hot dip galvanised MS down take pipes of 150 mm NB - Medium quality as per IS:1239 (part-I) all complete.The minimum coating of Zinc shall be of 610 gm/Sqm and shall comply with IS:4759 and other relevant codes.	RM	1200	0.92		
A 1800: MISCELLANEOUS WORKS				-		
A 1801	Total firm price on FOR Site basis for Designing and supplying of Heavy duty galvanised chemical anchor fasteners of Hilti/Equivalent make of 12 mm diameter and appropriate length in concrete (minimum grade M20) to take direct tension of minimum 1 MT including anchor fastener, materials, equipment, labour etc. complete as per direction of BHEL-Engineer.	EACH	6	0.38		
A 1802	Total firm price on FOR Site basis for Supplying of complete Raw materials for Concrete of grade M-25 conforming to IS:456 with coarse sand and graded hard stone aggregate 20 mm nominal size in foundations/Sub Structure/ Super Structure etc. at any level, any shape, position or thickness etc. complete including shuttering, curing, reinforcement, use of plasticizer/ superplasticizer conforming to IS:9103 (latest) to achieve required slump in concrete all complete and as directed by BHEL Engineer. (Measurement shall be done after completion of concreting at Site and payment shall be released as per the actual Quantity of concrete executed)	CUM	30	2.35		
A 2300: STRUCTURAL STEEL				-		
	Structural steel works including all labour, material, equipments, transportation of finished products (from storage yard to site), handling etc. at any level as per specification, drawings and as directed by BHEL Engineer.			-		
A2301	Total firm price on FOR Site basis for Supplying Chlorinated Rubber based Zinc Phosphate Primer to be applied after Manual cleaning of steel structures embedded in concrete. Primer Coat of Chlorinated Rubber based Zinc Phosphate primer of 50 micron (DFT) shall be applied. (Measurement shall be done after application of primer. Payment shall be released as per the actual quantity of primer work executed)	MT	465	0.632		
A 2302	Total firm price on FOR Site basis for Supplying Intermediate Coat, Finish Coat and Final Finish Coat of paints to be applied over steel surfaces (already applied with primer coat) :-			-		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
(i)	Intermediate Coat: Intermediate Coat of Polyamide Cured pigment Titanium Di-Oxide (TiO2) or Micaceous Iron Oxide (MIO) Epoxy Based Paint (Solid by Volume minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in shop after an interval of minimum overnight (after the application of primer coat) by Airless Spray Technique. Color and Shade of the Coat shall be as approved by the BHEL Engineer. Work shall include protection, cleaning, scaffolding etc. all complete. (Measurement shall be done after application of paint over the steel structure surfaces. Structure Steel in MT shall be measured for the painting work and payment shall be released as per the actual quantity of painting work executed)	MT	260	1.01		
(ii)	Finished Coat: Intermediate coat shall be followed with the application of Finished Coat of Polyamide cured Color pigment Epoxy based paint (solid by volume Minimum 60%) of minimum 75 micron DFT. This coat shall be applied after an interval of minimum overnight and maximum indefinite (from application of Intermediate coat) either before Erection by Airless Spray technique or after Erection by Brush and / or spray. The finished coat thickness of 75 Micron can be built up either application at shop / yard or in two applications one at shop / yard and other at Site. (Measurement shall be done after application of paint. Payment shall be released as per the actual quantity of painting work executed)			-		
	a) First Coat Application at shop / Yard of minimum 35 Micron DFT	MT	260	0.47		
	b) Second Coat Application at Site of Minimum 40 Micron DFT	MT	9160	0.54		
(iii)	Final Finish Coat: Finished coat shall be followed with the application of Final finish coat polyurethane based colour pigment paint (solid by volume minimum 40%) of minimum 25 micron DFT. This coat shall be applied within seven days from completion of finish coat, after Erection by brush and or spray, Color and shade of the coat shall be as approved by BHEL Engineer. Work shall include touch up paint, protection, cleaning, scaffolding etc. all complete. (Measurement shall be done after application of paint. Payment shall be released as per the actual quantity of painting work executed)	MT	9160	0.34		
A 2303	Total firm price on FOR Site basis for Supplying factory made Electro-forged grating units with mild steel conforming to IS : 2062 at all elevation. Grating units shall be blast cleaned to Sa 2 1/2 finished (Swedish standard SIS-05-5900) and hot-dipped galvanised (galvanisation of 610 gms/sqm) in flooring, platforms, drain and trench covers, walk-ways, passages, staircases with edge binding strips and anti-skid nosing in treads etc. including fixing clamps, fittings, fixtures, packing, grinding, drilling, welding, edge preparation, etc. all complete.	MT	163	55.156		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 2304	Total firm price on FOR Site basis for Supply of permanent mild steel bolts (class 4.6 as per IS : 1367 and grade 'C' as per IS: 1363) and nuts, washers etc. up to and inclusive of 39 mm diameter and up to 300mm long for structural steel work etc. all complete	KG	1050	0.0489		
A 2305	Total firm price on FOR Site basis for Supplying high strength structural bolts (of property class 8.8 and product grade 'C' as per IS: 1367) and conforming to IS: 3757 and high strength structural hardened and tempered nuts (of property class '8' as per IS:1367) conforming to IS:6623 with hardened and tempered washers as per IS:6649 etc. up to and inclusive of 39 mm diameter and up to 300 mm long for structural steel work etc all complete.	KG	15300	0.11		
A 2306	Total firm price on FOR Site basis for Supplying PTFE type sliding bearings of reputed manufacturer , individual bearing suitable for required vertical loads as per the construction drawings and for maximum displacement of ±50 mm including all taxes, duties etc. for following vertical loads.			-		
a	40 Tons	EACH	5	12.65		
b	50 Tons	EACH	5	13.234		
c	60 Tons	EACH	5	16.24		
d	70 Tons	EACH	5	18.945		
e	80 Tons	EACH	5	21.65		
A 2307	Total firm price on FOR Site basis for Supplying flexible open ended bellow strap of neoprene of minimum thickness 2 mm and minimum width 200 mm with aluminium stripped edges as sealing below top of bunker and bottom of tripper floor to avoid the coal dust nuisance all complete as per specifications and as directed by BHEL Engineer.	RM	350	0.53		
A 2308	Total firm price on FOR Site basis for Supplying Mild steel pipe (medium class) hand railing for staircase, ladders, opeings, etc. with kick plates , galvanized at the rate of 610 Gms/Sq M. as per IS 4736 all complete as per the specifications and as directed by BHEL Engineer, of following size pipes:			-		
a	32 mm nominal bore pipe-medium grade	MT	13	42.385		
b	40 mm nominal bore pipe- medium grade	MT	8	42.385		
	Total Amount- Section A (Rs.)					

SECTION B: E & C PART

Brief description of SECTION B: E & C Part :- Receipt, loading, transportation, unloading, preservation and handling at site etc. of finished materials of Bunker Structures, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures supplied by BHEL units, raw materials supplied by BHEL from BHEL stores / yard and materials supplied by the contractor. Pre assembly, Erection, Alignment, Bolting/ Welding/ Fastening, Grouting, Testing, Painting and Handing Over of Bunker Structures, Raw coal bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures, Miscellaneous Platform Structures including Miscellaneous Civil Works etc. at site all complete as per Specifications, Drawings and as directed by BHEL Engineer for **Unit # 1 of 2X800 MW NTPC GADARWARA STPP.**

B	E&C PART					
ST. NO	DESCRIPTION OF ITEM	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 700 MS EMBEDMENTS						
B 701	Fabricating, Fixing / Erection, Installation and Alignment of mild steel embedments, inserts, pipe sleeves, angle pieces, rungs of various diameters, plates of dimensions as required etc. including welding, bolting, cutting, drilling, scaffolding, setting etc. all complete. (Supply of Embedments, inserts etc. is covered under Section A "Supply Part")	MT	53	8.52		
B 702	Fabrication, Fixing / Erection, Installation and Alignment of following items in concrete / brickwall for all kind of works, including setting material in concrete, layout, scaffolding, cutting, forming, grinding, drilling, bolting, welding, jointing, testing, primer, painting etc. all complete. as per specifications, drawings and as directed by BHEL Engineer. (Supply of materials is covered under Section A "Supply Part")			-		
a	MS pipes of all diameters	Kg	5350	0.01		
b	PVC pipes / conduits of all diameters	Kg	100	0.022		
c	UPVC pipes / conduits of all diameters	Kg	100	0.022		
d	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for brick work with expansion sleeve of A6 polyamide:			-		
i	Upto 250 kg	Each	15	0.034		
ii	Beyond 250 Kg and upto 500 kg	Each	4	0.053		
iii	Beyond 500 Kg and upto 750 kg	Each	4	0.084		
e	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for concrete work with expansion sleeve of stainless steel:			-		
i	Upto 250 kg	Each	35	0.04		
ii	Beyond 250 Kg and upto 500 kg	Each	31	0.06		
iii	Beyond 500 Kg and upto 750 kg	Each	31	0.10		
B 703	Prestressing, Placing and releasing of Vibration Isolation Spring modules over the FAN foundation at all elevations including providing all assistance under the supervision of the VIS supplier, transportation from BHEL store, necessary staging, platforms, leveling, alignment etc. all complete. (Vibration Isolation springs shall be issued Free of cost by BHEL)	Each	248	0.75		
B 800 GROUTING						
	Grouting including all labour, material, equipment, roughening surface, cleaning, ramming, curing etc. at any level unless otherwise specified as per specification, drawings and as directed by BHEL Engineer.			-		
				-		
B 801	Grouting of pocket holes, pipe sleeves and under base plate of structural steel work / machinery / pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture. Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade). (Supply of Grouting Material is covered under Section A "Supply Part", cleaning of the pockets by compressed air shall be in the scope of the contractor).	CUM	30	1.78		
B 802	Grouting of pocket holes, pipe sleeves and under base plates of structural steel work / machinery / pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. all complete with ConbextraGP-1 or equivalent . (Supply of Grouting Material is covered under Section A "Supply Part", cleaning of the pockets by compressed air shall be in the scope of the contractor).	CUM	20	6.547		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 803	Grouting of pocket holes, pipe sleeves and under base plates of structural steel work/ machinery/ pipe supporting structures including roughening of surface, cleaning, ramming, curing, etc. all complete with Conbextra GP-2 or equivalent . (Supply of Grouting Material is covered under Section A "Supply Part", cleaning of the pockets by compressed air shall be in the scope of the contractor).	CUM	8	7.27		
B 900: DOORS, WINDOWS, VENTILATORS, LOUVERS						
	Fixing Doors, windows, ventilators, louvers, roof ventilators, rolling shutters, partitions including all labour, material, equipments, transportation (at site), handling, preparation of working drawings etc. at any level as per specifications, drawings and as directed by BHEL Engineer.			-		
B 901	Fixing / Erection, Installation and Alignment of single or double steel door shutters with 45mm thk flush design shutter comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150 mm on centres including void filled with mineral wool (density as per specification), all fittings, Godrej or equivalent make mortice lock with handle on both sides, shop and final painting etc. all complete. (Supply of fabricated door shutters in covered under Section A "Supply Part")	SQM	30	0.714		
B 902	Fixing / Erection, Installation and Alignment of fire proof steel doors (single or double shutter) with panic devices shall be 45mm thk flush design comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150mm on centers including all fittings, shop painting with approved post office/signal red color fire resistant paint, final painting (at site) and mineral wool insulation (64 kg/cum density) complete and shall be fire proof as per IS:3614, TAC requirements and as per specification. Minimum ratings shall be 2 Hrs. (Supply of Fabricated fire proof doors is covered under Section A "Supply Part")	SQM	20	1.805		
B 903	Fixing / Erection, Installation and Alignment of steel windows / ventilator with steel sections as per IS:1038, IS:1361 & IS:7452 latest revision.including all fittings, metal beadings, hold fasts, shop and final painting , wire mesh wherever required, glazing etc. all complete as per specifications. (Glazing shall be paid separately). (Supply of steel windows / ventilators is covered under Section A "Supply Part")			-		
a	openable type	SQM	166	0.342		
b	fixed type	SQM	111	0.33		
B 904	Fixing / Erection, Installation and Alignment of pressed steel frames fabricated from 16 gauge M.S sheet mortised, reinforced drilled and tapped for hinges and locks bolts strikes, hold fasts adjustable floor anchors, floor tiles/weather bars ,paintings etc. all complete as per specifications. (Supply of pressed steel frames is covered under Section A "Supply Part")	Kg	150	0.015		
B 905	Cutting, Fixing and fitting of glazing of first grade class in steel / aluminium / wooden frames, where ever required, cleaning after fixing including hardware, gaskets, clips, beadings etc. all complete as per specifications. (Supply of Glazing is covered under section A "Supply Part")			-		
a	6 mm thick wired glass	SQM	40	0.09		
b	6 mm thick multi (twin) wall fire retardant (Continuous use under temperature 100 degree C), impact resistant and ultraviolet resistant polycarbonate sheet with sealed open edgcs.	SQM	175	0.26		
B 906	Fixing / Erection, Installation and Alignment of steel louvered window with mild steel frame all round including verticals with pressed steel louvers, paintin etc. all complete. (Supply of steel louvered window with mild steel frame all round is covered under section A "Supply Part")	KG	5000	0.01		
B 1000: BRICKWORK						
B 1001	Breaking of existing brick work at all levels including plastering, removing the rubbish up to a distance of 500 m including transportation, loading, unloading etc. all complete as directed by the BHEL Engineer.	CUM	3	0.53		
B 1002	Making openings in existing brick wall or partition wall including making good the broken edges/surface with cement mortar etc. complete.	CUM	3	0.71		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 1500: ROOFING / SIDE CLADDING						
	Erecting Roofing / side cladding work including all labour, material, equipment, transportation (at site), handling, scaffolding, laps, hooks, washers, corner pieces, Flashing, capping, trimming, closure for vertical / horizontal joints, ridges, hips etc. at any level as per specification, drawings and as directed by BHEL Engineer.			-		
B 1501	Fixing / Erection, Installation and Alignment of thermally insulated sandwiched metal cladding for roofs with troughed profile permanently colour coated sheet on outside (External sheet) and plain permanently colour coated sheet on inside (Internal Sheet) with 50 mm thick mineral wool insulation in between the two sheets. Outside sheeting of cladding system shall have troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 . Continued.. Inside sheeting of cladding system shall have plain profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326. Out side and Inside Steel Sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. (SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728) . Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling. Mineral wool shall conform to IS : 8183, having a density of 32 Kg/Cu.M. for glass wool & 48 Kg/Cu. M. for rock wool. The work shall include fixing to supports / rails by concealed fixing system, corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification .Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done . (Supply of fabricated thermally insulated sandwiched metal cladding is covered under Section A "Supply Part")	SQM	3369	0.368		
B 1502	Fixing and fitting of shear connectors of mild steel studs having 16mm dia and minimum 75 mm projected length above purlin passing through metal decking as per relevant IS codes and specification. (Supply of shear connectors of mild steel studs is covered under Section A "Supply Part")	Kg	3000	0.01		
B 1503	Fixing / Erection, Installation and Alignment of single sheet metal cladding for roof, external walls , internal walls, ridge, hips, flashing / trimming / closure for vertical / horizontal joints, capping, etc, with troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6 mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 . The troughed profile steel metal sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728. Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling. The work shall include fixing to supports, corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification . Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done . (Supply of fabricated single sheet metal cladding is covered under Section A "Supply Part")	SQM	8000	0.16		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 1504	Fixing / Erection, Installation and Alignment of Side/Roof Cladding with troughed translucent sheets of Polycarbonate material including laps, hooks, washers, corner piece etc. at all elevations complete as per specification, drawing and as directed by the engineer for the following. (Supply of Fabricated Side / Roof Cladding with translucent sheets of Polycarbonate material is covered under Section A "Supply Part")			-		
(i)	2 mm thick fire retardant and ultraviolet resistant translucent polycarbonate clean sheet of GE plastic or equivalent approved make.	SQM	900	0.086		
B 1700: RAIN WATER DOWN TAKE PIPES				-		
B 1701	Fixing hot dip galvanised MS down take pipes of 150 mm NB - Medium quality as per IS:1239 (part-I) all complete. The minimum coating of Zinc shall be of 610 gm/Sqm and shall comply with IS:4759 and other relevant codes.	RM	1200	0.232		
B 1800 MISCELLANEOUS WORKS				-		
	Miscellaneous works including all labour, material, equipment etc. at any level unless otherwise specified as per specification, drawings and as directed by engineer - in - charge.			-		
B 1801	Concrete of grade M-25 conforming to IS:456 with coarse sand and graded hard stone aggregate 20 mm nominal size in foundations/Sub Structure/ Super Structure etc. at any level, any shape, position or thickness etc. complete including shuttering, curing, reinforcement, use of plasticizer/ superplasticizer conforming to IS:9103 (latest) to achieve required slump in concrete all complete and as directed by BHEL Engineer. (Supply of Raw Materials for Concreting e.g. Coarse Sand, Cement, Aggregates, Reinforcement, Shuttering etc. is covered under Section A "Supply Part")	CUM	30	0.59		
B 1802	Dismantling concrete work for all types of structures at all levels including stacking of servicable material to a lead of 500 m and disposal of unservicable material upto a lead of 2 km , cutting of reinforcement, labour, equipment, safety precautions etc. all complete as per drawings, specification and instructions of BHEL Engineer. (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)			-		
(i)	Plain cement concrete of all grades	CUM	3	1.12		
(ii)	Reinforced cement concrete of all grades	CUM	28	1.577		
B1803	Chipping of concrete in reinforced concrete work, cutting pockets, making openings at all levels and according to shapes, disposal of waste materials upto a lead of 2 km as directed by engineer including equipment, safety precautions, making good the broken surface etc. all complete as per specification, drawing, instructions of BHEL Engineer but excluding cutting of reinforcement . (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)	CUDM	50	0.06		
B 1804	Extra over and above ST. NO. 1803 for cutting of reinforcement, all sizes and types including labour, equipment, return of cut reinforcement to store etc. all complete as per specification, drawings and instructions of engineer in charge. Measurement shall be on the cross sectional area of reinforcement cut. (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)	SQCM	25	0.065		
B 1805	Cutting Reinforced concrete with mechanised tools like Core drilling machine etc. for cutting pockets, holes, cores in slab, beam, column or foundation as per direction of engineer in charge. (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)	CUDM	5	0.06		
B 1806	Dismantling of metal sheet in cladding at any elevation, lowering of material and carriage of the dismantled material up to field fabrication shop or return to projects storage including scaffolding, staging, tools & tackles, gas cutting, welding, consumables, etc. complete as per specification, drawings and instructions of the Engineer.	SQM	25	0.046		
B 1807	Fixing of Heavy duty galvanised chemical anchor fasteners of Hilti/Equivalent make of 12mm diameter and appropriate length in concrete (minimum grade M20) to take direct tension of minimum 1MT including anchor fastener, materials, equipment, labour, scaffolding complete as per direction of Engineer.	Each	6	0.10		
B 1808	Providing small size openings (having size within 150mmx150mm area) in existing finished Floors, Walls, Cladding, Roof etc. including making good the broken edges/surface with cement mortar, fixing steel /precast concrete section as lintel , painting, finishing to match with existing finishing, scaffolding/ staging works, gas cutting of reinforcement/structural work, cleaning and removing of all debris within 1Km lead etc. all complete as per specification and as directed by Engineer.	SQM	5	0.335		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2300: STRUCTURAL STEEL						
	Structural steel works including, skilled labour, mterial, equipments including suitable capacity gantry cranes, crawler / Tyre mounted cranes, transportation, handling etc. at any level as per specification, drawings and as directed by BHEL Engineer.			-		
	Fabrication of structural steel at Fabrication shop / Yard with mild steel rolled section / built up section / combination of both conforming to IS:2062, pipes conforming to IS:1161/ IS:1239, chequered plate conforming to IS: 3052, mild steel rounds, monorails, stays, safety chains, ladders, MS grating etc. in columns, beams, gantry girders, bunkers, silos, hoppers, roof trusses, portals, laced purlins, space frames, hangers, struts, monorails, galleries, stiffeners, wall beams, sheeting runners, brackets, stub columns, bracings, cleats, trestles, base plates, splice plates, chequered plate flooring, decking and seal plates, steel frame grid over false ceiling, walkway platforms, ladders, stairs, stringers, treads, landings, hand-rails etc.			-		
B 2301	Work shall include connection design & preparation of fabrication drgs, issuing and collection of steel from stores (supplied by BHEL as Free of Cost Item), fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, fit up, welding, electrodes and other consumables, edge preparation, preheating (min preheat and interpass temperature of 20°C for welding over 20 mm and upto 40 mm & 66°C for welding over 40 mm and upto 63 mm & 110°C for thickness over 63 mm & use of low hydrogen/ radiogenic electrodes), post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, transportation to site from fabrication shop / yard, protection against damage in transit (weight of temporary structures not payable for packing & transit), return of surplus / waste steel materials to store etc. all complete. including appointment of a seperate agency, approved by BHEL, for review and approval of fabrication drgs, in consultation with BHEL. (Structural Steel Material e.g. Plates, Angles, Chaneels, Beams, chequered plates, mild steel rounds, monorails, stays, safety chains, ladders, MS gratings etc. will be issued as free of cost (FOC) by BHEL)	MT	310	7.910		
B 2302	Erection, alignment, welding of already fabricated structural steel made from mild steel, pipes, chequered plate and mild steel rounds, at all elevations involving rolled sections, built up sections fabricated out of plates, rolled sections and combination of plates and rolled sections, in columns, beams, gantry girders, roof trusses, portals, laced purlins, space frames, shear connectors, hangers, struts, monorails, galleries, stiffeners, wall beams, sheeting runners, brackets, stub columns, bracings, cleats, trestles, base plates, splice plates, chequered plate flooring, decking and seal plates, diaphragm, steel frame grid over false ceiling, walkway platforms, ladders, stairs, stringers, treads, landings, hand-rails, toeplates, MS Rungs, insert plates, edge angles, embedments, lugs, posts, stays, louvers, lacings, gusset plates, safety chains for walkways adjacent to crane girders etc including issuing and collection of fabricated structural steel from stores, transportation, bolting, erection bolts & nuts (weight of erection bolts & nuts shall not be payable. Supply of permanent bolt of grade C mild steel bolts & nuts to be paid separately), assembly, use of low hydrogen/ radiogenic electrodes as per specification, post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transportation at site, stability of structures, installation of temporary structures (Scaffolding, Access ladders, Working Platforms etc.), setting column bases, surface preparation, touch-up painting, dismantling and removal of all temporary structures (weight of temporary structures not payable) complete with all labour, material, electrodes and other consumables, equipment, testing (mechanical and non-destructive), all other general and special requirements, all other activities required for completion of the work including return of surplus/ waste steel materials to store etc. as per specification, drawings and instructions of the BHEL Engineer. (Fabricated Structural Steel will be issued as Free of Cost (FOC) by BHEL)	MT	8010	3.951		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2303	Erection of coal bunkers' supplied by BHEL Unit (cylindrical or rectangular shape with bottom conical portion) on structural steel frame work including preparation of erection scheme, receiving fabricated material either from project store or anywhere at project site, all field connections, bolting, welding etc. complete as shown on drawings and as directed by BHEL Engineer, including labour and material complete. Work shall included protection against damage in transportation at site, stability of structures, installation of temporary structures (Scaffolding, Access ladders, Working Platforms etc.), touch-up painting, dismantling and removal of all temporary structures (weight of temporary structures not payable) complete with all labour, material, electrodes and other consumables, equipment, testing (mechanical and non-destructive), all other general and special requirements, all other activities required for completion of the work as per specification, drawings and instructions of the Engineer. (Fabricated Structural Steel will be issued as Free of Cost (FOC) by BHEL)	MT	1150	4.75		
B 2304	Fabrication and Erection of M.S. Seal Plates approximate 12 gauge thick in conveyor gallery structures confirming to IS:2062. Work shall include fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, fit-up, welding, electrodes and other consumables, edge preparation, testing of welders, inspection of welds, visual inspection, rectification and correction of defective welding works, transportation to site from fabrication shop, protection against damage in transit (weight of temporary structures not payable for packing & transit), surface preparation, primer paint, shop paints etc. all complete. (Structural Steel Material i.e.g. Plates etc. will be issued as free of cost (FOC) by BHEL)	MT	20	7.91		
B 2305	Extra over ST NO. B 2301 for Blast cleaning of all Steel Surfaces to near white metal conforming to Sa 2 1/2 finish of Swedish standard SIS-05-5900 followed by providing with self curing Inorganic Zinc Silicate Primer Coat (Solid by Volume Minimum 60%) of Minimum 75 Micron Dry Film Thickness (DFT) including the cost of primer .The primer Coat shall be applied in shop / Yard immediately after blast cleaning by Airless spray technique etc all complete.	MT	310	2.33		
B 2306	Extra over ST NO. 2301 for Manual cleaning of steel structures embedded in concrete and applying Primer Coat of Chlorinated Rubber based Zinc Phosphate primer of 50 micron (DFT). (Supply of primer is covered under Section A "Supply Part")	MT	410	0.63		
B 2307	Applying Following Paints over steel surfaces (already applied with primer coat) :-			-		
(i)	Intermediate Coat: Intermediate Coat of Polyamide Cured pigment Titanium Dioxide (TiO2) or Micaceous Iron Oxide (MiO) Epoxy based paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in shop after an interval of Minimum overnight (after the application of primer Coat) by Airless spray technique. Color and shade of the Coat shall be as approved by Engineer Incharge . Work shall include protection, cleaning, scaffolding etc. all complete.	MT	260	0.81		
(ii)	Finished Coat: Intermediate coat shall be followed with the application of Finished Coat of Polyamide cured Color pigment Epoxy based paint (solid by volume Minimum 60%) of minimum 75 micron DFT. This coat shall be applied after an interval of minimum overnight and maximum indefinite (from application of Intermediate coat) either before Erection by Airless Spray technique or after Erection by Brush and / or spray. The finished coat thickness of 75 Micron can be built up either application at shop / yard or in two applications one at shop / yard and other at Site.					
	a) First Coat Application at Shop / Yard of minimum 35 micron DFT	MT	260	0.405		
	b) Second Coat application at site of minimum 40 Micron DFT	MT	9160	0.405		
(iii)	Final Finish Coat: Finished coat shall be followed with the application of Final finish coat polyurethane based colour pigment paint (solid by volume minimum 40%) of minimum 25 micron DFT. This coat shall be applied within seven days from completion of finish coat, after Erection by brush and or spray, Color and shade of the coat shall be as approved by BHEL Engineer. Work shall include touch up paint, protection, claning, scaffolding etc. all complete. (Supply of Paints is covered under Section A "Fabrication and Supply Part")	MT	9160	0.405		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2308	Fixing /Erection and Alignment of factory made Electro-forged blast cleaned to Sa 2 1/2 finished (Swedish standard SIS-05-5900), hot dipped galvanised grating units with mild steel conforming to IS:2062 (minimum galvanisation shall be 610 gms/sqm) at all elevations in flooring, platforms, drain and trench covers, walk-ways, passages, staircases with edge binding strips and anti-skid nosing in treads etc. including fixing clamps, fittings, fixtures, all taxes, duties, packing, grinding, drilling, welding, edge preparation, etc. all complete. (Supply of fabricated Electro-Forged Galvanised Grating Units is covered under Section A "Supply part")	MT	163	13.789		
B 2309	Fixing in position of permanent mild steel bolts (class 4.6 as per IS : 1367 and grade 'C' as per IS: 1363) and nuts, washers etc. up to and inclusive of 39 mm diameter and upto 300 mm long for structural steel work etc. all complete. (Supply of permanent mild steel studs is covered under Section A "Supply Part")	Kg	1050	0.01		
B 2310	Fixing in positing of high strength structural bolts (of property class 8.8 and product grade 'C' as per IS: 1367) and conforming to IS: 3757 and high strength structural hardened and tempered nuts (of property class '8' as per IS:1367) conforming to IS:6623 with hardened and tempered washers as per IS:6649 etc. up to and inclusive of 39 mm diameter and upto 300 mm long for structural steel work etc all complete. (Supply of high strength structural bolts is covered under Section A "Supply Part")	Kg	15300	0.028		
B 2311	Dismantling of steel structure at any elevation , lowering of material and carriage of the dismantled material up to field fabrication shop / projects storage including temporary dismantling, cutting, re-welding, supporting, and restoring to correct position all temporarily dismantled members, re-alignment of all adjacent connected members to their correct positions (weight of such adjacent members and temporarily dismantled members not payable) , scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	53	4.97		
B 2312	Addition to, alterations in and/or modification of "Erection Marks" including cutting of parts, gauging of welds, cutting, grinding, fabrication, welding, drilling holes, straightening, removal of bends, raising to the required level, painting, transportation, return of unutilised steel pieces to the project store, temporarily dismantling, cutting, re-welding, supporting and restoring to correct position of all the temporarily dismantled members, realignment of adjacent connected members (weight of such temporarily dismantled and adjacent members not payable) etc. all complete for the following:			-		
(i)	In erected position	MT	53	6.74		
(ii)	In fabrication yard / preassembly yard	MT	53	6.31		
B 2313	Re-erection of dismantled fabricated structural steel members including carriage of modified "Erection Marks" from the field fabrication shop to erection site, lifting to required position, aligning in position, tack welding, final welding and touch up painting including temporary dismantling and re-erection of temporarily dismantled members, cutting, rewelding, supporting and restoring to the correct position of all temporarily dismnatled members, re-alignment of adjacent connected members (weight of such temporarily dismantled members and adjacent members not payable) , scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	103	5.13		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2314	Erection, alignment, welding of already fabricated Stainless steel liner (SS:304 grade of 4 mm thickness on M.S. plate for inside surfaces of conical hopper portion and part of vertical portion of bunkers) at all heights including collection of fabricated SS liner segments from storeyard at site, transportation, assembly, alignment, providing and fixing with stainless steel studs, bolting (including countersunk), welding with electrode classification E308L for welding of stainless steel to stainless steel and E309 for stainless steel to mild steel, erection bolts & nuts (Weight of erection bolts & nuts shall not be payable. Supply of permanent bolt of grade C mild steel bolts & nuts to be paid separately), inspection of welds, visual inspection, rectification and correction of defective welding works, erection scheme, protection against damage in transportation at site, stability of structures, installation of temporary structures (Scaffolding, Access ladders, Working Platforms etc.), dismantling and removal of all temporary structures (weight of temporary structures not payable) complete with all labour, material, electrodes and other consumables, all other general and special requirements, all other activities required for completion of the work as per specification, drawings and instructions of the Engineer. (Only stainless steel liner's weight shall be paid under this item).	MT	100	36.742		
B 2315	Fixing in position PTFE type sliding bearings of reputed manufacturer, individual bearing suitable for required vertical loads as per the construction drawings and for maximum displacement of ± 50 mm including all taxes, duties, transportation, installation, drilling, bolting, erecting, aligning etc all complete for following vertical loads. (Supply of PTFE type sliding bearings is covered under Section A "Supply Part")			-		
a	40 Tons	EACH	5	3.163		
b	50 Tons	EACH	5	3.31		
c	60 Tons	EACH	5	4.06		
d	70 Tons	EACH	5	4.74		
e	80 Tons	EACH	5	5.413		
B 2316	Fixing flexible open ended bellow strap of neoprene of minimum thickness 2 mm and minimum width 200 mm with aluminium stripped edges as sealing below top of bunker and bottom of tripper floor to avoid the coal dust nuisance all complete. (Supply of open ended bellow strap is covered under Section A "Supply Part")	RM	350	0.133		
B 2317	Fixing / Erection, Installation and Alignment of Mild steel pipe (medium class) hand railing for staircase, ladders, openings, etc. with kick plates , galvanized at the rate of 610 Gms/Sq M. all complete as per the specifications and as directed by BHEL Engineer, for the following size pipes: (Supply of Mild Steel pipe hand railing is covered under Section A "Supply Part")			-		
a	32 mm nominal bore pipe- medium grade	MT	13	10.60		
b	40 mm nominal bore pipe- medium grade	MT	8	10.60		
B 2318	Conducting radiography test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	105	1.43		
B 2319	Conducting ultrasonic test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	105	0.94		
B 2320	Conducting ultrasonic test on steel plates as per ASTM-A435 or equivalent wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	SQM	5	1.38		
B 2321	Conducting magnetic particle test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	105	0.84		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A * FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2322	Conducting dye penetration test on welds wherever specified by the engineer including provision of necessary equipments, measuring devices, gauges etc. all complete (over and above the work already specified in the specifications.)	RM	105	0.87		
	Total Amount- Section B (Rs.)					
	GRAND TOTAL - Section- A + Section B (Rs.)					

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A * FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
NOTE:						
1	Bidder's quoted GRAND TOTAL price as "A" above shall be taken into account for evaluation and awarding and hence, shall be complete in all respect for the full scope defined in specification and in accordance with all terms & conditions of tender.					
2	Contractor shall fully understand description and Specifications of items mentioned in BOQ.					
3	Conditional price bids with any deviation / clarification etc are liable to be rejected. No cutting / erasing / over writing shall be done.					
4	Quantities mentioned in rate schedules are approximate only and liable for variation on either side depending upon site / design requirement. The tentative contract value (CV) of entire scope of work shall be calculated as per finally quoted / accepted rates & the Quantities indicated in BOQ cum Rate Schedule .					
5	Contractor's total quoted price as per rate schedule will be taken as tentative only. The contractor undertakes to execute actual quantities as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually executed at site and payments will also be regulated for the same.					
6	In case of any mis-match in rate and amount on price discrepancy, the same will be dealt as per clause no. 1.4 of GCC.					

RATE SCHEDULE FOR PACKAGE –B (UNIT No. 2)

ITEM NO.	Description of Item	QTY	Total Amount "B" in Rupees (in figures and words)
	PACKAGE-B		
1.0	Lumpsum price for complete scope of work for "Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Transfer Points, Trestles and Conveyor Galleries and Misc. Civil Works for Unit # 2 at 2X800 MW NTPC Gadawara Super Thermal Power Station."	1 set	
	Note: The rates of different items for the entire scope shall be worked out & awarded as per " Annexure B "		
Name -:			
Place -:			
Date-:			
Signature of the Bidder With Stamp			

BOQ CUM RATE SCHEDULE- UNIT# 2

Project: 2X800 MW NTPC GADARWRA Super Thermal Power Project

BOQ cum Rate Schedule for the Works of "Erection, Alignment & Welding, Testing, Painting and Handing Over of Bunker Structure, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its supporting Trestles of Bunker Structures, Miscellaneous Platform Structures and Other Miscellaneous Civil Works including supplying materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. and Misc. Fabrication works for Unit # 2 at 2X800 MW NTPC Gadawara Super Thermal Power Station."

SECTION A: SUPPLY PART

Brief description of SECTION A: Supply Part:- Supply of Materials for the works of MS Embedments, Doors, Windows, Glazing, Roofing / Side Cladding, Rain Water Down Take Pipes, Structural Steel Painting, Gratings, Mild Steel Bolts, High Strength Structural Bolts, PTFE Bearings, MS Hand Railings, Concreting etc. for Bunker Structures, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures, Miscellaneous Platform Structures, Other Miscellaneous Civil Works including procurement of Raw Material, loading, transportation and handling etc. & receipt of the same at site all complete as per specifications, drawings and as directed by BHEL Engineer for Unit # 2 of 2X800 MW NTPC GADARWARA STPP.

A	SUPPLY					
ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 700: MS EMBEDMENTS						
	Embedments including all labour, material, equipment, transportation of finished products (from workshop to site), handling etc. at any level as per specification, drawings and as directed by BHEL-Engineer.					
A 701	Total firm price on FOR basis for Supplying MS Embedments, inserts, pipe sleeves, angle pieces, rungs of various diameters, plates of dimensions as required etc. including painting, complete as per specifications, drawings and as directed by BHEL Engineer.	MT	52	34.181		
A 702	Total firm price on FOR basis for Supplying Fabricated Mild Steel foundation bolt assembly of Grade 4.6 conforming to IS:5624 along with nuts, lock nuts (as per IS:1363, 1364 and IS:3138), washers, anchor plates, stiffner plates, protective tape, pipe sleeves, primer, etc. for columns including pipe sleeves, templates wherever necessary etc. all complete as per specifications and as directed by the BHEL Engineer. All threaded and other surfaces of foundation bolts and its materials, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive measures. Work to include preparation of fabrication detailed drawings..	MT	50	42.383		
A 703	Total firm price on FOR Site basis for Supply of following items for all kind of works, as per specifications, drawings and as directed by BHEL Engineer.					
a	MS pipes of all diameters	KG	5350	0.043		
b	PVC pipes / conduits of all diameters	KG	100	0.087		
c	UPVC pipes / conduits of all diameters	KG	100	0.087		
d	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for brick work with expansion sleeve of A6 polyamide:					
i)	Upto 250 kg	EACH	15	0.135		
ii)	Beyond 250 Kg and upto 500 kg	EACH	4	0.210		
iii)	Beyond 500 Kg and upto 750 kg	EACH	4	0.338		
e	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for concrete work with expansion sleeve of stainless steel:					
i)	Upto 250 kg	EACH	35	0.160		
ii)	Beyond 250 Kg and upto 500 kg	EACH	31	0.244		
iii)	Beyond 500 Kg and upto 750 kg	EACH	31	0.382		
A 800 GROUTING						

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
	Supplying Grouting material including labour, material, equipment, transportation of material at site as per specification, drawings and as directed by BHEL Engineer.					
A 801	Total firm price on FOR Site basis for Supplying the complete grouting material for grouting of pocket holes, pipe sleeves and under base plate of structural steel work / machinery / pipe supporting structures with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture . Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade). (Measurement shall be done after Grouting at Site and payment shall be released as per the actual Quantity of Grouting executed).	CUM	30	7.1417		
A 802	Total firm price on FOR Site basis for Supplying the complete grouting material for grouting of pocket holes, pipe sleeves and under base plates of structural steel work / machinery / pipe supporting structures with Conbextra GP-1 or equivalent . (Measurement shall be done after Grouting at Site and payment shall be released as per the actual Quantity of Grouting executed)	CUM	20	26.264		
A 803	Total firm price on FOR Site basis for Supplying the complete grouting material for grouting of pocket holes, pipe sleeves and under base plates of structural steel work/ machinery/ pipe supporting structures with Conbextra GP-2 or equivalent . (Measurement shall be done after Grouting at Site and payment shall be released as per the actual Quantity of Grouting executed)	CUM	7	29.166		
A 900: DOORS, WINDOWS, VENTILATORS, LOUVERS						
	Doors, windows, ventilators, louvers, roof ventilators, rolling shutters, partitions including all labour, material, equipments, transportation, handling, preparation of working drawings etc. as per specification, drawings and as directed by BHEL Engineer.					
A 901	Total firm price on FOR Site basis for Supplying, Fabricated Single or Double steel door shutters with 45mm thk flush design shutter comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150 mm on centres including void filled with mineral wool (density as per specification), all fittings, Godrej or equivalent make mortice lock with handle on both sides, primer, painting etc. all complete as per specifications.	SQM	30	2.861		
A 902	Total firm price on FOR Site basis for Supplying, Fabricated Fire Proof steel doors (single or double shutter) with panic devices shall be 45 mm thk flush design comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150 mm on centers including all fittings, primer & shop painting with approved post office/signal red color fire resistant paint and mineral wool insulation (64 kg/cum density) complete and shall be fire proof as per IS:3614, TAC requirements and as per specification. Minimum ratings shall be 2 Hrs.	SQM	20	7.237		
A 903	Total firm price on FOR Site basis for Supplying Steel Windows/Ventilator with steel sections as per IS:1038, IS:1361 & IS:7452 latest revision including all fittings, metal beadings, hold fasts, shop, primer painting, wire mesh wherever required, glazing etc. all complete. (Glazing shall be paid separately)					
a	Openable type	SQM	165	1.373		
b	Fixed type	SQM	110	1.315		
A 904	Total firm price on FOR Site basis for Supplying pressed steel frames , fabricated from 16 gauge M.S sheet mortised , reinforced drilled and tapped for hinges and locks bolts, strikes, hold fasts adjustable floor anchors, floor tiles/weather bars ,paintings etc. all complete as per specifications.	KG	150	0.054		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 905	Total firm price on FOR Site basis for Supplying glazing of first grade / class in steel/aluminium/wooden frames, where ever required including hardware, gaskets, clips, beadings etc. all complete as per drawing, specifications.					
a	6 mm thick wired glass	SQM	40	0.367		
b	6mm thick multi (twin) wall fire retardant (Continuous use under temperature 100 degree C), impact resistant and ultraviolet resistant polycarbonate sheet with sealed open edges.	SQM	175	1.035		
A 906	Total firm price on FOR Site basis for Supplying Steel Louvered Window with mild steel frames all round including verticals with pressed steel louvers, painting etc. all complete.	KG	5000	0.032		
A 1500: ROOFING / SIDE CLADDING						
	Roofing / side cladding including all labour, material, equipment, transportation (from workshop to site), handling, scaffolding, laps, hooks, washers, corner pieces, flashing, capping, trimming, closure for vertical / horizontal joints, ridges, hips etc. at any level as per specification, drawings and as directed by BHEL Engineer.					
A 1501	Total firm price on FOR Site basis for Supplying thermally insulated sandwiched metal cladding for roofs with troughed profile permanently colour coated sheet on outside (External sheet) and plain permanently colour coated sheet on inside (Internal Sheet) with 50 mm thick mineral wool insulation in between the two sheets. Outside sheeting of cladding system shall have troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade S340 class 4 as per ASTM A792M / grade S350GD as per EN 10326. Continued.. Inside sheeting of cladding system shall have plain profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326. Out side and Inside Steel Sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. (SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728) . Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling, transportation . Mineral wool shall conform to IS : 8183, having a density of 32 Kg/Cu.M. for glass wool & 48 Kg/Cu. M. for rock wool. This shall include supply of corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification . Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done .	SQM	3368	1.474		
A 1502	Total firm price on FOR Site basis for Supplying shear connectors of mild steel studs having 16 mm dia and minimum 75 mm projected length above purlin passing through metal decking as per relevant IS codes and specification.	KG	3000	0.035		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 1503	Total firm price on FOR Site basis for Designing, Supplying Single Sheet Metal Cladding for Roof, External Walls , Internal Walls , ridge, hips, flashing/trimming /closure for vertical/ horizontal joints, capping, etc. with troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metalthickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 . The troughed profile steel metal sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728. Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling. This shall include supply of corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification . Sheetting work in roof & sides shall be measured in Sq.M. for net area of the work done .	SQM	8000	0.642		
A 1504	Total firm price on FOR Site basis for Supplying Side/Roof Cladding with troughed translucent sheets of Polycarbonate material including laps, hooks, washers, corner piece etc. at all elevations complete as per specification, drawing and as directed by the BHEL Engineer for the following.					
(i)	2 mm thick fire retardant and ultraviolet resistant translucent polycarbonate clean sheet of GE plastic or equivalent approved make.	SQM	900	0.346		
1700 RAIN WATER DOWN TAKE PIPES						
A 1701	Total firm price on FOR Site basis for Supplying hot dip galvanised MS down take pipes of 150 mm NB - Medium quality as per IS:1239 (part-I) all complete.The minimum coating of Zinc shall be of 610 gm/Sqm and shall comply with IS:4759 and other relevant codes.	RM	1200	0.925		
A 1800: MISCELLANEOUS WORKS						
A 1801	Total firm price on FOR Site basis for Designing and supplying of Heavy duty galvanised chemical anchor fasteners of Hilti/Equivalent make of 12 mm diameter and appropriate length in concrete (minimum grade M20) to take direct tension of minimum 1 MT including anchor fastener, materials, equipment, labour etc. complete as per direction of BHEL-Engineer.	EACH	6	0.383		
A 1802	Total firm price on FOR Site basis for Supplying of complete Raw materials for Concrete of grade M-25 conforming to IS:456 with coarse sand and graded hard stone aggregate 20 mm nominal size in foundations/Sub Structure/ Super Structure etc. at any level, any shape, position or thickness etc. complete including shuttering, curing, reinforcement, use of plasticizer/ superplasticizer conforming to IS:9103 (latest) to achieve required slump in concrete all complete and as directed by BHEL Engineer. (Measurement shall be done after completion of concreting at Site and payment shall be released as per the actual Quantity of concrete executed)	CUM	30	2.352		
A 2300: STRUCTURAL STEEL						
	Structural steel works including all labour, material, equipments, transportation of finished products (from storage yard to site), handling etc. at any level as per specification, drawings and as directed by BHEL Engineer.					
A2301	Total firm price on FOR Site basis for Supplying Chlorinated Rubber based Zinc Phosphate Primer to be applied after Manual cleaning of steel structures embedded in concrete. Primer Coat of Chlorinated Rubber based Zinc Phosphate primer of 50 micron (DFT) shall be applied. (Measurement shall be done after application of primer. Payment shall be released as per the actual quantity of primer work executed)	MT	465	0.635		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 2302	Total firm price on FOR Site basis for Supplying Intermediate Coat, Finish Coat and Final Finish Coat of paints to be applied over steel surfaces (already applied with primer coat) :-					
(i)	Intermediate Coat: Intermediate Coat of Polyamide Cured pigment Titanium Di-Oxide (TiO2) or Micaceous Iron Oxide (MiO) Epoxy Based Paint (Solid by Volume minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in shop after an interval of minimum overnight (after the application of primer coat) by Airless Spray Technique. Color and Shade of the Coat shall be as approved by the BHEL Engineer. Work shall include protection, cleaning, scaffolding etc. all complete. (Measurement shall be done after application of paint over the steel structure surfaces. Structure Steel in MT shall be measured for the painting work and payment shall be released as per the actual quantity of painting work executed)	MT	260	1.016		
(ii)	Finished Coat: Intermediate coat shall be followed with the application of Finished Coat of Polyamide cured Color pigment Epoxy based paint (solid by volume Minimum 60%) of minimum 75 micron DFT. This coat shall be applied after an interval of minimum overnight and maximum indefinite (from application of Intermediate coat) either before Erection by Airless Spray technique or after Erection by Brush and / or spray. The finished coat thickness of 75 Micron can be built up either application at shop / yard or in two applications one at shop / yard and other at Site. (Measurement shall be done after application of paint. Payment shall be released as per the actual quantity of painting work executed)					
	a) First Coat Application at Shop / Yard of minimum 35 Micron DFT	MT	260	0.474		
	b) Second Coat Application at Site of Minimum 40 Micron DFT	MT	9160	0.542		
(iii)	Final Finish Coat: Finished coat shall be followed with the application of Final finish coat polyurethane based colour pigment paint (solid by volume minimum 40%) of minimum 25 micron DFT. This coat shall be applied within seven days from completion of finish coat, after Erection by brush and or spray, Color and shade of the coat shall be as approved by BHEL Engineer. Work shall include touch up paint, protection, cleaning, scaffolding etc. all complete. (Measurement shall be done after application of paint. Payment shall be released as per the actual quantity of painting work executed)	MT	9160	0.338		
A 2303	Total firm price on FOR Site basis for Supplying factory made Electro-forged grating units with mild steel conforming to IS : 2062 at all elevation. Grating units shall be blast cleaned to Sa 2 1/2 finished (Swedish standard SIS-05-5900) and hot-dipped galvanised (galvanisation of 610 gms/sqm) in flooring, platforms, drain and trench covers, walk-ways, passages, staircases with edge binding strips and anti-skid nosing in treads etc. including fixing clamps, fittings, fixtures, packing, grinding, drilling, welding, edge preparation, etc. all complete.	MT	162	55.315		
A 2304	Total firm price on FOR Site basis for Supply of permanent mild steel bolts (class 4.6 as per IS : 1367 and grade 'C' as per IS: 1363) and nuts, washers etc. up to and inclusive of 39 mm diameter and up to 300mm long for structural steel work etc. all complete	KG	1050	0.046		
A 2305	Total firm price on FOR Site basis for Supplying high strength structural bolts (of property class 8.8 and product grade 'C' as per IS: 1367) and conforming to IS: 3757 and high strength structural hardened and tempered nuts (of property class '8' as per IS:1367) conforming to IS:6623 with hardened and tempered washers as per IS:6649 etc. up to and inclusive of 39 mm diameter and up to 300 mm long for structural steel work etc all complete.	KG	15300	0.1105		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
A 2306	Total firm price on FOR Site basis for Supplying PTFE type sliding bearings of reputed manufacturer , individual bearing suitable for required vertical loads as per the construction drawings and for maximum displacement of ±50 mm including all taxes, duties etc. for following vertical loads.					
a	40 Tons	EACH	5	12.687		
b	50 Tons	EACH	5	13.272		
c	60 Tons	EACH	5	16.284		
d	70 Tons	EACH	5	18.998		
e	80 Tons	EACH	5	21.712		
A 2307	Total firm price on FOR Site basis for Supplying flexible open ended bellow strap of neoprene of minimum thickness 2 mm and minimum width 200 mm with aluminium stripped edges as sealing below top of bunker and bottom of tripper floor to avoid the coal dust nuisance all complete as per specifications and as directed by BHEL Engineer.	RM	350	0.530		
A 2308	Total firm price on FOR Site basis for Supplying Mild steel pipe (medium class) hand railing for staircase, ladders, opeings, etc. with kick plates, galvanized at the rate of 610 Gms/Sq M. as per IS 4736 all complete as per the specifications and as directed by BHEL Engineer, of follwing size pipes:					
a	32 mm nominal bore pipe-medium grade	MT	12	42.505		
b	40 mm nominal bore pipe- medium grade	MT	7	42.505		
	Total Amount- Section A (Rs.)					

SECTION B: E & C PART

Brief description of SECTION B: E & C Part :- Receipt, loading, transportation, unloading, preservation and handling at site etc. of finished materials of Bunker Structures, Raw Coal Bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures supplied by BHEL units, raw materials supplied by BHEL from BHEL stores / yard and materials supplied by the contractor. Pre assembly, Erection, Alignment, Bolting/ Welding/ Fastening, Grouting, Testing, Painting and Handing Over of Bunker Structures, Raw coal bunkers, Coal Handling Transfer Points, Coal Conveyor Galleries and its Supporting Trestle of Bunker Structures, Miscellaneous Platform Structures including Miscellaneous Civil Works etc. at site all complete as per Specifications, Drawings and as directed by BHEL Engineer for Unit # 2 of 2X800 MW NTPC GADARWARA STPP.

B	E&C PART					
ST. NO	DESCRIPTION OF ITEM	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 700 MS EMBEDMENTS						
B 701	Fabricating, Fixing / Erection, Installation and Alignment of mild steel embedments, inserts, pipe sleeves, angle pieces, rungs of various diameters, plates of dimensions as required etc. including welding, bolting, cutting, drilling, scaffolding, setting etc. all complete. (Supply of Embedments, inserts etc. is covered under Section A "Supply Part")	MT	52	8.55		
B 702	Fabrication, Fixing / Erection, Installation and Alignment of following items in concrete / brickwall for all kind of works, including setting material in concrete, layout, scaffolding, cutting, forming, grinding, drilling, bolting, welding, jointing, testing, primer, paintig etc. all complete. as per specifications, drawings and as directed by BHEL Engineer. (Supply of materials is covered under Section A "Supply Part")					
a	MS pipes of all diameters	Kg	5350	0.01		
b	PVC pipes / conduits of all diameters	Kg	100	0.022		
c	UPVC pipes / conduits of all diameters	Kg	100	0.022		
d	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for brick work with expansion sleeve of A6 polyamide:					
i	Upto 250 kg	Each	15	0.034		
ii	Beyond 250 Kg and upto 500 kg	Each	4	0.052		
iii	Beyond 500 Kg and upto 750 kg	Each	4	0.084		
e	Expansion fasteners (mechanical galvanised) of HILTI make or equivalent of safe tensile capacity as specified below for concrete work with expansion sleeve of stainless steel:					
i	Upto 250 kg	Each	35	0.04		
ii	Beyond 250 Kg and upto 500 kg	Each	31	0.061		
iii	Beyond 500 Kg and upto 750 kg	Each	31	0.096		
B 703	Prestressing, Placing and releasing of Vibration Isolation Spring modules over the FAN foundation at all elevations including providing all assistance under the supervision of the VIS supplier, transportation from BHEL store, necessary staging, platforms, leveling, alignment etc. all complete. (Vibration Isolation springs shall be issued Free of cost by BHEL)	Each	248	0.747		
B 800 GROUTING						
	Grouting including all labour, material, equipment, roughening surface, cleaning, ramming, curing etc. at any level unless otherwise specified as per specification, drawings and as directed by BHEL Engineer.					
B 801	Grouting of pocket holes, pipe sleeves and under base plate of structural steel work / machinery / pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture . Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade). (Supply of Grouting Material is covered under Section A "Supply Part", cleaning of the pockets by compressed air shall be in the scope of the contractor).	CUM	30	1.785		
B 802	Grouting of pocket holes, pipe sleeves and under base plates of structural steel work / machinery / pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. all complete with ConbextraGP-1 or equivalent . (Supply of Grouting Material is covered under Section A "Supply Part", cleaning of the pockets by compressed air shall be in the scope of the contractor).	CUM	20	6.566		
B 803	Grouting of pocket holes, pipe sleeves and under base plates of structural steel work/ machinery/ pipe supporting structures including roughening of surface, cleaning, ramming, curing, etc. all complete with Conbextra GP-2 or equivalent . (Supply of Grouting Material is covered under Section A "Supply Part", cleaning of the pockets by compressed air shall be in the scope of the contractor).	CUM	7	7.287		
B 900: DOORS, WINDOWS, VENTILATORS, LOUVERS						
	Fixing Doors, windows, ventilators, louvers, roof ventilators, rolling shutters, partitions including all labour, material, equipments, transportation (at site), handling, preparation of working drawings etc. at any level as per specifications, drawings and as directed by BHEL Engineer.					

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 901	Fixing / Erection, Installation and Alignment of single or double steel door shutters with 45mm thk flush design shutter comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150 mm on centres including void filled with mineral wool (density as per specification), all fittings, Godrej or equivalent make mortice lock with handle on both sides, shop and final painting etc. all complete. (Supply of fabricated door shutters in covered under Section A "Suply Part")	SQM	30	0.715		
B 902	Fixing / Erection, Installation and Alignment of fire proof steel doors (single or double shutter) with panic devices shall be 45mm thk flush design comprising of two outer sheets of 18 gauge steel sheets rigidly connected and reinforced inside with continuous vertical 20 gauge stiffeners, spot welded in position at not more than 150mm on centers including all fittings, shop painting with approved post office/signal red color fire resistant paint, final painting (at site) and mineral wool insulation (64 kg/cum density) complete and shall be fire proof as per IS:3614, TAC requirements and as per specification. Minimum ratings shall be 2 Hrs. (Supply of Fabricated fire proof doors is covered under Section A "Supply Part")	SQM	20	1.809		
B 903	Fixing / Erection, Installation and Alignment of steel windows / ventilator with steel sections as per IS:1038, IS:1361 & IS:7452 latest revision.including all fittings, metal beadings, hold fasts, shop and final painting , wire mesh wherever required, glazing etc. all complete as per specifications. (Glazing shall be paid separately). (Supply of steel windows / ventilators is covered under Section A "Supply Part")					
a	openable type	SQM	165	0.343		
b	fixed type	SQM	110	0.329		
B 904	Fixing / Erection, Installation and Alignment of pressed steel frames fabricated from 16 gauge M.S sheet mortised, reinforced drilled and tapped for hinges and locks bolts strikes, hold fasts adjustable floor anchors, floor tiles/weather bars ,paintings etc. all complete as per specifications. (Supply of pressed steel frames is covered under Section A "Supply Part")	Kg	150	0.014		
B 905	Cutting, Fixing and fitting of glazing of first grade class in steel / aluminium / wooden frames, where ever required, cleaning after fixing including hardware, gaskets, clips, beadings etc. all complete as per specifications. (Supply of Glazing is covered under section A "Supply Part")					
a	6 mm thick wired glass	SQM	40	0.092		
b	6 mm thick multi (twin) wall fire retardant (Continuous use under temperature 100 degree C), impact resistant and ultraviolet resistant polycarbonate sheet with sealed open edegs.	SQM	175	0.259		
B 906	Fixing / Erection, Installation and Alignment of steel louvered window with mild steel frame all round including verticals with pressed steel louvers, paintin etc. all complete. (Supply of steel louvered window with mild steel frame all round is covered under section A "Supply Part")	KG	5000	0.010		
B 1000: BRICKWORK						
B 1001	Breaking of existing brick work at all levels including plastering, removing the rubbish up to a distance of 500 m including transportation, loading, unloading etc. all complete as directed by the BHEL Engineer.	CUM	2	0.530		
B 1002	Making openings in existing brick wall or partition wall including making good the broken edges/surface with cement mortar etc. complete.	CUM	2	0.711		
B 1500: ROOFING / SIDE CLADDING						
	Erecting Roofing / side cladding work including all labour, material, equipment, transportation (at site), handling, scaffolding, laps, hooks, washers, corner pieces, Flashing, capping, trimming, closure for vertical / horizotal joints, ridges, hips etc. at any level as per specification, drawings and as directed by BHEL Engineer.					
	Fixing / Erection, Installation and Alignment of thermally insulated sandwiched metal cladding for roofs with troughed profile permanently colour coated sheet on outside (External sheet) and plain permanently colour coated sheet on inside (Internal Sheet) with 50 mm thick mineral wool insulation in between the two sheets. Outside sheeting of cladding system shall have troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metalthickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 . Continued..					

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 1501	Inside sheeting of cladding system shall have plain profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326. Out side and Inside Steel Sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. (SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728) . Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling. Mineral wool shall conform to IS : 8183, having a density of 32 Kg/Cu.M. for glass wool & 48 Kg/Cu. M. for rock wool. The work shall include fixing to supports / rails by concealed fixing system, corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification .Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done . (Supply of fabricated thermally insulated sandwiched metal cladding is covered under Section A "Supply Part")	SQM	3368	0.369		
B 1502	Fixing and fitting of shear connectors of mild steel studs having 16mm dia and minimum 75 mm projected length above purlin passing through metal decking as per relevant IS codes and specification. (Supply of shear connectors of mild steel studs is covered under Section A "Supply Part")	Kg	3000	0.009		
B 1503	Fixing / Erection, Installation and Alignment of single sheet metal cladding for roof, external walls , internal walls , ridge, hips, flashing / trimming / closure for vertical / horizontal joints, capping, etc, with troughed profile steel metal sheets with zinc coated to class Z275 having minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6 mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN10326 OR troughed profile steel metal sheets with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326 . The troughed profile steel metal sheets shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP) (with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or Polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 microns (nominal) SMP or Polyester paint over 5 microns (nominal) primer coat on other side. SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728. Coated surface shall be provided with a protected guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling. The work shall include fixing to supports, corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete as per Specification . Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done . (Supply of fabricated single sheet metal cladding is covered under Section A "Fabrication and Supply Part")	SQM	8000	0.160		
B 1504	Fixing / Erection, Installation and Alignment of Side/Roof Cladding with troughed translucent sheets of Polycarbonate material including laps, hooks, washers, corner piece etc. at all elevations complete as per specification, drawing and as directed by the engineer for the following. (Supply of Fabricated Side / Roof Cladding with translucent sheets of Polycarbonate material is covered under Section A "Supply Part")					
(i)	2 mm thick fire retardant and ultraviolet resistant translucent polycarbonate clean sheet of GE plastic or equivalent approved make.	SQM	900	0.086		
B 1700: RAIN WATER DOWN TAKE PIPES						
B 1701	Fixing hot dip galvanised MS down take pipes of 150 mm NB - Medium quality as per IS:1239 (part-I) all complete.The minimum coating of Zinc shall be of 610 gm/Sqm and shall comply with IS:4759 and other relevant codes.	RM	1200	0.231		
B 1800 MISCELLANEOUS WORKS						
	Miscellaneous works including all labour, material, equipment etc. at any level unless otherwise specified as per specification, drawings and as directed by engineer - in - charge.					
B 1801	Concrete of grade M-25 conforming to IS:456 with coarse sand and graded hard stone aggregate 20 mm nominal size in foundations/Sub Structure/ Super Structure etc. at any level, any shape, position or thickness etc. complete including shuttering, curing, reinforcement, use of plasticizer/ superplasticizer conforming to IS:9103 (latest) to achieve required slump in concrete all complete and as directed by BHEL Engineer. (Supply of Raw Materials for Concreting e.g. Coarse Sand, Cement, Aggregates, Reinforcement, Shuttering etc. is covered under Section A "Supply Part")	CUM	30	0.588		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 1802	Dismantling concrete work for all types of structures at all levels including stacking of servicable material to a lead of 500 m and disposal of unservicable material upto a lead of 2 km , cutting of reinforcement, labour, equipment, safety precautions etc. all complete as per drawings, specification and instructions of BHEL Engineer. (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)					
(i)	Plain cement concrete of all grades	CUM	2	1.120		
(ii)	Reinforced cement concrete of all grades	CUM	27	1.581		
B1803	Chipping of concrete in reinforced concrete work, cutting pockets, making openings at all levels and according to shapes, disposal of waste materials upto a lead of 2 km as directed by engineer including equipment, safety precautions, making good the broken surface etc. all complete as per specification, drawing, instructions of BHEL Engineer but excluding cutting of reinforcement . (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)	CUDM	50	0.057		
B 1804	Extra over and above ST. NO. 1803 for cutting of reinforcement, all sizes and types including labour, equipment, return of cut reinforcement to store etc. all complete as per specification, drawings and instructions of engineer in charge. Measurement shall be on the cross sectional area of reinforcement cut. (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)	SQCM	25	0.066		
B 1805	Cutting Reinforced concrete with mechanised tools like Core drilling machine etc. for cutting pockets, holes, cores in slab, beam, column or foundation as per direction of engineer in charge. (Scope includes Supply of complete materials, equipments, labours, scaffoldings etc. as required)	CUDM	5	0.060		
B 1806	Dismantling of metal sheet in cladding at any elevation, lowering of material and carriage of the dismantled material up to field fabrication shop or return to projects storage including scaffolding, staging, tools & tackles, gas cutting, welding, consumables, etc. complete as per specification, drawings and instructions of the Engineer.	SQM	25	0.046		
B 1807	Fixing of Heavy duty galvanised chemical anchor fasteners of Hilti/Equivalent make of 12mm diameter and appropriate length in concrete (minimum grade M20) to take direct tension of minimum 1MT including anchor fastener, materials, equipment, labour, scaffolding complete as per direction of Engineer.	Each	6	0.095		
B 1808	Providing small size openings (having size within 150mmx150mm area) in existing finished Floors, Walls, Cladding, Roof etc. including making good the broken edges/surface with cement mortar, fixing steel /precast concrete section as lintel , painting, finishing to match with existing finishing, scaffolding/ staging works, gas cutting of reinforcement/structural work, cleaning and removing of all debris within 1Km lead etc. all complete as per specification and as directed by Engineer.	SQM	5	0.336		
B 2300: STRUCTURAL STEEL						
	Structural steel works including, skilled labour, mterial, equipments including suitable capacity gantry cranes, crawler / Tyre mounted cranes, transportation, handling etc. at any level as per specification, drawings and as directed by BHELL Engineer.					
B 2301	Fabrication of structural steel at Fabrication Shop / Yard with mild steel rolled section / built up section / combination of both conforming to IS:2062, pipes conforming to IS:1161/ IS:1239, chequered plate conforming to IS: 3052, mild steel rounds, monorails, stays, safety chains, ladders, MS grating etc. in columns, beams, gantry girders, bunkers, silos, hoppers, roof trusses, portals, laced purlins, space frames, hangers, struts, monorails, galleries, stiffeners, wall beams, sheeting runners, brackets, stub columns, bracings, cleats, trestles, base plates, splice plates, chequered plate flooring, decking and seal plates, steel frame grid over false ceiling, walkway platforms, ladders, stairs, stringers, treads, landings, hand-rails etc.	MT	310	7.932		
	Work shall include connection design & preparation of fabrication drgs, issuing and collection of steel from stores (supplied by BHEL as Free of Cost Item) , fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, fit up, welding, electrodes and other consumables, edge preparation, preheating (min preheat and interpass temperature of 20°C for welding over 20 mm and upto 40 mm & 66°C for welding over 40 mm and upto 63 mm & 110°C for thickness over 63 mm & use of low hydrogen/ radiogenic electrodes), post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, transportation to site from fabrication shop / yard, protection against damage in transit (weight of temporary structures not payable for packing & transit), return of surplus / waste steel materials to store etc. all complete. including appointment of a seperate agency, approved by BHEL, for review and approval of fabrication drgs, in consultation with BHEL. (Structural Steel Material e.g. Plates, Angles, Channels, Beams, chequered plates, mild steel rounds, monorails, stays, safety chains, ladders, MS gratings etc. will be issued as free of cost (FOC) by BHEL)					

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2302	Erection, alignment, welding of already fabricated structural steel made from mild steel, pipes, chequered plate and mild steel rounds, at all elevations involving rolled sections, built up sections fabricated out of plates, rolled sections and combination of plates and rolled sections, in columns, beams, gantry girders, roof trusses, portals, laced purlins, space frames, shear connectors, hangers, struts, monorails, galleries, stiffeners, wall beams, sheeting runners, brackets, stub columns, bracings, cleats, trestles, base plates, splice plates, chequered plate flooring, decking and seal plates, diaphragm, steel frame grid over false ceiling, walkway platforms, ladders, stairs, stringers, treads, landings, hand-rails, toeplates, MS Rungs, insert plates, edge angles, embedments, lugs, posts, stays, louvers, lacings, gusset plates, safety chains for walkways adjacent to crane girders etc including issuing and collection of fabricated structural steel from stores, transportation, bolting, erection bolts & nuts (weight of erection bolts & nuts shall not be payable. Supply of permanent bolt of grade C mild steel bolts & nuts to be paid separately) , assembly, use of low hydrogen/ radiogenic electrodes as per specification, post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transportation at site, stability of structures, installation of temporary structures (Scaffolding, Access ladders, Working Platforms etc.), setting column bases, surface preparation, touch-up painting, dismantling and removal of all temporary structures (weight of temporary structures not payable) complete with all labour, material, electrodes and other consumables, equipment, testing (mechanical and non-destructive), all other general and special requirements, all other activities required for completion of the work including return of surplus/ waste steel materials to store etc. as per specification, drawings and instructions of the BHEL Engineer. (Fabricated Structural Steel will be issued as Free of Cost (FOC) by BHEL)	MT	8010	3.966		
B 2303	Erection of coal bunkers' supplied by BHEL Unit (cylindrical or rectangular shape with bottom conical portion) on structural steel frame work including preparation of erection scheme, receiving fabricated material either from project store or anywhere at project site, all field connections, bolting, welding etc. complete as shown on drawings and as directed by BHEL Engineer, including labour and material complete. Work shall included protection against damage in transportation at site, stability of structures, installation of temporary structures (Scaffolding, Access ladders, Working Platforms etc.), touch-up painting, dismantling and removal of all temporary structures (weight of temporary structures not payable) complete with all labour, material, electrodes and other consumables, equipment, testing (mechanical and non-destructive), all other general and special requirements, all other activities required for completion of the work as per specification, drawings and instructions of the Engineer. (Fabricated Structural Steel will be issued as Free of Cost (FOC) by BHEL)	MT	1150	4.759		
B 2304	Fabrication and Erection of M.S. Seal Plates approximate 12 gauge thick in conveyor gallery structures conforming to IS:2062. Work shall include fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, fit-up, welding, electrodes and other consumables, edge preparation, testing of welders, inspection of welds, visual inspection, rectification and correction of defective welding works, transportation to site from fabrication shop, protection against damage in transit (weight of temporary structures not payable for packing & transit), surface preparation, primer paint, shop paints etc. all complete. (Structural Steel Material i.e. Plates etc. will be issued as free of cost (FOC) by BHEL)	MT	20	7.932		
B 2305	Extra over ST NO. B 2301 for Blast cleaning of all Steel Surfaces to near white metal conforming to Sa 2 1/2 finish of Swedish standard SIS-05-5900 followed by providing with self curing Inorganic Zinc Silicate Primer Coat (Solid by Volume Minimum 60%) of Minimum 75 Micron Dry Film Thickness (DFT) including the cost of primer .The primer Coat shall be applied in Shop / Yard immediately after blast cleaning by Airless spray technique etc all complete.	MT	310	2.334		
B 2306	Extra over ST NO. 2301 for Manual cleaning of steel structures embedded in concrete and applying Primer Coat of Chlorinated Rubber based Zinc Phosphate primer of 50 micron (DFT). (Supply of primer is covered under Section A "Supply Part")	MT	410	0.635		
B 2307	Applying Following Paints over steel surfaces (already applied with primer coat) :-			0.000		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
(i)	Intermediate Coat: Intermediate Coat of Polyamide Cured pigment Titanium Dioxide (TiO2) or Micaceous Iron Oxide (MIO) Epoxy based paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in shop after an interval of Minimum overnight (after the application of primer Coat) by Airless spray technique. Color and shade of the Coat shall be as approved by Engineer Incharge . Work shall include protection, cleaning, scaffolding etc. all complete.	MT	260	0.813		
(ii)	Finished Coat: Intermediate coat shall be followed with the application of Finished Coat of Polyamide cured Color pigment Epoxy based paint (solid by volume Minimum 60%) of minimum 75 micron DFT. This coat shall be applied after an interval of minimum overnight and maximum indefinite (from application of Intermediate coat) either before Erection by Airless Spray technique or after Erection by Brush and / or spray. The finished coat thickness of 75 Micron can be built up either application at shop or in two applications one at shop and other at Site.					
	a) First Coat Application at Shop / Yard of minimum 35 micron DFT	MT	260	0.406		
	b) Second Coat application at site of minimum 40 Micron DFT	MT	9160	0.406		
(iii)	Final Finish Coat: Finished coat shall be followed with the application of Final finish coat polyurethane based colour pigment paint (solid by volume minimum 40%) of minimum 25 micron DFT. This coat shall be applied within seven days from completion of finish coat, after Erection by brush and or spray, Color and shade of the coat shall be as approved by BHEL Engineer. Work shall include touch up paint, protection, claning, scaffolding etc. all complete. (Supply of Paints is covered under Section A "Supply Part")	MT	9160	0.406		
B 2308	Fixing /Erection and Alignment of factory made Electro-forged blast cleaned to Sa 2 1/2 finished (Swedish standard SIS-05-5900), hot dipped galvanised grating units with mild steel conforming to IS:2062 (minimum galvanisation shall be 610 gms/sqm) at all elevations in flooring, platforms, drain and trench covers, walk-ways, passages, staircases with edge binding strips and anti-skid nosing in treads etc. including fixing clamps, fittings, fixtures, all taxes, duties, packing, grinding, drilling, welding, edge preparation, etc. all complete. (Supply of fabricated Electro-Forged Galvanised Grating Units is covered under Section A "Supply part")	MT	162	13.828		
B 2309	Fixing in position of permanent mild steel bolts (class 4.6 as per IS : 1367 and grade 'C' as per IS: 1363) and nuts, washers etc. up to and inclusive of 39 mm diameter and upto 300 mm long for structural steel work etc. all complete. (Supply of permanent mild steel studs is covered under Section A "Supply Part")	Kg	1050	0.012		
B 2310	Fixing in positing of high strength structural bolts (of property class 8.8 and product grade 'C' as per IS: 1367) and conforming to IS: 3757 and high strength structural hardened and tempered nuts (of property class '8' as per IS:1367) conforming to IS:6623 with hardened and tempered washers as per IS:6649 etc. up to and inclusive of 39 mm diameter and upto 300 mm long for structural steel work etc all complete. (Supply of high strength structural bolts is covered under Section A "Supply Part")	Kg	15300	0.0275		
B 2311	Dismantling of steel structure at any elevation , lowering of material and carriage of the dismantled material up to field fabrication shop / projects storage including temporary dismantling, cutting, re-welding, supporting, and restoring to correct position all temporarily dismantled members, re-alignment of all adjacent connected members to their correct positions (weight of such adjacent members and temporarily dismantled members not payable), scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	52	4.980		
B 2312	Addition to, alterations in and/or modification of " Erection Marks " including cutting of parts, gauging of welds, cutting, grinding, fabrication, welding, drilling holes, straightening, removal of bends, raising to the required level, painting, transportation, return of unutilised steel pieces to the project store, temporarily dismantling, cutting, re-welding, supporting and restoring to correct position of all the temporarily dismantled members, realignment of adjacent connected members (weight of such temporarily dismantled and adjacent members not payable) etc. all complete for the following:					
(i)	In erected position	MT	52	6.757		
(ii)	In fabrication yard / preassembly yard	MT	52	6.326		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2313	Re-erection of dismantled fabricated structural steel members including carriage of modified "Erection Marks" from the field fabrication shop to erection site, lifting to required position, aligning in position, tack welding, final welding and touch up painting including temporary dismantling and re-erection of temporarily dismantled members, cutting, rewelding, supporting and restoring to the correct position of all temporarily dismantled members, re-alignment of adjacent connected members (weight of such temporarily dismantled members and adjacent members not payable), scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	102	5.142		
B 2314	Erection, alignment, welding of already fabricated Stainless steel liner (SS:304 grade of 4 mm thickness on M.S. plate for inside surfaces of conical hopper portion and part of vertical portion of bunkers) at all heights including collection of fabricated SS liner segments from storeyard at site, transportation, assembly, alignment, providing and fixing with stainless steel studs, bolting (including countersunk), welding with electrode classification E308L for welding of stainless steel to stainless steel and E309 for stainless steel to mild steel, erection bolts & nuts (Weight of erection bolts & nuts shall not be payable. Supply of permanent bolt of grade C mild steel bolts & nuts to be paid separately), inspection of welds, visual inspection, rectification and correction of defective welding works, erection scheme, protection against damage in transportation at site, stability of structures, installation of temporary structures (Scaffolding, Access ladders, Working Platforms etc.), dismantling and removal of all temporary structures (weight of temporary structures not payable) complete with all labour, material, electrodes and other consumables, all other general and special requirements, all other activities required for completion of the work as per specification, drawings and instructions of the Engineer. (Only stainless steel liner's weight shall be paid under this item).	MT	100	36.8475		
B 2315	Fixing in position PTFE type sliding bearings of reputed manufacturer, individual bearing suitable for required vertical loads as per the construction drawings and for maximum displacement of ±50 mm including all taxes, duties, transportation, installation, drilling, bolting, erecting, aligning etc all complete for following vertical loads. (Supply of PTFE type sliding bearings is covered under Section A "Supply Part")					
a	40 Tons	EACH	5	3.171		
b	50 Tons	EACH	5	3.318		
c	60 Tons	EACH	5	4.0702		
d	70 Tons	EACH	5	4.749		
e	80 Tons	EACH	5	5.428		
B 2316	Fixing flexible open ended bellow strap of neoprene of minimum thickness 2 mm and minimum width 200 mm with aluminium stripped edges as sealing below top of bunker and bottom of tripper floor to avoid the coal dust nuisance all complete. (Supply of open ended bellow strap is covered under Section A "Supply Part")	RM	350	0.132		
B 2317	Fixing / Erection, Installation and Alignment of Mild steel pipe (medium class) hand railing for staircase, ladders, openings, etc. with kick plates, galvanized at the rate of 610 Gms/Sq M. all complete as per the specifications and as directed by BHEL Engineer, for the following size pipes: (Supply of Mild Steel pipe hand railing is covered under Section A "Supply Part")					
a	32 mm nominal bore pipe- medium grade	MT	12	10.626		
b	40 mm nominal bore pipe- medium grade	MT	7	10.626		
B 2318	Conducting radiography test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	105	1.432		
B 2319	Conducting ultrasonic test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	105	0.941		
B 2320	Conducting ultrasonic test on steel plates as per ASTM-A435 or equivalent wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	SQM	5	1.380		
B 2321	Conducting magnetic particle test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	105	0.839		

ST. NO.	DESCRIPTION OF ITEMS	UNIT	QUANTITY	FACTOR	RATE= A* FACTOR/100000 (Rs.)	AMOUNT = RATE*QUANTITY (Rs.)
B 2322	Conducting dye penetration test on welds wherever specified by the engineer including provision of necessary equipments, measuring devices, gauges etc. all complete (over and above the work already specified in the specifications.)	RM	105	0.869		
	Total Amount- Section B (Rs.)					
	GRAND TOTAL - Section- A + Section B (Rs.)					
NOTE:						
1	Bidder's quoted GRAND TOTAL price as "A" above shall be taken into account for evaluation and awarding and hence,shall be complete in all respect for the full scope defined in specification and in accordance with all terms & conditions of tender.					
2	Contractor shall fully understand description and Specifications of items mentioned in BOQ.					
3	Conditional price bids with any deviation / clarification etc are liable to be rejected. No cutting / erasing / over writing shall be done.					
4	Quantities mentioned in rate schedules are approximate only and liable for variation on either side depending upon site / design requirement. The tentative contract value (CV) of entire scope of work shall be calculated as per finally quoted / accepted rates & the Quantities indicated in BOQ cum Rate Schedule .					
5	Contractor's total quoted price as per rate schedule will be taken as tentative only. The contractor undertakes to execute actual quantities as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually executed at site and payments will also be regulated for the same.					
6	In case of any mis-match in rate and amount on price discrepancy, the same will be dealt as per clause no. 1.4 of GCC.					

Project Manager
2X800 MW NTPC Gadawara STPP



**TECHNICAL REQUIREMENT FOR CIVIL,
STRUCTURAL & ARCHITECTURAL
WORKS FOR 2X800 MW, NTPC
GADARWARA (STAGE-I), SUPER
THERMAL POWER PROJECT**

SPECIFICATION NO. PE-TS-392-600-C001

VOLUME – IIB

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**GADARWARA, SUPER THERMAL POWER PROJECT
2X800 MW, STAGE-I**

VOLUME: IIB

SECTION – C

**TECHNICAL REQUIREMENTS FOR CIVIL,
STRUCTURAL & ARCHITECTURAL WORKS**



Bharat Heavy Electricals Limited



SPECIAL TECHNICAL REQUIREMENTS

2.0	Special Technical Requirements:
2.1	All the quality standards, tolerances, welding standards and 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. In case of any conflict between stipulations in various portions of the specification, most stringent stipulation would be applicable for implementation by the Bidder without any extra cost to the BHEL.
2.2	<u>Temporary Works:</u> All scaffoldings, staging, temporary bracing and other necessary temporary work required for proper execution of the Contract shall be provided by the Contractor at his own cost and inclusive of all materials, labour, supervision and other facilities. The layout and details of such Temporary work shall have the prior approval of the BHEL Engineer, but the Contractor shall be responsible for proper strength and safety of the same. All Temporary work shall be so constructed as not to interfere with any permanent work or with the work by other agencies. If it is necessary to remove any of the temporary work at any time to facilitate execution of the work or with the work of other agencies, such removal and re erection, if required, shall be carried out by the Contractor at the direction of the BHEL Engineer without any delay and any extra cost on this account shall be borne by the Contractor.
2.3	<u>Interface with structures under other's scope:</u> Modification in layout of foundation/structure during detail engineering stage may be necessary to avoid fouling with those under other's scope. Necessary changes on this account will be made without any extra cost to BHEL.
2.4	<u>Construction Methodology:</u> Construction and erection activities shall be fully mechanized from the start of the work. Dewatering shall be done using the combination of electrical and standby diesel pumps. All handling of materials shall be with cranes. Heavy trailers shall be used for transportation. Mechanized modular units of scaffolding and shuttering shall be used. Grouting shall be carried out using hydraulically controlled grouting equipment. All finishing items shall be installed using appropriate modern mechanical tools. Manual punching etc. Shall not be permitted. Heavy



**TECHNICAL REQUIREMENT FOR CIVIL,
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SPECIFICATION NO. PE-TS-392-600-C001

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	duty hoists for lifting of construction materials shall be deployed. Compressors for cleaning of foundations and other surfaces shall be used. Field laboratory shall be provided / arranged with all modern equipment for survey, testing of soil, aggregates, concrete, welding, etc. All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/ erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.
2.5	Foundation Bolts along with templates, inserts and embedments along with lugs, pipe sleeves, etc. whatsoever required in concrete/masonry for supporting Equipment and Structures shall be supplied by the Contractor and placed by Employer (NTPC). However the accuracy of these fixtures shall be checked and ensured by the Contractor during placement. Any modification required on these fixtures subsequent to their placement shall be done by Contractor.
2.6	Mill bunker building, Coal handling transfer points, Coal conveyor galleries and its Supporting Trestles shall be supported by Contractor on Foundation through Foundation Bolt assemblies and shear keys installed at the time of first stage concreting.
2.7	All other Structures shall be supported by Contractor on Foundation through Anchor Fasteners. For such Structures, Employer (NTPC) shall provide the Foundation, on which the Contractor shall supply and install, the Anchor Fasteners of requisite capacity to support his Structures.
2.8	Anchor Fasteners shall be used for supporting all such Equipment, where the Static and Dynamic Load due to Equipment is within the safe Load carrying capacity of the Anchor Fasteners. For such Equipment, Employer (NTPC) shall provide the Foundation, on which the Contractor shall supply and install the Anchor Fasteners of requisite capacity to support his Equipment.
2.9	The Employer (NTPC) shall provide the pockets only for those Equipment Foundations where the Load to be transferred is beyond the safe Load carrying capacity of Anchor Fasteners. For such Equipment, subsequent supply and installation of Foundation Bolts including Grouting of pockets shall be done by Contractor. In case, it is required that Foundation Bolts are required to be embedded during the first stage of concreting, then the Contractor shall make the Bolts available at site (before casting of foundation) for installation by Employer (NTPC) at the time of the concreting stage itself. During concreting, Contractor shall depute his engineers to verify that all foundation bolts/sleeves/embedments etc. are installed correct to layout and levels as per their design drawings. Any modification required on these fixtures subsequent to their placement shall be done by Contractor.
2.10	All inserts and embedment whatsoever required by the Contractor over the Concrete, masonry and other similar surfaces, for supporting their Structures / Equipment etc. shall be installed by the Contractor using Anchors Fasteners. All small size Openings having size (within 150 mm x



**TECHNICAL REQUIREMENT FOR CIVIL,
STRUCTURAL & ARCHITECTURAL
WORKS FOR 2X800 MW, NTPC
GADARWARA (STAGE-I), SUPER
THERMAL POWER PROJECT**

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	150 mm area) which are required on Floors, Walls, Cladding, Roof etc. shall be neatly created and finished by the Contractor using appropriate tools. The Employer (NTPC) shall however provide larger size Openings.
2.11	All Grouting of pockets, Underpinning of Base Plates, filling and finishing of Openings etc. shall be done by the Contractor. The Employer (NTPC) shall do encasement of Base Plates. Anchor Fasteners shall be fixed in position by Contractor as recommended by the manufacturer and approved by the Employer (NTPC).
2.12	The work shall be carried out according to the approved Design / Drawings. The Contractor's work shall cover satisfying the complete requirements as per IS Codes, requirements of various Statutory Bodies, International Standards, best prevailing practices and to the complete satisfaction of the Employer (NTPC).
2.13	All the quality standards, tolerances, Welding standards and other technical requirements shall be strictly adhered to.
2.14	The Contractor shall fully appraise himself of the prevailing conditions at the proposed Site, climatic conditions including monsoon pattern, soil conditions, local conditions and Site specific parameters and shall provide for all such conditions and contingent measures, including those which may not have been specifically brought out in the Specifications but required for successful execution of work.
2.15	In case of any conflict between stipulations in various portions of the Specification, most stringent stipulation would be applicable for implementation by the Contractor without any extra cost to the BHEL / Employer (NTPC).
2.16	All Materials shall be as per applicable Standards and Codes.
2.17	All Materials brought for incorporation in works shall be of best quality as per IS, unless specified otherwise.
2.18	Welding shall be used for fabrication and Erection. Site connections shall be with Welding / Bolts. For Bolt connection, IS : 4000, IS : 3757, IS : 6623 and IS : 6649 shall be followed. For Welding of Structures IS : 814, IS : 816, IS : 1024, IS : 4353 and IS : 9595 shall be followed. Other requirements pertaining to welding mentioned elsewhere in the specification shall also be satisfied by the Contractor.
2.19	Whenever Contractor is taking any support from any of the Employer's (NTPC) Structures, the Contractor shall ensure that no damage is done, to the Employer's (NTPC) Structures including Painting thereof. In case of any damage to the Employer's (NTPC) Structure and / or Painting, then the Contractor shall rectify the same to the complete satisfaction of the Employer (NTPC).
2.20	Supporting Structures shall be so configured that the temperature of Steel does not exceed 60° C unless specified otherwise



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2.21	The bracing in Structures shall be provided such that under no circumstances normal / convenient access to any points is blocked or obstructed.
2.22	Propping / supporting of any Beam on the bracing members shall not be permitted
2.23	Electrodes
2.23.1	The electrodes used for welding shall be of suitable type and size depending upon specifications of the parent material, the method of welding, the position of welding and quality of welds desired. Only low hydrogen electrodes shall be used for welding of medium / high tensile steel and for mild steel plate thickness above 20 mm.
2.23.2	All low hydrogen electrodes shall be baked and stored before use as per manufacturer's recommendation. The electrodes shall be re-baked at 250°C - 300°C for one hour and later on cooled in the same oven to 100° C. It shall be transferred to a holding oven maintained at 60°C - 70°C. The electrodes shall be drawn from this oven for use.
2.23.3	Where coated electrodes are used they shall meet the requirements of IS: 814 and relevant ASME - Sec. II. Covering shall be heavy to withstand normal conditions of handling and storage.
2.23.4	Only those electrodes that give radiographic quality welds shall be used for welds, which are subjected to radiographic testing.
2.23.5	Where bare electrodes are used these shall correspond to specification of the parent material. The type of flux-wire combination for submerged arc welding shall conform to the requirements of F-60 class of AWSA-5-17-69 and IS: 3613. The electrodes shall be stored properly and the flux shall be baked before use in an oven in accordance with the manufacturer's requirements as stipulated.
2.23.6	The contractor shall take specific approval of the weld for the various electrodes proposed to be used on the works before any welding is started.
2.24	Edge Preparation for Welding: Suitable edge as per weld joint detail shall be prepared either by machines or by automatic gas cutting. All edges cut by flame shall be ground before they are welded.
2.25	Pre Heating and Post Heating
2.25.1	Mild steel and medium / high tensile steel plates thicker than 20mm, will require Pre-Heating of the parent plate prior to welding as mentioned in Table - 1 for mild steel and Table - 2 for medium / high tensile steel, however, higher pre heat temperature may be required as per approved welding procedure and it shall be followed. In welding materials of unequal thickness, the thicker part shall be taken for this purpose.



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2.25.2

Base metal shall be preheated, not withstanding provisions of IS: 9595 to the temperature given in Table - 1 for mild steel and Table - 2 for medium / high tensile steel, prior to welding or tack welding. When base metal not otherwise required to be pre heated is at a temperature below 0°C it shall be pre heated to at least 20°C., prior to tack welding or welding. Pre heating shall bring the surface of the base metal to the specified pre heat temperature and this temperature shall be maintained as minimum inter-pass temperature while welding is in progress.

2.25.3

TABLE - 1
MINIMUM PREHEAT AND INTERPASS TEMPERATURE FOR
WELDING MILD STEEL

Thickness of thicker part at Point of welding	Welding Using#	
	Low hydrogen electrode or submerged arc welding	Other than low hydrogen electrode
Upto and including 20mm	None#	None#
Over 20mm and up to and including 40mm	20°C	Not allowed
Over 40mm and up to and including 63mm	66°C	Not allowed
Over 63mm	110°C	Not allowed

Note: Type of electrode and the preheating requirements for welding shall be as per approved welding procedure.

2.25.4

TABLE - 2
MINIMUM PREHEAT AND INTERPASS TEMPERATURE FOR
WELDING MEDIUM / HIGH TENSILE STEEL

Thickness of thicker part at Point of welding	Welding Using#	
	Low hydrogen electrode or submerged arc welding	Other than low hydrogen electrode
Upto and including 20mm	None#	Not allowed#
Over 20mm	120°C – 140°C	Not allowed



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Note: Type of electrode and the preheating requirements for welding of medium and high tensile steel shall be as per approved welding procedure.

2.25.5 Pre heating may be applied by external flame which is non-carbonizing like LPG, by electric resistance or electric induction process such that uniform heating of the surface extending up to a distance of four times the thickness of the plate on either side of the welded joint is obtained.

2.25.6 Thermo-chalk, thermo-couple or other approved methods shall be used for measuring the plate temperature.

2.25.7 All butt welds with plates thicker than 50mm and all site butt welds of main framing beam supporting the bunker shall require post weld heat treatment as per procedure given in AWS D-1.1. Post heating shall be done up to 600°C and rate of application shall be 200°C per hour.

2.25.8 The post heat temperature shall be maintained for 60 minutes per 2.5 cm thickness. For maintaining slow and uniform cooling, asbestos pads shall be used for covering the heated areas.

2.26 Erection and Commissioning of steel helical springs / Vibration Isolation Springs (VIS)

2.26.1 Complete erection and commissioning of the steel helical springs and viscous dampers including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc. all by a specialist supervisor.

2.26.2 The scope of work shall be deemed to include all activities, which may not have been explicitly mentioned but are reasonably implied for the successful commissioning of steel helical springs and viscous dampers.

2.26.3 Supervision
The supervision of installation of steel helical springs and viscous dampers including pre-stressing, placing, releasing and alignment of spring units shall be done by a specialist supervisor of sub vendor / supplier, trained for this purpose.

2.26.4 Realignment of Spring System
If any realignment of the steel helical springs and viscous dampers is required to be done for aligning the shaft or for any other reasons during the first one year of operation from the date of commissioning of the machine, the same shall be done by the contractor.

2.27 Corrosion Protection
General
(a) All equipments, pipes, etc. shall be painted as per the requirements specified in the relevant section of the specification.



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(b) All Steel structures (except those embedded in Concrete) shall be provided with Painting as given below which is designed for a minimum maintenance free life of Ten (10) years (expected life, long range Ten (10) to Twenty (20) years, as per BS : 5493.

(c) All Paints shall be of high build constitution.

(d) All Painting shall be done as per approved Painting scheme of the Vendors / Manufacturers, which shall be submitted by the Bidder and as approved by the Employer (NTPC). Painting scheme shall also include Item codification / Description of all Coats of Paints for manufacturer's, from whom the Paint is intended to be procured.

2.28

Painting of Steel Surfaces embedded in Concrete.

(a) For the portion of Steel surfaces embedded in Concrete, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT).

(b) All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive fluid and during execution of civil works, the dried film of coating shall be removed using organic solvents.

2.29

Painting of Steel Surfaces (other than those embedded in Concrete)

(a) All Steel surfaces shall be provided with self curing Inorganic Zinc Silicate Primer Coat (Solid by Volume Minimum 60%) of Minimum 75 Micron Dry Film Thickness (DFT) applied over blast cleaned surface to near white metal conforming to Sa 2 1/2 finish of Swedish standard SIS-05-5900. The Primer Coat shall be applied in Shop immediately after blast cleaning by Airless spray technique.

(b) Primer Coat shall be followed with the application of Intermediate Coat of Polyamide Cured pigmented Titanium Dioxide (TiO₂) or Micaceous Iron Oxide (MI₂) Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied in Shop after an interval of Minimum overnight (from the application of Primer Coat) by Airless spray technique.

(c) Intermediate Coat shall be followed with the application of Finish Coat of Polyamide Cured colour pigmented Epoxy based Paint (Solid by Volume Minimum 60%) of Minimum 75 Micron DFT. This Coat shall be applied after an interval of Minimum overnight and maximum indefinite (from the application of Intermediate Coat) either before Erection by Airless spray technique or after Erection by brush and / or spray. Colour and shade of the Coat shall be as approved by the Employer (NTPC). The Finish Coat thickness of 75 Micron can be built up either in Single application at Shop or in two applications one at Shop and the other at Site.

(d) Finish Coat shall be followed with the application of Final Finish Coat of Polyurethane based colour pigmented Paint (Solid by Volume Minimum 40%) of Minimum 25 Micron DFT. This Coat shall be applied within Seven (7) days (from the completion of Finish Coat), after Erection by



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	brush and / or spray. Colour and shade of the Coat shall be as approved by the Employer (NTPC)
2.30	Touch-up Painting on damaged areas (a) For Coatings damaged up to metal surface Surface preparation shall be carried out by Manual Cleaning. Minimum 6 inches adjoining area with existing Coating shall be roughened by Wire brushing, emery paper rubbing etc., for best adhesion of patch Primer. Primer Coat of self-priming Epoxy Touch-up Primer applied by brush immediately after the surface preparation. (Minimum DFT 100 Microns). Over this Primer Coat, Intermediate Coat, Finish Coat and Final Finish Coat shall be applied as covered above by brush with Intermediate Coat applied within maximum seven (7) days of application of touch up Primer. (b) For Coatings damaged upto Intermediate Coatings (i.e. where Primer Coat is intact). Damaged area including Minimum 6 inches adjoining area with existing Coating should be roughened by wire brushing, emery paper rubbing etc., for best adhesion of patch Primer without damaging the Primer Coat. Touch-up Primer, Intermediate, Finish and Final Finish Coats shall be applied as specified above for Coatings damaged up to metal surface.
2.31	Painting of Welded areas / Painting of areas exposed after removal of temporary supports / Touch-up Painting on damaged areas of Employer's (NTPC) Structures, where inter-connection, Welding / modification etc. has been carried out by the Contractor. (a) Clean the surface to remove flux spatters and loose rust, loose Coatings in the adjoining areas of Weld seams by wire brush and emery paper. (b) Painting procedure to be followed as mentioned above for Touch-up Painting on damaged areas.
2.32	Dry film thickness of each coat shall be checked and measured as per the procedure specified in paint application standard no. 2 by SSPC: The Society for Protective Coating. The thickness as measured shall not be less than the minimum thickness specified for the coat of paint under relevant clauses of technical specification.
2.33	Coating for Mild Steel parts in contact with Water. (a) All mild Steel parts coming in contact with water or water vapour shall be hot dip



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	galvanised. The Minimum Coating of Zinc shall be 610 Gms / Sq. M. for galvanised Structures and shall comply with IS : 4759 and other relevant Codes. Galvanising shall be checked and tested in accordance with IS : 2629.
2.34	Gratings All gratings shall be blast cleaned to Sa 2 1/2 finish of Swedish standard SIS-05-5900 or cleaned by acid pickling and shall be hot dip galvanised at the rate of 610 Gms / Sq. M.
2.35	Hand Railings and Ladders All handrails and ladders shall be galvanised at the rate of 610 Gms / Sq. M. as per IS 4736.
2.36	Hand Railing Minimum 1000 mm high hand railing shall be provided around all Openings, projections / balconies, walkways, platforms, Steel Stairs, etc., All handrails and ladder Pipes shall be 32/40 mm nominal bore MS Pipes (medium class). Handrails shall have top and middle rails at a height of 1000 mm and 500 mm and the vertical post spacing shall not exceed 1.50 M, with provision of kick Plates (100 mm high and 6 mm thick).
2.37	GRATING All gratings shall be Electro-forged type. Minimum thickness of the grating shall be 40 mm for in door installation and 32 mm for outdoor installation. The Opening size shall not be more than 30 mm X 100 mm. The Minimum thickness of the main bearing bar shall be 5 mm. Cutting of gratings shall not be carried out at Site. Any cutting of gratings required to provide passage for Columns / Pipes / Cables / Ducts etc. shall be done by the Contractor in Shop and cut edges of Grating shall be suitably reinforced with binding strips.
2.38	FIRE EXITS All fire exits shall be Painted with P 0 Red / signal Red colour shade, which shall not be used anywhere except to indicate the emergency or safety measures. Fire safety norms shall be followed as per National Building Code and requirements of various statutory bodies shall be followed for providing Fire Exits, Escape Stairs and Fire Fighting Equipment.
2.39	OPENINGS Details / Data of all Openings required by the Contractor in Floors / Walls / Cladding / Roof to be provided by the Employer (NTPC) shall be given by the Contractor, who shall also furnish all Foundation Loads to be considered by the Employer (NTPC) for the Design of Foundations to support the Contractors Structures / Equipment. Accordingly, the same shall be listed in Engineering Information Flow Schedule to be furnished by the Contractor. If the details / data of all Openings required by the Contractor in Floors / Walls / Cladding / Roof are not furnished by the Contractor, as per the Engineering Information Flow Schedule



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then all such required Openings shall be created by the Contractor himself, at a later date in Floors / Walls / Cladding / Roof by using special tools, as required. In this case edge protection to the Openings shall also be provided by the Contractor using Anchor Fasteners.

For routing of Pipes / Cables / Ducts, Employer (NTPC) shall only provide suitable passage / Opening in Floors / Walls / Cladding. Any Pipe sleeves or embedments required by the Contractor in these passages / Openings shall be provided by the Contractor himself. These passage / Openings shall be suitably sealed by the Contractor after completion of Erection works.

2.40

GROUTING

Non-shrink cementitious flowable grout shall be used for Grouting of pockets and underpinning work below Base Plate of columns. Nominal thickness of grout shall be 50 mm. Nonshrink cum plasticizer admixture shall be added in the grout. Crushing Strength of the grout shall generally be one grade higher than that of the base Concrete. Minimum grade of grout shall be M30.

However, for Equipment Foundations, high Strength (Minimum Characteristic Compressive Strength of 60 N / mm² at 28 days) ready mixed non-shrink, Chloride free, Cement based, free flowing, non-metallic grout as recommended by Equipment manufacturer shall be used. The ready mix grout shall be of reputed make as approved by the Employer (NTPC).

The surface to be grouted shall be properly cleaned by using compressed air. Contractor shall provide the required shim plates.

2.41

For roofing & side cladding, troughed permanently colour coated sheets (internal or external) shall conform to any one of the following -

(i) of steel with zinc coated to class Z275 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.6mm of grade G250 as per AS1397 / grade SS255 as per ASTM A653M / grade S250GD as per EN 10326.

(ii) of steel with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.5mm of grade G350 as per AS1397 / grade SS340 class 4 as per ASTM A792M / grade S350GD as per EN 10326.

(iii) of steel with aluminium-zinc alloy coated to class AZ150 with minimum bare metal thickness (i.e. excluding the thickness of coating and painting) of 0.4mm of grade G550 as per AS1397 / grade SS550 as per ASTM A792M / grade S550GD as per EN 10326.

Steel shall be colour coated with total coating thickness of 35 microns (nominal) dry film thickness (DFT) comprising of Silicon Modified Polyester paint (SMP with silicon content of 30% to 50%) or Polyester paint, of 20 microns (nominal) SMP or polyester paint on one side (exposed side) over 5 micron (nominal) primer coat and 5 micron (nominal) SMP or Polyester paint over 5 micron (nominal) primer coat on other side, (SMP and Polyester paint shall conform to Product type 4 of AS/ANZ 2728. Coated surface shall be provided with a protected



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guard film (polyethylene) of about 40 microns to avoid any damage to the coating during handling.

Sheet shall be of approved profile, sectional properties, colour and shade.

Chemical composition of troughed permanently colour coated metal decking sheets and metal sheet for roofing and side cladding, shall conform to the provisions of the same reference code to which the mechanical properties conform to. Mechanical properties shall be confirmed by relevant tests.

Tolerance on minimum BMT (bare metal thickness) shall be (-)0.00mm and (+)0.06mm. Plain permanently colour coated steel metal sheets for ridge and hips, flashings, trimmings, closure for vertical and horizontal joints, capping etc shall confirm to the same requirements as those of troughed permanently colour coated metal sheet for roofing and side cladding.

For metal decking the sectional modulus and moment of inertia of troughed profile per meter width shall be so as to limit the deflection of sheets to span/250 for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS:801 for satisfying the deflection and strength requirements.

For metal roofing and side cladding, the sectional modulus and moment of inertia of troughed profile per metre width shall be such that the deflection of sheets is limited to span/250 for two span condition. The sectional modulus and moment of inertia of troughed profile shall be computed as per the provisions of IS: 801 for satisfying the deflection and strength requirements. No increase in allowable stress is permissible under wind load condition.

Maximum spacing of the fasteners shall be 390 mm c/c along the length of purlins / runners.

However exact spacing shall be as per the design done by the bidder for the fasteners considering the wind load, self load and other associated loads. Minimum diameter of the fastener shall be 5.5 mm and atleast 3 nos. of fasteners shall be used per sheet.

Sealant used for cladding shall be butyl based, two parts poly sulphide or equivalent approved, non-staining material and shall be flexible enough not to interface with fit of the sheets.

Filler blocks as a trough filler shall be used to seal cavities formed between the profiled sheet and the support or flashing. The filler blocks shall be manufactured from black synthetic rubber or any other material approved by the Engineer.

For insulation of cladding, mineral wool conforming to IS: 8183 shall be used. The density shall be 32 or 48 kg. /Cu.M. for glass or rock wool respectively. The nominal thickness of insulation shall be 50mm.

Special coated fasteners shall be used conforming to corrosion resistant class 3 as per AS3566 and shall be tested to 1000 hours salt spray test.

The dimensional tolerances of profiled sheets for sheet length, sheet cover width,



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straightness, squareness, depth of profile, radius and angle of curved sheets, ripple of side lap, etc. shall be as per "Manufacturing tolerances for profiled metal roof and wall cladding & roofing" by The Metal Cladding & Roofing Manufacturers Association Limited, UK.

Sheets shall be laid with a minimum overlap of 15 cm at the ends and side laps shall be of one trough length subject to a minimum of 50 mm, having a proper water tight arrangement.

The minimum lap of sheets with ridges, hips and valleys shall be 15 cm measured at right angles to the line of the ridge, hip and valley respectively.

Metal decking sheets shall be laid over the supporting purlins with a minimum bearing of 50 mm and end projection of 75 mm at lap joints.

Flashings, cappings, trimming, closure for vertical/horizontal joints, ridge and hips etc. shall be provided with a minimum lap of 15 cm. The lapping of sheets shall provide the dust free, airtight enclosure. If required, this may be achieved by using 2-parts polysulphide sealing compound or butyl tape.

Distorted, blemished or water stained sheets shall not be used.

Side and end laps of the sheets shall be made weather proof by securing them with the fasteners not less than 4.8mm dia with 2.0 mm thick neoprene washer. Maximum spacing of the fasteners should not exceed 500 mm.

Precautions shall be taken during the erection of the sheets to ensure that partially erected sheets are protected from damage at all times and particularly during inclement weather.

Sheets shall be laid over the supporting purlins with a minimum bearing of 50 mm and end projection of 75 mm at lap joints.

Side cladding for Mill Bunker building, Transfer points & conveyor galleries (including roof) shall have single skin troughed profile permanently colour coated sheets. However, roof of Mill bunker building and transfer points shall be provided with troughed profile permanently colour coated sheet on outside and plain permanently coated sheet on inside with 50mm thick mineral wool insulation in between the two sheets.

The polycarbonate sheet to be used for cladding and glazing purpose in conveyor galleries shall have toughed profile to match with the metal cladding profile. Minimum 2.0 mm thick fire retardant and UV resistant polycarbonate clean sheet of GE plastic or equivalent approved make shall be used. The polycarbonate sheet shall be installed along with the metal cladding so as to have a watertight lapping arrangement. Suitable detailing shall be made to cater for the thermal expansion. IS: 14434 to be referred for other details.

Polycarbonate sheet minimum 6mm thick multi (twin) wall fire retardant (Continuous use under temperature 100°C), impact resistant and ultraviolet resistant sheet shall be provided (as glazing) in transfer houses, pump houses, etc.



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2.42

NUTS AND BOLTS

M. S. Nuts and Bolts shall conform to IS:1363, 15:1364, IS:1367.

High Tensile fixing with Bolts and nuts shall respectively be as per IS:3757 and IS:6623.

Washers shall conform to IS 5369, IS : 5370, IS : 5372, IS : 5374, IS : 6610, IS : 6649, as appropriate.

2.43

STATUTORY REQUIREMENTS

Contractor shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules, Water Act for pollution control, Explosives Acts, etc.

Provisions of safety, health and welfare according to Factories Act shall be complied with.

These shall include railing, fire escape, etc.

Provisions for Fireproof Doors, number of Staircases, etc. shall be made in the Layout / schemes according to the requirements of Statutory Bodies.

Statutory clearances and norms of State Pollution Control Board shall be followed.

2.44

PERMISSIBLE TOLERANCES

All Structural Steel work shall be Shop fabricated outside the Plant area.

Tolerances on dimensions for fabrication of Steel Structures shall be according to IS 7215.

Tolerances on dimensions for Erection of Steel Structures shall be according to IS 12843.

Tests on Welds shall be as per ASTM standards, IS : 816 and IS 9595.

Dimensional and weight tolerance of Rolled Steel shapes shall be as per IS : 1852.

2.45

LIST OF CODES AND STANDARDS

All applicable standards, references, Specifications, Codes of practice, etc., shall be the latest edition including all applicable official amendments and revisions. A complete set of all these documents shall be available at Site with Contractor.



TITLE:

**STANDARD TECHNICAL
SPECIFICATION FOR METAL DOORS,
WINDOWS, VENTILATORS, LOUVERS
ETC.**

SPECIFICATION NO. PE-TS-392-600-C005

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SECTION - D SUB-SECTION-D5

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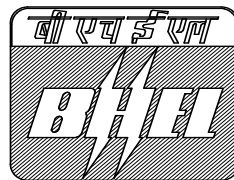
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**METAL DOORS, WINDOWS, VENTILATORS,
LOUVERS ETC.**

SPECIFICATION NO. PE-TS-392-600-C005



Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL House

Asian Games Village Complex

Siri Fort, New Delhi-110049



TITLE:

**STANDARD TECHNICAL
SPECIFICATION FOR METAL DOORS,
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SPECIFICATION NO. PE-TS-392-600-C005

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METAL DOORS, WINDOWS, VENTILATORS, LOUVERS ETC.**1.00.00 SCOPE**

This section covers supplying and/or erecting and installing of all metal doors, windows, ventilators, louvers, glazed partitions, etc. The scope of work shall also include the assembly and erection of all doors, windows, louvers, glazed partitions, etc. Supplying and/or fixing of all door and window accessories and hardware are also included in the scope.

2.00.00 INSTALLATION**2.01.00 Materials**

Steel sections used for fabrication of doors, windows etc. shall be standard rolled steel sections specified in IS: 1038 and IS: 1361 or as specified.

Steel sheets for frames, shutters, louver blades etc. shall be of gauge mentioned in drawings and schedules.

Aluminium sections for fabricating doors, windows, partitions etc. shall be extruded sections conforming to IS:733 or IS:1285 or as manufactured by Indian Aluminium Company Limited or approved equivalent. Aluminium door, windows and ventilator shall be fabricated as per IS:1948 and IS:1949. The alloy used shall conform to IS Designation HE 9-WP of IS: 733.

Hardware and fixtures shall be as specified and the best quality from approved manufacturers shall only be used. The tenderer shall specifically state the particular manufacturer's materials he proposes to use. Improper alignment or faulty operation due to inadequate strength of hardware or fixture shall entirely be the Contractor's responsibility.

All hardware and fixtures shall be able to withstand repeated use. Door closures shall conform to IS: 3564 and shall be suitable for doors weighing 61-80 Kg. unless otherwise stated. Each closer shall be guaranteed against manufacturing defect for one year and any defect found within this period shall be rectified or shall be replaced free of charge. Concealed door closers shall be either floor mounted or transom mounted, suitable for installation with metal doors. It shall conform to the performance Requirements and endurance test stated in IS: 3564 - Appendix-A. The Contractor shall submit samples of each type of hardware to the Engineer. The approved samples shall be retained by the Engineer for comparison of bulk supply. The samples shall be returned to the Contractor towards end for incorporation in the job. The mastic for caulking shall be of best quality from a manufacturer approved by, the Engineer. In general, mastic for fixing of metals frames shall be as per IS: 1081 or as approved by the Engineer.



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2.02.00 Fabrication**2.02.01 Steel Doors, Windows, Ventilators, louvers etc.****a) Door Frames**

Frames shall be fabricated from 16 gauge (G) sheets. They shall, be mortised, reinforced, drilled, and tapped for hinge lock and bolt strikes. Where necessary, frames shall be reinforced for door closers. Welded construction with mitered Corners shall be used. Rubber door silencers shall be furnished for the striking jamb. Loose "T" masonry anchors shall be provided. Frames shall finish flush with floor and adjustable floor anchors shall be installed. Frames shall be brought to site with floor ties/weather bars installed in, place.

b) Double or Single Plate Flush Door Shutters

Door shutters shall be 45 mm thick, completely flush design and shall comprise of two outer sheets of 18 G steel sheets, rigidly connected and reinforced inside with continuous vertical 20 G stiffeners, spot welded in position at not more than 150 mm on centres including void filled with mineral wool (64kg/cum density).

Both edges of doors shall be joined and reinforced full height by steel channels placed immediately inside and welded to the door faces. Top and bottom of doors shall be reinforced horizontally as shown on drawing by steel channels running full width of door. Doors shall not have more than 2.5 mm clearance at jambs and heads, shall have proper level on lock stiles and rails to operate without binding, and shall be reinforced at corners to prevent sagging or twisting. Pairs of double doors shall have meeting-stile edges bevelled or rebated. Where shown in drawings, or called for in the schedule of items. The doors shall be sound deadened by filling the inside voids with mineral wool or other suitable approved materials.

Doors shall be mortised, reinforced, drilled, and tapped in shop for hinges, locks, and bolts. They shall also be reinforced for closers, push-plates, and other surface hardware where necessary. Any drilling and tapping required for surface hardware shall be done at site. Where shown in drawings, provision shall be made for fixing glazing, vision panels, louvers etc. glazing mouldings shall be of 18 G steel or extruded aluminium sections and suitable for fixing 6 mm. glass. Louvers blades shall be V or Z shaped and made out of 18G sheets.



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c) Single or Double Sheet Door Shutters

Single sheet doors shall be made from best quality 18 G (mild) steel sheets, and shall present a flush surface on the outside. The inside shall be stiffened with semi tubular edge and central stiffening rail, which shall convey the lock and other fixture. The frames shall be made from best quality, 16 G mild steel sheets.

Wherever required, provisions for fixing glass panes, louvers etc. shall be made.

The manufacturing shall be done as specified in 2.02.01 (b) “Double Plate Flush Door Shutters.”

d) Sliding Door

Sliding doors shall be either double plate or single plate Construction made out of 18 gauge steel sheets with adequate stiffeners. The contractor shall specify the weight of the door in his shop drawings and submit the manufacturer's catalogue of the sliding gear proposed to use. Where called for the Contractor shall make provision for openings to the door for monorail beams. Doors shall close positively to exclude rainwater from seeping in. When called for, sliding doors shall withstand specified wind loads without buckling or jamming. The door shall slide freely under all ambient conditions.

e) Door Threshold

Door threshold shall be provided. Doors without threshold shall have bottom tie of approved type.

f) Steel Windows, Sashes, and Ventilators etc.

These shall conform in all respects to IS: 1038 and IS: 1361, IS: 7452 latest editions. The details as called for in the above codes shall be applicable for coupling mullions, transoms, weather bars, and pivot arrangements for ventilators, etc. or as called for. All welds shall be dressed flush on all exposed and contact surfaces. Where composite unit openings are required the individual window units shall be joined together with requisite transoms and mullions. All windows shall be outside glazed, fixed with putty or metal glazing beads as specified. Where aluminium glazing beads are specified, they shall be extruded aluminium channel 9.5 mm x 9.5 mm x 1.6 mm (Indal Section No. 2209) /hindalco /jindal unless otherwise shown on drawings. Aluminium beads shall be given one coat of zinc chromate primer before fixing to windows.



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Extruded sections shall have a minimum 3 mm wall thickness. All sections shall be approved by the Engineer before fabrication is taken up. Doors frames, mullions, transom etc. shall be anodized in a bath of sulphuric acid to provide a clear coating and electro color coating of required shade as per IS 1868 (minimum anodized coating of grade AC15)of minimum 15 micron thickness. The anodized materials shall then be sealed by immersing in boiling water for 15 minutes. A protective transparent Coating shall be applied to the sections before shipment from the factory.

All work shall be fitted and shop assembled to a first class job, and ready for erection. Shop joints shall be made to hair lines and then welded or braced by such method as will produce an uniform colour throughout the work. Work on the above, other than described, shall be carefully fitted and assembled with neat joints with concealed fasteners. Wherever possible, joints shall be made in concealed locations and on edges of doors. Field connections of all work may be made with concealed screws or other approved type of fasteners. Glazing beads shall be snap fit type without visible screws and shall be of sizes to accommodate 6 mm thick glazing. All work shall be adequately braced and reinforced as necessary for strength and rigidity.

2.03.00**Shop Coat or Paint**

The shop Paint for steel doors, windows etc. shall be best lead or zinc chromate primer paint from, approved manufacturer. All surfaces shall be thoroughly cleaned of rust, grease, loose mill scales etc. and given one coat of shop paint. Portions like mullions, transoms etc. that will be inaccessible after assembly of units shall be given an extra coat of paint before assembly.

Where called for, all steel doors, windows, etc. shall be hot dip galvanized to give a coating weight of 1½ - 2 oz. per sqft. One coat zinc chromate primer coat shall then be applied as shop paint.

Portions of aluminium frame, which come in contact with masonry construction shall be (before shipment from workshop) protected with a heavy coat of alkali resistant paint. Aluminium coming in contact with other incompatible metals shall be coated with zinc chromate primer.

2.04.00**Handling & Storage of Fabricated Material**

All metal doors, windows, etc. shall be packed and crated properly before dispatch, to ensure that there will be no damage to the fabricated materials. Loading into wagons and trucks shall be done with all care to ensure safe arrival of materials at site in undamaged condition.

When taking delivery of items supplied by Owner, the Contractor shall satisfy himself that the items supplied are up to the specified standard. Any defect



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detected shall promptly be brought to the notice of the Engineer.

All metal doors, windows etc. shall be stored under cover in a way to prevent damage or distortion. Special care shall be taken to prevent staining of aluminium products by rust, mortar etc.

2.05.00**Assembly & Erection at Site**

In general, the fixing of steel doors, windows, ventilators, louvers, etc. shall conform to IS: 1081. The Contractor shall assemble and install all steel doors, windows, sashes, fixed metal louvers, etc. including transoms and mullions for composite units in respective places, keening proper "Lines and levels", and in approved workmanlike manner, to give trouble free and leak-proof installations. Installation shall be done according to instructions of the manufacturer, and/or as approved by the Engineer. If required by the Engineer, the installation shall have to be carried out under the supervision of the manufacturer's staff. The Contractor shall take all precaution against damage of the components during installation. Necessary holes, chases, etc. required for fixing shall be made by the Contractor and made good again as per original, after installation, without any extra charge.

After installation of steel doors, windows, etc. all abrasions to shop-coat of paint shall be retouched and made good the same quality of paint used in shop coat.

All coupling mullions, transoms, frames, etc. in contact with adjacent steel and other members, shall be well bedded in mastic. The Contractor shall bring to the site the cement in original sealed containers of manufacturer and shall apply it as per the instruction. For all frames supplied by either the owner or the Contractor, mastic shall be supplied by the Contractor and caulking done properly as per drawings, specifications and as per instructions of the Engineer.

Door shutters, partitions hardware fixtures etc. shall be fixed only after major equipments have been installed in rooms.

Wherever required, nylon cords of approved quality shall be supplied along with pivoted sashes and shall be of adequate length to terminate one metres from the floor. Loose ends of cords shall end in metal or plastic pull as approved by the Engineer.

2.06.0**Fire proof Door**

Fire proof doors shall be provided at all fire exit points as specified and also to restrict the spread of fire within buildings whether from internal fire or from external fire. The construction details of door shall conform to the requirements stipulated in IS:3614(Part-1). Doors shall comply with the



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testing requirement mentioned in IS:3614 (Part-2). The doors shall be approved by Tariff Advisory Committee(TAC) and shall have minimum 2 hrs. fire rating.

Metal covered (on both sides) Doors having insulating core filled up with mineral wool shall be used at all fire exit points and shall open out side.

All necessary accessories and hardware ,panic bars shall also be supplied along with doors. Fire proof door shall be provided with zinc silicate primer (minimum DFT 75 micron) after blast cleaning the surface to near white metal surface and shall be finished painted with epoxy based painting.

3.00.00 ACCEPTANCE CRITERIA

3.01.00 For fabricated Items

- a) Overall dimensions shall be within ± 1.5 mm of the size shown on drawings.
- b) Mullions, transoms etc. shall be in one length and permissible deviations from straightness shall be limited to ± 1.5 mm from the axis of the member.
- c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm for double leaf doors; the gap at the meeting stiles shall not be more than 1.5 mm.
- d) Door leaves shall be undercut where shown on drawings.
- e) Doors, windows, frames, etc. shall be on a true plane, free from warp or buckle.
- f) All welds shall be dressed flush on exposed and contact surfaces.
- g) Correctness of location and smoothness of operations of all shop installed hardware and fixtures
- h) Provision for hardware and fixtures to be installed at site.
- i) Glazing beads shall be cut with mitered corners.
- j) Glazing clips, fixing devices etc. shall be supplied in adequate numbers.
- k) Shop coats shall be properly applied.
- l) Exposed aluminum surfaces shall be free from scratches, stains, and discoloration. Anodized surfaces shall present a uniform and pleasing look.

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3.02.00	For installed Items a) Installations shall be at correct location, elevation and in general, on a true vertical plane. b) Fixing details shall be strictly as shown in drawings. c) Assembly of composite units shall be strictly, as per drawings with mastic caulking of transoms and mullions, gaskets, weather strips etc. complete. d) All frames on external walls shall be mastic caulked to prevent leakage through joint between frames and masonry. e) All open able section shall operate smoothly without jamming. f) Locks, fasteners etc. shall be engage positively. Key shall, be non-interchangeable. g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint. h) Aluminium doors, windows, etc. shall be free from scratches stain or discoloration.	
4.00.00	INFORMATION TO BE SUBMITTED	
4.01.00	With Tender a) Names of manufacturers for Doors, windows etc. b) Manufacturer's catalogue for all hardware and fixtures proposed to be used.	
4.02.00	After Award a) Before starting fabrication of all metal doors, windows, etc. the Contractor shall submit detailed fabrication drawings to the Engineer for approval. The fabrication shall be started only after approval of drawings. b) He shall submit a programme of work to be done for the approval of the Engineer. c) Before bulk supply, he shall submit for the approval of the Engineer samples of all bought out items and samples of each type of fabricated items. The samples shall by retained by the Engineer for comparison of bulk supply and returned to the Contractor towards the end for final incorporation in the job.	

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5.00.00	IS CODES All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed. Specification for Wrought Aluminium and Aluminium Alloy bars, rods and sections (for general engineering purpose) - IS: 733 Specification for Wrought Aluminium and Aluminium Alloy, extruded round tube, hollow Section (for general engineering purpose) - IS: 1285 Steel doors, windows, and ventilators - IS: 1038 Steel windows for industrial, building - IS: 1361 Aluminium doors windows, and ventilators - IS: 1948 Aluminium windows for industrial buildings - IS: 1949 Steel doorframes - IS: 4351 Code of practice for fixing and glazing of Metal (steel and aluminium) doors, windows and Ventilators. - IS: 1081 Specification for Fire-check Doors – Part 1: Plate, Metal covered and Rolling type - IS: 3614 Hot Rolled Steel Sections for Doors, Windows and Ventilators – Specification - IS: 7452	
6.00.00	RATES AND MEASUREMENT	
6.01.00	Rates	
	Rates shall be applicable of all elevation. Rates shall include preparation of working drawings (if required), supply of material, fixtures, gaskets, erection of unit, caulking and jamming of frames, including cutting/drilling/welding, grouting, grinding, making good of the structure for installing the unit etc. complete as per “Schedule of Items”.	



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Rates shall also include cost of surface preparation, application of primer, enamel painting or anodizing as applicable.

Rate for fire proof door is inclusive of providing insulation core, primer, shop painting (epoxy based), all hardware as specified in Schedule of items.

6.02.00 Measurement

Supply and installation of doors, windows, and ventilators shall be measured in Sqm in net outer to outer (excluding frame) area of doors, windows, and ventilators of each type used as described in "Schedule of Items". Frame for steel or aluminium shall be measured in Kgs. Wooden frames shall be measured in Cum. Measurement for aluminium partition shall be from net outer to outer area of frames i.e., frames are part of partition.

Measurement for fire proof door shall be in SqM in net area outer to outer of the door.



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ANNEXURE-A

SCHEDULE OF FIXTURES

A. TIMBER DOORS

1. For single leaf panel/flush doors

- i) 100 mm brass butt hinges with screws - 3 Nos.
- ii) 150 mm brass tower bolts with screws - 1 No.
- iii) 100 mm x 225 mm clear plastic push
Plate with counter sunk brass screws - 1 No.
- iv) 30 mm brass ring pull handle with
Plates and screws - 1 No.
- v) 150 mm brass coat hook with screws - 1 No.

vi) Heavy duty, cylinder looks on active leaf - for flush door. For door-closure, see "Door Schedule".

B. ALUMINIUM DOORS

1. For double leaf door

- i) Concealed hanging arrangement for door leaves.
- ii) Concealed two points bolt encasing simultaneously at head and threshold on inactive leaf, operable from inside.
- iii) Heavy duty, cylinder look on active leaf.
- iv) Pull handle of approved design on both leaves.
- v) Doors stoppers for both leaves.
- vi) Overhead hydraulic door closure for both leaves.
- vii) Floor mounted hydraulic door closer



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ANNEXURE-A

C. STEEL DOORS AND WINDOWS

1. Doors

a) Double leaf doors

- i) 100 mm butt hinges - 3 Nos. on each leaf.
- ii) 300 mm aluminium tower bolt - 2 Nos. (top and bottom)
On inside of inactive
Leaf. 1. No. (Top only)
On inside active leaf.
- iii) 200 mm anodized aluminium Pull handle - 1 No. of each leaf.
- iv) Door stopper of approved design - 1 No. of each leaf.

NOTE: For locks, door closure and threshold, see "Door Schedule".

b) Single leaf doors

- i) 100 mm butt hinges - 3 Nos.
- ii) 300 mm aluminium tower bolt - 2 Nos. top & bottom of
Inside face
- iii) 200mm anodised aluminium Pull handle - 1 No.
- iv) Door stopper of approved design - 1 No.

NOTE: For locks, door closures and threshold, sec "Door Schedule".

2. Windows, Ventilators, etc.

a) Side Hung Windows

- i) Hinges - As per standard Practice of the
Manufacturer, but minimum two
Hinges Per leaf.
- ii) 12" peg stays - 1 No. per leaf



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ANNEXURE-A

iii) 2 point handles - 1 No. per leaf

b) Top Hung Ventilators (Projecting Out)

i) Hinges - As per standard Practice of the
Manufacturer, but minimum two
Hinges Per leaf.

ii) Adjustable sliding fabrication
Assembles - 2 Nos. per leaf.

iii) 2 point handles - 1 No. per leaf.

c) Bottom Hung Ventilators (Projecting in)

i) Hinges - As per standard Practice of the
Manufacturer, but minimum two
Hinges Per leaf.

ii) Concealed side arms for
Opening adjustment. - 2 Nos. per leaf.

iii) Spring Catch - 1 No. per leaf.



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ANNEXURE-A

D. ALUMINIUM WINDOW, VENTILATORS, ETC.

(As per I.S-1948 latest editions)

a) Side Hung Windows

- i) Hinges - As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
- ii) 300 mm peg stays - 1 No per leaf
- iii) 2 point handles - 1 No per leaf

b) Top Hung Ventilators (Projecting out)

- i) Hinges - As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
- ii) Adjustable sliding fabrication assemblies - 2 Nos. per leaf
- iii) 2 Point handles - 1 No. per leaf

c) Bottom Hung Ventilation&(Projecting In)

- i) Hinges - As per standard Practice of the Manufacturer, but minimum two hinges Per leaf.
- ii) Concealed side arms for opening adjustment - 2 Nos. per leaf
- iii) Spring Catch - 1 No. per leaf



TITLE:

**TECHNICAL SPECIFICATION FOR
GLASS AND GLAZING**

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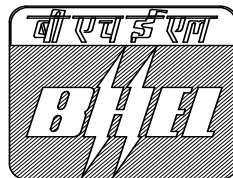
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GLASS AND GLAZING

SPECIFICATION NO. PE-TS-392-600-C006



Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL House

Asian Games Village Complex

Siri Fort, New Delhi-110049



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GLASS AND GLAZING**1.00.00 SCOPE**

This section covers supplying and fixing of all glass and glazing including all clips, putty, mastic cement etc. wherever required as per specifications.

2.00.00 INSTALLATION**2.01.00 General**

The Contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvers, miscellaneous glazing and partitions, from approved manufacturer like Hindustan Pilkinton or equivalent, having uniform refractive index and free from flaws, specks, and bubbles. The glass shall be brought to site in the original packing from the manufacturer and cut to size at site.

Materials

- a) Glare reducing or heat absorbing glass shall be "Calorex" of Hindustan Pilkinton or approved equivalent and special care shall be taken to grind smooth and round off the edges before fixing.
- b) Clear glass shall be flat draw sheet glass and shall be at least 4 mm thick. Sheet glass for doors shall be minimum 5.5 mm thick.
- c) Wired glass shall be thick- rolled glass with centrally embedded 42g wire mesh of Georgian type. This may be of clear or coloured glass, as required.
- d) Obscure glasses shall have a cast surface in one side.
- e) Coloured and figured glass shall be as per approved sample.
- f) In general, the putty shall conform to IS: 400 and be of best quality from approved manufacturer. It shall be brought to site in the manufacturer's original packing.
- g) Neoprene gaskets with snap-fit glazing beads shall be fixed as per manufacturer's instructions and shall sit snugly against glass to give a leak proof installation.
- h) Polycarbonate sheet multi (twin) wall fire retardant and ultra violet resistant with sealed open edges. as per IS: 14443.
- i) Patterned, figured or rolled glass :-It is a decorative and translucent glass



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with figures or patterns on one face. In addition to diffusing light and obstructing visibility from the outside, the figures soften the interior lighting. This type of glass is usually more fragile and less convenient to clean

- j) Ground Glass :- Ground glass surface has been ground to produce a flat but rough (matte) finish. Glass surface has been ground or etched to create a roughened non transparent surface. this are similar as figured glass, obstructing visibility from the outside.

- k) heat-reflecting type float glass:

A metallic coating is applied to one side of the glass in order to significantly increase the amount of reflection by the glass of both the visible and infra-red (light and heat) range of the electromagnetic spectrum. This metallic coating can be applied to clear or body tinted glass. The reflective glass imparts a mirror like appearance to the exterior of buildings under most daytime conditions. Due to the coating of metal oxides on the glass, they are widely applied in buildings for its highly reflective surface and its wide palette of colours. It reduces heat gain and glare from the exterior and allows optimum visible light transmission to the interior. An exceptional property of solar reflective glass is that the coating of metal oxides on the glass can be achieved without affecting the transparency of the glass.

Density : 2.4 – 2.5 g/cm³

- l) Laminated glass:

Laminated glass is composed of two or more layers of glass with one or more layers of a transparent/ pigmented and specially treated plastic Polyvinyl Butyral [PVB] sandwiched between the glass layers. The glass panes (layers) can be either normal glass or tempered glass. When the glass is broken, fragments tend to adhere to the plastic [PVB] interlayer thereby reducing the risk of injury and helping to resist further damage by weather.

Laminated glass retains its colour and strength for the life of the building and is as easily cleaned as any conventional glass.

When exposed to heat, laminated glass breaks but stays in place longer. The risk of thermal breakage is avoided only when heat strengthened / tempered laminated glass is used.

Density (approximate) : 2.42 – 2.52 g/cm³

Tensile strength : 32 N/sq. M

Compressive strength : 1000 N /mm²

Modulus of elasticity : 70 GPa

Coefficient of linear expansion: 9×10^{-6} m / mK

U value : 2.84 W/sq. m. K for 3 mm thick clear to 5.96 W/sq. m. K for 6 mm thick clear



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UV transmittance : 30% for bronze 6 mm thick to 80% for 6 mm thick clear.

Shading co-efficient : 0.5% for 6 mm thick gray to 0.9% for 6mm thick clear.

Visible light transmittance : 25% for 6mm thick bronze to 90% for 6mm thick clear
(product specific information to be referred)

2.03.00**Glazing, Setting, and Finish**

All glazing clips, bolts, nuts, putty, mastic cement etc. as required shall be supplied by the Contractor.

All glass shall be thoroughly cleaned before putting in position. Each glass pane shall be held in place by special glazing clips of approved type. As specified in relevant I.S. Codes, four glazing chips shall be provided per glass pane, except for large panes where six or more clips shall be used as per engineer's instructions. All holes that may be necessary for holding the clips glazing heads and all other attachments shall be drilled by, the Contractor.

Glass panes shall be set without springing, and shall be bedded in putty and back puttied, except where mouldings or gasket are specified, putty, mastic cement etc. shall be smoothly finished to the even line and figured glass shall be set with smooth side out.

Where owner will supply glass, the Contractor shall cut it to size and fix them in the same as specified above.

The Contractor shall supply necessary glazing clips, putty, mastic cement etc.

After completion of glazing, the Contractor shall remove all dirt stains, excess putty etc. clean glass panes and leave the work in perfectly acceptable condition. All broken cracked or damaged glass shall be replaced by new ones at the contractor's own cost.

3.00.00**ACCEPTANCE CRITERIA**

- a) All installation shall be free from cracked, broken, or damaged glass. Edges of large panes of thicker glass and heat absorbing glass shall be inspected carefully for chipped, cracked, or underground edges.
- b) Glazing shall be carefully done to avoid direct contact with metal frames.
- c) All glass shall be embedded in mastic or fixed by neoprene gaskets to give a leak proof installation.



TITLE:

TECHNICAL SPECIFICATION FOR GLASS AND GLAZING

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- d) At completion, the panes shall be free from dirt, stains, excess putty etc. to the complete satisfaction of the Engineer.

4.00.00

I.S. CODES

Following are some of the important I.S.Codes relevant to this Section:

IS: 3548 - Code of practice for glazing in building.

IS: 1081 - Code of practice' for fixing and glazing metal doors, windows ventilators.

IS: 2553 PART-I- Code of practice for safety glass, toughened or laminated glass.

IS: 2835 – 1987-Code of practice for sheet glass, flat transparent sheet glass.

IS: 14443-Code of practice for polycarbonate sheet specification.

IS: 5437- Code of practice for figured rolled and wired glass.



TITLE:

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5.00.00

RATES

Rates of glass and glazing are included in respective items for supply and installation of window, ventilator, and partitions. No separate payment shall be made for glazing clips, mastic cement, putty, screws; rails, etc. nor for drilling holes in frames for inserting glazing clips.



TITLE:

**STANDARD TECHNICAL
SPECIFICATION FOR ROLLING
STEEL SHUTTERS AND GRILLS**

SPECIFICATION NO. PE-TS-392-600-C007

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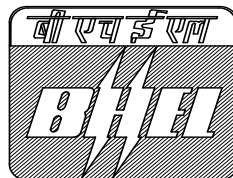
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ROLLING STEEL SHUTTERS AND GRILLS

SPECIFICATION NO. PE-TS-392-600-C007



Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL House

Asian Games Village Complex

Siri Fort, New Delhi-110049



TITLE:

**STANDARD TECHNICAL
SPECIFICATION FOR ROLLING
STEEL SHUTTERS AND GRILLS**

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TITLE:

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ROLLING STEEL SHUTTERS AND GRILLS**1.00.00 SCOPE**

This Section covers the design and supply of materials, fabrication, delivery and erection of Rolling Shutters/Grills with motor drive and/or manual operation including all accessories as hereinafter specified.

2.00.00 INSTALLATION**2.01.00 Components**

- a) Slats for rolling shutters shall be made from tested bright hot rolled double dipped galvanised steel lath section of 18 swg tested mild steel strips at 75 mm rolling centers, interlocking with each other. The profile will be such as to prevent excessive deflection under specified wind load.
- b) Rolling grills shall be constructed out of 6mm rods at 35 mm on centers running horizontally flexible connected with vertical links spaced not more than 200 centers. Alternatively, rolling grills shall be made from perforated slats of approved design reinforced with 6mm dia rods.
- c) End locks shall be heavy type M.C.I./C.I. and shall be provided at each end of alternate slats unless specified otherwise.
- d) Bottom bars shall be finished with two angles not less than 6 mm thick for external shutters. When shown on drawings, a flexible weather strip shall be applied to make tight contact with the floor. Bottom lath shall be coupled to a lock plate fabricated from 3mm thick galvanized steel plate and securely riveted with stiffening angles.
- e) Guides shall be of such depth as to retain the shutter under a wind pressure of 100 Kg/Sq.m.
- f) Shafts shall be of steel pipe of sufficient size to carry the tensional load with a maximum deflection of 1/360th of span. Grease packed ball bearings or bushings shall be provided for smooth trouble free operation.
- g) Hoods shall be formed of not less than 20 gauge steel, suitable reinforced to prevent sag.
- h) Locks shall be slide bolt and hasp, or cylinder lock operable from one or both sides. Provision securing hand chain with pad-lock, provision for removable handle for hand cranks etc. shall be made as prescribed by the Engineer.
- i) Power unit shall be suitable for 3 phase, 50 cycles, 400-volt A.C. power



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supply and be either floor or wall mounted unit. The motor shall be of sufficient capacity, to move the shutter in either direction at a speed of 0.3 metres per second. In addition to the gear motor each standard power unit shall include a magnetic brake, a reversing starter with built-in overload protection, a geared limit switch and one push button station located inside the building unless otherwise stated in drawing.

It is desirable that the bottom bar of motor operated doors shall be provided with a sensitive edge, electrically connected to stop the travel of the door on meeting an obstruction.

- j) Operating chains shall be of tested quality, heavily galvanized and with all ends rounded to assure smooth operation and hand protection.
- k) Reduction gears shall be high strength grey cast iron, machine moulded from machine out patterns.

2.02.00 Manually Operated Shutters/Grills (self coiling type or push pull down)

Self-coiling type rolling shutters shall be raised or lowered manually by means of a puffing hook applied to the pulling handles fixed on the bottom lock plate. The length of the pulling hook shall be adequate to push the bottom lock plate to the topmost position with ease. Manually operated shutters shall be easily operable by one person. The speed of operation shall be about 1.3 metres per second. In general, manually operated shutters shall be push pull type for opening up to 8 Sq. metres in area. It shall be used up to a maximum of about 8 m² clear area without ball bearings and up to a clear area of about 12 m² with ball bearings, as per IS 6248. Larger shutters shall, be either chain or gear operated or crank and gear operated. The crank handle shall be removable. All shutters shall be lockable from one or both sides as desired by the Engineer.

2.03.00 Mechanically or Gear Operated Shutters/Grills

It shall be fitted with ball bearings. It shall be used up to 'a maximum of about 25 m² clear area, if the rolling shutter is operated by a bevel gear-box and crank handle and up to a maximum of about 35 m² clear area, as per IS 6248. All shutters shall be lockable from one or both sides as desired by the Engineer. Gear-operated type rolling shutters ordinarily employ a worm drive arrangement, the worm driving the worm wheel attached to one end of the roller. Worm drive is preferred in view of its irreversible nature, which provides a safeguard against any accidental downward descent of the curtain due to failure of the springs.

2.04.00 Power operated Shutters/Grills



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Electrically operated rolling shutters shall be operated by an electric motor operating on 400/440 V, 3 phase, 50 cycles ac supply. The electric motor shall drive the worm shaft by chain or Vee-belt drive or through a reduction gear box. The reduction gear box shall have a control lever within easy reach from the floor so that the motor may be disengaged and the auxiliary chain gear operating mechanism may be engaged instantly in the event of power failure. The motor unit shall be so mounted that the motor may be completely removed without interfering with the operation of the rolling shutter or the auxiliary drive. The electric drive shall be so designed as to limit the speed of movement of the curtain in either direction to not more than about 10 cm/s

The controls provided for the electric motor shall include push

The controls provided for the electric motor shall include push button control through the medium of a 3-phase reversing starter with Interlocking contractors and overload protection. The reversing starter shall be wall-mounted and fitted adjacent to the shutter in a convenient position. A minimum of 3 phase buttons marked 'Forward', 'Reverse & 'Stop' or 'Up', 'Down', 'Stop' shall be provided with a mechanical locking arrangement to prevent unauthorized or irregular operation of the push buttons. Limit switches shall be provided to cut off current to the motor when the rolling shutter reaches the limit of its travel in the 'Up' and 'Down' directions.

Arrangement shall also be provided for emergency mechanical Operation of the rolling shutter in the event of failure of electricity or electrical equipment. The emergency mechanical operation shall be by an auxiliary chain wheel and hand chain drive on the worm shaft.

2.05.00 Shop Coat

Shutters shall be painted with one coat of red lead or zinc chromate primer. Where specified, shutters shall be galvanized and subsequently painted one coat of zinc chromate for adhesion of field coat and shop paint as per specification.

2.06.00 Erection

Shutters shall be installed by the manufacturer or his authorized representative and all work shall be as per manufacturer's instructions. Any drilling or cutting to concrete, masonry etc. shall be made good after erection of shutters and all abrasion to shop coat shall be touched up. All electrical work shall be in strict accordance with the latest Indian Electricity Rules.

3.00.00 ACCEPTANCE CRITERIA AND GUARANTEE

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3.01.00	Shop Inspection	After completing the manufacture of the different components of the rolling shutter, an arrangement for shop inspection by the Engineer shall be made to check the conformity with approved shop drawings.			
3.02.00	Field Inspection	After installing the shutters, the Contractor shall test the performance of the shutter in the presence of the Engineer. The shutters shall be smoothly operable under all ambient conditions. All control and locking devices shall give fault free performance.			
3.03.00	Guarantee	The Contractor shall give one year's guarantee for the successful operation of the shutters. This shall be supported by a separate and unilateral guarantee from the manufacturer of the shutters.			
4.00.00	I.S. CODE	IS: 6248 - Metal rolling shutters and rolling grills.			
5.00.00	RATES AND MEASUREMENT				
5.01.00	Rates	Rates for rolling shutters and grill shall include the cost of the locks, guide channels, cost of drive as specified. In case of electrically operated rolling shutters, the rate shall also include the mounting of controls, wire and wiring from the nearest junction box, conduit and other electrical connections and cost of electric motor.			
5.02.00	Measurement	Supply and installation of rolling shutter and grill shall be measured in Sqm in net outer to outer (including frame) area of each type used as described in “Schedule of Items”.			



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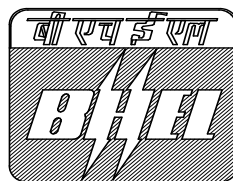
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MISCELLANEOUS METAL

SPECIFICATION NO. PE-TS-392-600-C001



Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL



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MISCELLANEOUS METAL**1.00.00 SCOPE**

This section covers supply, fabrication and erection of miscellaneous metal items of light nature in gates, balcony and stair hand rails, structural works, ladders, hangers, masonry anchors, anchor bolts, fasteners, chain link fencing, barbed wire fencing etc. as specified or shown on drawing or as instructed by the Engineer. The above items shall be of fabricated or cast of mild steel, aluminium, brass, cast iron, M.S. & galvanized M.S. sheets, aluminium sheets, expanded metal, wire mesh as shown on drawings or specified.

2.00.00 INSTALLATION**2.01.00 Fabrication/casting****2.01.01 General**

All work shall be done according to approved shop drawings. All workmanship shall be equal to the best practice in modern structural or foundry shop.

2.01.02 Shop Connections

- a) All shop connections shall be riveted or welded except when noted otherwise on drawings.
- b) Welding of steel shall be done in accordance with IS: 816.
- c) Welding of aluminium shall be done accordance with IS: 2812, "Arc welding of Aluminium and Alloys." Special care shall be taken to grind smooth all welded surface that shall remain exposed to view. Welds shall be electrically continuous if so required by the Engineer.

2.01.03 Shop Coat

Before leaving the shop, all metal work shall be thoroughly cleaned by effective means of all loose mill scale, rust and foreign matter. Except where encased in concrete, all steelwork shall be given one coat of approved metal protective paint, applied by brush thoroughly and evenly, well worked into joints and other open spaces. All paint shall be applied to dry surfaces. When specified steel work shall be galvanised or painted with a coat of zinc chromate primer. Aluminium surfaces, which shall come in contact with masonry, shall be given one coat of bituminous paint.

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2.02.00	Erection				
2.02.01	Bracing				
	The Contractor shall provide all necessary temporary guys and braces to ensure alignment and stability of the members and to take care of all loads to which the structure may be subjected, including erection of equipment and operation of the same.				
2.02.02	Temporary Bolting-Up				
	As erection proceeds the Contractor shall plum up and level all members and shall securely bolt up to take care of all dead load, wind load and erection stresses. Wherever erection equipment or other loads are carried by members during erection, proper provision shall be made to take care of the stresses resulting from the same.				
2.02.03	Turned Bolt				
	For field connections where bolting is specified, holes for the turned bolts may be reamed in the field, if required. All drilling or reaming for turned bolts shall be done after the parts to be connected are assembled.				
2.02.04	Welding				
	Where specified on drawings, welding shall be done in accordance with IS: 816 for steel and IS: 2812 for Aluminium & Alloys.				
2.02.05	Cutting and Fitting				
	No cutting of sections, flanges, webs of angles shall be done without the approval of the Engineer. Where indicated on the drawings, holes, cuttings, etc. shall be provided as required for installation, to the work by the other Contractors. No additional holes or cuttings, than those shown on drawings, shall be made without the approval of the Engineer.				
2.02.06	Drifting				
	Correction minor misfits and a reasonable amount of reaming and cutting of excess stock from rivets may be permitted. For this, light drifting may be allowed to draw holes together. Twist drills shall be used to enlarge as necessary to make connections, reaming that weakens the members or make 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 or a moderate amount of reaming and slight				

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	chipping and cutting shall immediately be called to the attention of the Engineer-and approval of the method of correction obtained. The use of cutting torches to enlarge or alter rivet holes shall not be permitted. 2.02.07 Spot Painting All field rivets and bolts and also any serious abrasion to shop paint shall be spot painted with the same materials and used for the shop paint or equivalent. 2.02.08 Good All cutting to concrete or masonry shall be made good to the satisfaction of the Engineer. 2.02.09 Grouting All bearing plates, lintels and beams, etc. shall be set to proper grade and level by the Contractor and the Engineer's approval obtained before proceeding with the grouting. Grouting shall be done in 1:1:2 concrete with 6 mm down stone chips or as specified in schedule of items. 2.02.10 Anchor Fasteners The anchor fasteners shall be of two type viz. for masonry works and for concrete works. The expansion sleeves are different for masonry type anchor fastner and concrete type anchor fastener. Depending upon the safe tensile load capacity of each fastener, size of anchor fastener varies. The Contractor shall submit the Manufacture's literature showing the average pull out and average shear value for anchor of various sizes. Anchors shall be fixed in position strictly as per the manufacturer's instructions and as approved by the Engineer. Anchor fastener is considered as light duty for carrying safe tensile load up to 0.5MT per fastener and as heavy duty for carrying safe tensile load above 0.50MT per fastener. Heavy Duty Anchor Fasteners The safe tensile load carrying capacity of the anchors shall be arrived by providing the minimum factor of capacity of 2.5 for the characteristic load of the anchor. Minimum size of anchor shall be M8 (8mm). All anchors shall be from the approved manufacturers like HILTI or equivalent. a) Anchor fasteners shall be supplied and fixed in position by the contractor. Anchor fasteners can be of mechanical bonding or chemical bonding. b) Capacity of the anchor shall be established after considering the effect of concrete grade, embedment depth, concrete thickness, anchor spacing and edge distance from the concrete edge.	



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- c) The selection for the particular type of bonding for the anchors shall be made after considering the concrete grade, available embedment depth, load to be transferred, space available for installing anchors.
- d) The mechanical bonding anchor are torque controlled anchors made from carbon steel of grade 8.8 as per IS:1367 part 3. Anchors in bolt as well as nut version are acceptable. The bolt version anchors consist of bolt washer, sleeves, plastic section, expansion sleeves and a cone. Nuts version anchor consists of nuts, threaded rod, washer, sleeves, plastic section, expansion sleeves and a cone. All steel component of anchor shall be electro galvanised to minimum 5 micron coating thickness. The plastic section shall be of polyacetal Derlin 100 or equivalent.
- e) Chemical bonding anchor shall consist of foil capsule and threaded rod. The foil capsule shall contain the resin and hardener. The threaded rod shall have chiselled tip. The behaviour of anchors under fire shall conform the heating curves as per ISO:834. Anchors of size M8 to M24 shall conform to grade 5.8 and anchors of size M27 to M39 shall conform to grade 8.8 as per IS:1367 part 3. All steel components of the anchors shall be electro-galvanised to minimum 5 micron thickness.

Light Duty Anchors

This anchor shall comprise of stud, nut, washers, and expansion sleeve. The one end of the stud shall have thread and the other end shall have cold formed conical head. All steel components of the anchors shall be electro-galvanised to minimum 5 micron thickness. The expansion sleeve shall preferably be of stainless steel of SS316. The anchors shall conform to minimum grade 5.8 as per IS:1367 part 3.

2.02.11 Pipe Joints

MS pipes or GI pipes shall be joined by threaded sockets or by welding. Cast iron pipes shall be socket and spigot joined and caulked with hemp and molten head.

2.03.0 FENCING**2.03.01 Galvanised Chain Link Fencing**

The material requirement shall conform to IS: 2721 latest edition. The galvanised chain link fencing shall be woven from 3.15mm dia. wire with mesh size of 50mm unless otherwise specified. The mesh wire shall not vary from specified dia. by more than $\pm 0.05\text{mm}$. All steel wire shall be hot dipped galvanised wire. The dia shall be measured over the galvanised coating. The line wire shall be 4.0mm dia. GI wire. The stirrup wire for securing the line wire to the intermediate post (RCC/structural steel) shall be GI wire 2.5 mm diameter. The tying wire for securing the chain link fencing to the line wire shall be 1.6mm diameter GI wire. Hair pin chain staples for fastening down



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the bottom of galvanised chain line fencing to the concrete sill shall be 3.15mm wire. The ends shall be bent outwards for securing anchorage.

Cleat for eye bolts shall be of uniform size and shall consist of mild steel angle of 75 x 50 x 8 mm. The eye bolts strainer shall consist of bolt with welded eye sufficiently threaded and fitted with a nut and washer. Two-way eye bolt strainer shall have suitable ring nuts fitted after the wires have been strained on one side. Stretcher bar shall consist of GI flats 25 x 4.75 mm. They shall be secured to the cleats by steel bolts.

The chain link fencing shall be strained between each pair of straining posts and secured to each straining posts by means of a stretcher bar. One of top line wire shall be threaded through appropriate adjacent row of mesh, care being taken that no meshes in the row are bypassed by the line wire except where deviation is necessary at the straining posts. The second top line wire shall be strained in front of the fencing. The fencing shall be attached to the top and bottom line wire by wire ties spaced at 150mm apart and to the other middle line wire by wire ties spaced at 450mm apart.

The bottom of fencing shall be treated as follows:

Hair pin staples shall be threaded through the bottom row of mesh at 750mm c/c and set in the sill 25mm below the chain link fencing to a depth of 150mm.

2.03.02 PVC coated Galvanised Chain Link Fencing

The PVC coated galvanized chain link fencing shall be woven from minimum 8 gauge PVC coated wire (including PVC coating) with mesh size of 75mmX75mm. The diameter of the hot dip galvanized steel wire for chain link fencing excluding PVC coating shall not be less than 12 gauge. The mesh wire shall not vary from specified dia. by more than +0.05mm. Other fixing details shall be as provided under sub head Galvanised **Chain Link Fencing** above.

2.03.03 Barbed Wire Fencing

The barbed wire shall be conform to IS: 278 latest edition. The barbed wire shall be galvanised and galvanising shall conform to the requirement laid down for 'light-coated wire' of IS:4826 and it shall be smooth and relatively free of lumps etc. Wire with excessive roughness blisters, salammoniac spots shall be rejected. The barbed wire shall be made from two line wires and two point wires. The barbs shall have four points and shall be formed by twisting two point wires, each two turns, tightly around both or one line wire (Type A - around both line wire, Type B - around one line wire) making altogether four complete turns. The barbs shall be so finished that four points are set and located or locked as far as possible at right angle to each other.

Straining posts shall be provided at all ends and corners of fences or at changes in direction or acute variation in level and at intervals not exceeding



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66 M on straight lengths of fence. Intermediate posts shall be spaced at regular intervals not exceeding 3.0m. Struts shall be fitted to all straining posts behind the chain link fabric in the direction of line of fence. There shall be four evenly spaced row of line wire in all. The top line wire shall be doubled, making five line wire in all. The bottom wire shall be closed to the ground. Each line wire shall be strained tightly by means of eyebolts strainers or winders at each straining points. Each line wire shall be secured to each intermediate post by a wire stirrup passed through a hold in the post and secured to the line wire by three complete turns on each sides of the post. The barbed wire shall be fitted with one dropper at the centre of each bay, secured to the wire so that they could not be bunched together. Droppers for barbed wire shall be of mild steel of not less than 25 x 4.75 mm thick with 38 x 4.85 mm half round staples for fastening the barbed wire to them. Bracing for the rows of barbed wire shall be approved by the Engineer.

2.03.04**Concertina Fencing**

Concertina shall be from high tensile serrated galvanized wire (HTSW) made with wire diameter of 2.5 mm which will be stretched to 6m and attached on two strands of galvanized HTSSW (high tensile spring steel wire) of 2.5mm dia by means of clips at 1m interval. These two HTSSW strands will be attached to the fence posts/ angles with 12mm security fasteners.

3.00.00**ACCEPTANCE CRITERIA**

- a) All items shall be correct shape, size, weight etc. shown on drawings and schedule of items.
- b) For installed items, the tolerances shall be as follows
 - i) Permissible deviation from, straightness – 1 in 1000.
 - ii) Seats, stiffener connections etc. shall be as per approved drawings and shall not interfere with architectural clearances.
- c) All castings shall be free from blowholes, cracks, and other blemishes.
- d) All MS wire fencing shall be in true vertical plain, and shall not bulge.

4.00.00**IS CODES**

- IS:278 Specification for Galvanised Steel Barbed wire for fencing.
- IS:816 Code of practice for use of Metal Arc welding for general construction in mild steel.

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	IS:1367 Industrial Fasteners – Threaded steel fasteners - Technical supply condition. IS:2721 Specification for Galvanised Steel Chain Link fence fabric. IS:2812 Arc welding of Aluminum and Alloy 5.00.00 RATES AND MEASUREMENTS 5.01.0 Rates Rates shall include supply, fabrication and installation for misc. metals works as required for completion of works like gates, fencing, handrails, ladders, hangers, anchors etc., unless otherwise specified in Schedule of Items. Rate for fencing shall also include excavation, concreting and supply, erection & fabrication of post (post made of either structural steel or reinforced cement concrete), unless any specific item is excluded in the schedule of items. 5.02.0 Measurements Measurement for MS gates shall be in MT. Measurement for fencing shall be in Sqm unless otherwise specified in schedule of item. Measurement for Anchors shall be in nos. for the type as specified in schedule of items. Measurement of other misc. metals shall be done in MT unless otherwise specified in schedule of items.	



TITLE:

**STANDARD TECHNICAL
SPECIFICATION FOR PAINTING,
WHITEWASHING, POLISHING**

SPECIFICATION NO. PE-TS-392-600-C011

VOLUME - II B

SECTION - D SUB-SECTION-D11

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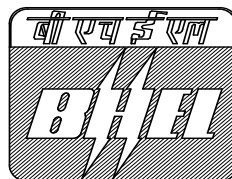
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PAINTING, WHITEWASHING, POLISHING

SPECIFICATION NO. PE-TS-392-600-C011



Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL House

Asian Games Village Complex

Siri Fort, New Delhi-110049



TITLE:

**STANDARD TECHNICAL
SPECIFICATION FOR PAINTING,
WHITEWASHING, POLISHING**

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PAINTING, WHITE WASHING, POLISHING, ETC.**1.00.00 SCOPE**

This section covers painting, white washing, varnishing, polishing etc. of both interior and exterior surfaces of wood work, masonry, concrete plastering, plaster of paris, false ceiling, structural and other miscellaneous steel items, rain water down comer, floor and roof drains, soil, waste and service water pipes, and other ferrous and non-ferrous metal items.

Copper, bronze, chromium plate, Nickel, stainless steel and aluminium shall generally not be painted or finished except if otherwise specified.

Before commencing painting, the Contractor shall obtain the approval of the Engineer in writing regarding the schedule of work to minimize damage; disfiguration or staining to work of other trades or other installations.

2.00.00 Installation**2.00.01 Materials**

Materials shall be highest grade products or well-known approved manufacture and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name and colour shade, with labels intact and seals unbroken. All materials shall be subject to inspection, analysis and approved by the Engineer. It is desired that materials of one manufacturer only shall be used as far as possible and paint of one shade is obtained from the same manufacturing batch. Each and every supply of primer, finish paint etc. shall be accompanied by manufacturer's test certificate. All paint shall be subject to analysis from random samples taken at site from painters bucket, if so desired by the Engineer.

All prime coats shall be compatible to the material of the surface to be finished as well as to the finished coats to be applied.

All unspecified materials such as snellac, turpentine or linseed oil shall be of the highest quality available and shall conform to the latest IS standards. All such materials shall be made by reputable recognized manufacturers and shall be approved by the Engineer.

All colours shall be as per painting schedule and tinting and matching shall be done to the satisfaction of the Engineer. In such cases, where samples are required, they shall be executed in advance with the specified materials for the approval of the Engineer.



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a) White Wash/Colour Wash

Shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the engineer, and shall conform to IS: 712 latest editions. Samples of lime shall be submitted to the Engineer for approval, and lime as per approved sample shall be brought to site in unslaked condition. After slaking, it shall be allowed to remain in a tank for two days and then stirred up with a pole, until it attains the consistency of thin cream. 100 grams of gum to 6 litres of white wash water and a little of indigo or synthetic ultramarine blue shall be added to the lime. Mineral colour not affected by lime shall be added to white wash to get the required tint/shade approved by the Engineer.

b) Dry distemper

Shall be made from suitable pigments, extenders, lime proof tinters, water-soluble binders etc. and shall conform to IS: 427. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for a day's work shall be prepared.

c) Oil Bound Washable Distemper

Shall be of oil emulsion type containing suitable preservatives and shall conform to IS: 428. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for a day's work shall be prepared.

d) Waterproof Cement Paint

Shall be made from best quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides. The paint shall conform to IS: 5410.

e) Acrylic based weather coat paint

Providing and applying two or more coats of **Acrylic based weather coat paint** of approved brand and manufacture and required shade over one coat of primer after necessary cleaning/ washing, preparing the surface using coir brush/ wire brush, sand paper, including filling of cracks with putty wherever required etc. all complete to give smooth, hard, durable & glossy finish over a coat of primer over prepared plaster surface as per manufacturers guidelines. The final finished coating shall be fungus resistant, UV resistant, water repellent and extremely durable with colour fastness as per specification.



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f) Acrylic Emulsion Paint

Shall be water-based acrylic copolymer emulsion with rutile titanium dioxide and other selected pigments and fungicide conforming to IS: 5411 (Part-1). It shall exhibit excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, shall be able to withstand washing with mild soap and water without any deterioration in colour, or without showing flaking, blistering, or peeling.

g) Acrylic Distemper

Two or more coats of **acrylic distemper** of approved brand and manufacture to give an even shade including a priming coat with distemper primer complete.

h) Acid/Alkali Resistant Paint

Providing and applying 2 or more coats of **acid/alkali resistant paint** of approved brand and colour to floors, walls and ceiling including preparation of surface to receive paint, providing and applying bitumen primer conforming to IS 158 complete all as per manufacturer's recommendations and as approved by engineer, at all heights above or below grade level, complete as per specifications.

i) Fire Resistant Transparent Paint

Two or more coats of **fire resistant transparent paint** as per IS 162 on all woodwork over French polish as per IS 348 or flat oil paint as per IS 137 of approved grade and manufacture to give an even shade as per specifications.

j) Anti-Corrosive Bitumastic paint

Two or more coats of black **anti-corrosive bitumastic** painting of approved brand and manufacture to give an even shade complete.

Bitumen paint (black bituminous anti-corrosive paint)

Bitumen based anti-corrosive paint conforming to IS: 158 shall be used.

k) Resin Bonded Granular Textured

Providing and applying **resin bonded granular textured finish, for external applications** shall consist of crushed stone/quartz chips of .5 mm to 2.5 mm size and of approved natural colour/shade and bonded with synthetic resins, adhesives and additives altogether in a single pack mix, applied on cured and dried plaster surface with a dry film thickness of minimum 2 mm. The final



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finish shall have UV resistance, fungus, bacterial resistance properties all complete with grooves filled with poly sulphide sealant of matching colour and shade as per specification/drawing/approval of engineer in charge.

l) Epoxy Paint

Providing and applying ready made **Epoxy Paint** over areas other than steel structure with suitable pigments of approved shade as per specification and direction of Engineer. The epoxy paint shall be a two pack material and shall be resistant to water, splash, spillage & acidic environment. The epoxy paint coating shall be of 150micron thickness over epoxy primer.

m) Synthetic plaster for external applications

Providing and applying **Synthetic plaster for external applications** composed of synthetic fibre and petroleum based chemical similar to RENOVO or equivalent and of approved natural color/shade applied on cured and dried plaster surface. The final finish Paint shall have UV resistance, fungus, bacterial resistance properties all complete with grooves filled with poly sulphide sealant of matching color and shade as per specification/drawing/approval of engineer in charge.

n) Synthetic Enamel Paint

Shall be made from synthetic resins and drying oil with rutile titanium dioxide and other selected pigments to give a smooth, hard, durable and glossy finish to all exterior and resist interior surfaces. White and pastel shades shall not yellowing and darkening with aging. The paint shall conform to IS: 2932 and IS: 2933.

o) Aluminium Paint

Shall be in two pack containers and shall resist weathering. The paint shall conform to IS: 2339.

p) Varnishing

Shall be best quality alkyd varnish suitable for brushing over the tint of paint or light natural wood and shall not darken or yellow with age.

q) French Polish

Shall be made from best quality shellac, denatured spirit and other suitable alcohol soluble ingredients and made by a well known approved manufacturer. The material shall conform to IS: 348.

French polish shall not be used on bare wood it shall only be used as

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	finishing coat on wood after the woods pretreated with a liquid wood filler conforming to IS: 345 is applied and rubbed out. 2.00.02 Storage The Contractor shall arrange for safe and proper storage of all materials and tools. The storage space if allotted within the building shall be adequately protected from damage, disfigurement, & stains. Paint shall be kept covered at all times and mixing shall be done in suitable containers. All necessary precautions shall be taken by the contractor to prevent fire. 2.01.00 Preparation of surface Before starting the work the Contractor shall obtain the approval of the Engineer regarding the soundness & readiness of the surface to be painted on. 2.01.02 Wood All surfaces shall be free from, dirt and loose or peeling paints. The surface shall be rubbed down smooth. All nails & screws shall be sunk below the surface and filled with putty after applying an under coat. Small knots that do not justify cutting and sap streaks shall be covered with minimum 2 coats of pure shellace coating applied thinly & extended 25 mm beyond the area. All large, loose, or resinous knots shall be removed and filled with sound wood. All work shall be done as per IS: 2338. 2.01.02 Masonry, Concrete, and Plastered Surface Surface shall be free from all oil, grease, efflorescence, mildew, loose paint, or other foreign and loose materials. Masonry cracks shall be cleaned out and patch filled with mortar similar to the original surface and uniformly textured. Where this type of resurfacing may lead to the finishing paint being different in shade from, the original surfaces, the resurfaces area shall be treated with minimum one coat of cement primer, which should be continued to the surrounding area for a distance of minimum 100 mm. Surface with Mildew or Efflorescence shall be treated as below: All mildewed surfaces shall be treated with an approved fungicide such as ammoniacal wash consisting of 7g of copper carbonate dissolved in 80ml liquor ammonia and diluted to water, or 2.5 percent magnesium silicofluoride solution and allowed to dry thoroughly before paint is applied. 2.01.03 Metal The surface preparation shall be done in accordance with IS:1477(Part-1) 'Code of practice for painting of ferrous metals in building' and as directed by	



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Engineer. All metal surfaces shall be absolutely clean, dry, and free from rust, scales, weld slag, flux deposit, wax, grease, dried soap films, foreign matters like cement mortar etc and free from existing loose red oxide zinc chromate primer and should be removed by means of wire brushes, hand scrappers, sand paper, emery cloth, emery papers, or by mechanical power tools etc. or as directed by Engineer. For exposed chemical resistant paints, surfaces shall be blast cleaned to near white metal. All galvanized iron surfaces shall be pretreated with a compatible primer according to the manufacturer's direction. Any abrasion in shop coat shall be touched up with the same quality of paint as the original coat. The actual painting work should be commenced only after obtaining clearance from the Engineer regarding proper cleaning of the surface.

2.02.00 Application**2.02.01 General**

The method of application shall be as recommended by the manufacturer. In case of selection of special shades and colour (not available in standard shades) the Contractor shall mix different shades and prepare test panels of minimum size 1 meter square as per instruction of the Engineer and obtain his approval prior of application of finishing paints.

Proper tools and implements shall be used. Scaffoldings used shall be independent of the surface to be painted to avoid shade differences of the freshly repaired anchor notes.

Painting shall be done by skilled labours in a workmanlike manner. All materials shall be evenly applied so as to free of sags, runs, crawls, or other defects. All coats shall be of proper consistency. In case of application by brush, no brush marks shall be visible. The brushes shall be clean and in good condition before application of paint.

All priming undercoat for painting shall be applied by brush only, and rollers spray equipments etc. shall not be used.

No work shall be done under conditions that are unsuitable production of good results. No painting shall be done when plastering is in progress or is drying. Application of paint, which seals the surfaces to moisture shall only be done after the moisture on and below the surface has dried out.

All coats shall be thoroughly dry before succeeding coat is applied. Coats of painting as specified are intended to cover surfaces perfectly. In case the surface is not covered property by applying the specified number of coats, further coats shall be applied by the Contractor when so desired by the Engineer.



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All primers and undercoats shall be tinted to approximate the colour of the finishing coats. Finished coats shall be of exact colour and shade as per approved samples and all finish shall be uniform in colour and texture. All parts of mouldings and ornaments shall be left clean and true to finish.

Painting on ferrous metal surface shall, be done as per IS: 1477 (Part I & 2). The total dry thickness of film should not be less than 120 Micron.

2.02.02 White Washing

The surface where white washing is to be applied shall be cleared of all loose materials and dirt. All holes and irregularities of the surface shall be filled up with lime putty and shall be allowed to dry up before white washing.

One coat of whitewash shall consist of one stroke from top downwards, another from bottom upwards over the first stroke and another from left to right before the previous one dries up. Second coat shall be applied and in case the Engineer feels that one or more coats are required the Contractor shall do so without any extra cost to the Owner. No brush marks shall show on the finished surface.

2.02.03 Dry Distemper

New plastered surface shall be allowed to dry for at least two months. New lime or lime cement plastered surface shall be washed with a solution of 1 part Vinegar to 12 parts water or 1:50 sulphuric acid solution and for 24 hours after which the wall shall be thoroughly washed with clean water. For cement-plastered surface, the surface shall be washed with solution of 100 gms. of zinc sulphate to 1 litre of water and allowed to dry.

Dry distemping shall be done as per manufacturers instruction. In applying the distempers the brush, should first be applied horizontally and immediately crossed off perpendicularly. Brushing shall not be continued too long, otherwise brush marks may result.

2.02.04 Oil bound washable distemper

The distemper shall be applied after surface is primed with an alkali resistant primer, and followed by minimum two coats of oil bound washable distemper all as per manufacturer's instruction.

2.02.05 Waterproof Cement Paint

Surface to be coated with cement paint shall be washed and brushed down. As soon as the moisture has disappeared, the surface shall be given one coat of paint. Care shall be taken so that the paint does not dry out too rapidly. After 4 to 6 hours, the water shall be sprinkled over the surface to assist curing and

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	prevent cracking. After the first coat has dried (24 to 48 hours) the second coat shall be applied in a similar manner. The finished surface shall be kept moist by occasional sprinkling with water for seven days after painting. 2.02.06 Acrylic Emulsion Paint Paint shall be applied after providing one coat of cement primer solvent of approved quality and primer shall be conform to IS: 109. Lime gauged cement plastered surfaces shall not be painted for at least one month after plastering. A sample patch shall be painted to check alkali reaction if so desired by the Engineer. Painting shall be done strictly as per manufacturer's specification. 2.02.07 Synthetic Enamel Paint Shall be applied on properly primed surface. Subsequential coat shall not be applied till the previous coat is dry. The previous shall be lightly sand papered for better adhesion of subsequent coats. 2.02.08 Aluminium Paint The paint, supplied in two pack containers shall be mixed and applied strictly as per manufacturer's direction. When more than one coat of paint is required or indicated, the next coat shall only be applied after the previous coat become hard dry. 2.02.09 Clear Synthetic Varnish The Varnish shall be applied on wood surface after (a) filling, (b) staining & (c) sealing operations are carried out. The application of a combination of filler and stain shall not be permitted. For the finishing coats of varnish, the surface shall be allowed to dry and be rubbed down lightly, wiped off and allowed to dry. Careful attention to cleanliness is required for varnishing. All dust and dirt shall be removed from the surface as well as from the neighbourhood. Damp atmosphere and draughts shall be avoided, and exposure to extreme heat or cold & dampness shall not be allowed. The varnish shall be applied liberally with a brush and spread evenly over a portion of the surface with light strokes to avoid frothing. It shall be allowed to flow on white the next section is being laid on excess varnish shall then be scrapped off the brush and the first section be crossed, recrossed and then laid off lightly. The varnish once it has begun to set shall not be retouched. In case of any mistake in application, the varnish shall be removed and the work started afresh. The varnish shall be minimum of two coats, with the first coat being a flatting	

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	varnish. This shall be allowed to dry hard and be flatted down, before applying the next coat. Sufficient time must be allowed between coats to get a hard dry surface before next coat is applied. All work shall be as per relevant IS Code. 2.02.10 French polish All unevenness of the surface shall be rubbed down to smoothness with sand paper and the surface shall well dusted .The pores in the shall be filled up with a paste of whitening in water or methylated spirit with a suitable pigment like burnt siemme or umber. After application of the filler paste, the French polish shall be applied with a pad of woollen cloth covered by a fine cloth. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles so that the polish is sparingly but uniformly applied over the entire area to give an even surface. A trace of linseed oil may be used on the pad for case of application. The surface shall be allowed to dry before further coats are applied in the same manner. To finish off, the pad shall be covered with a fresh piece of clean fine cloth, slightly damped with methylated spirit, and rubbed lightly and quickly with circular motions to leave the finished surface with a uniform texture and high gloss. 2.02.11 Chemical Resistant Paint For chemical resistant paints, epoxy, chlorinated rubber, or vinyl butryl paint system shall be used. Manufacturer's recommendation shall be followed regarding the paint system, exposed to moderately to severe corrosive condition and subject to acid/alkali spillage & fumes, shall be followed. 2.03.00 Protection Furniture and other movable objects, equipment, fittings and accessories shall be moved, protected and replaced upon completion of work. All stationary equipment shall be well covered so that no paint can fall on them. Work finished by other agencies shall be well protected. All protections shall be done as per instructions of the Engineer. 2.04.00 Cleaning up In addition to provisions in general conditions the Contractor shall, upon completion of painting etc. remove all marks and make good surfaces, where paint has been splashed or splattered, including all equipment, fixtures, glass, furniture, fittings etc. to the satisfaction of the Engineer.	



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3.00.00**ACCEPTANCE CRITERIA AND TESTING**

- a) All painted surfaces shall be uniform and pleasing in appearance.
- b) All varnished surfaces shall be of uniform texture and high glossy finish.
- c) The colour, texture etc. shall match exactly with those of approved samples.
- d) All stains, splashes, and splatters of paints and varnishes shall be removed from surrounding surfaces.

Testing

- a) As, each part of the work is under progress, i.e. preparation of surface, providing primer, providing different coats of finishing paints, it shall be passed by the Engineer. Variation from the drawings or specification or standard etc. shall not be accepted. The Contractor shall ascertain from the Engineer as to which parts will be inspected and passed from time to time. The Contractor shall provide all necessary arrangement for inspection of the painting work during its different working phase. The Contractor shall provide necessary scaffolding, approach for inspection of the above as per direction and satisfaction of the Engineer. All the necessary cost for scaffolding, approach, platform, lighting arrangement testing and inspection shall be borne by the Contractor. Such inspection and testing will not, however, exonerate the Contractor from his responsibilities for proper workmanship, material etc.
- b) The Contractor shall carry out all sampling and necessary testing in accordance with the relevant Indian Standards and shall conduct such tests as called for by the Engineer. Where no specific testing procedure is mentioned in the relevant codes, the tests shall be carried out as per the prevalent accepted Engineering practice as per the direction of the Engineer. Tests shall be done in a laboratory, approved by the Engineer, and cost of testing shall be borne by the contractor.
- c) Material/workmanship unsuitable for acceptance shall be removed and replaced by the Contractor. The work shall be redone as per Specification of the contract and direction of the Engineer without extra cost to owner.

4.00.00**I.S. CODE**

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other

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	standard practice, as may be specified by the Engineer, shall be followed. IS: 348 Specification for French polish IS: 427 Specification for Distemper, dry colour as required. IS: 428 Specification for Distemper oil emulsion, colour as required. IS: 1477 (I & II) Code of Practice for painting of ferrous metal in buildings. IS: 2338 (I & II) Code of Practice for finishing of wood and wood based materials. IS: 2339 Specification for Aluminium, Paints for general purposes in dual containers. IS: 2395 Code of Practice for painting concrete, masonry, and Plaster surface. IS: 2932 Specification for enamel, exterior type-1. IS: 5410 Specification for cement paint, colour as required. 5.00.00 RATES AND MEASUREMENT 5.01.00 Rates Rates shall be unit rates for complete items described in the “Schedule of Items”. Rate shall include cleaning, preparation of surface, supply and application of primer, painting and providing all protection and scaffolding required at site. 5.02.00 Measurements Painting over the concrete/masonry/wooden surface shall be measured net (on the surface area on which it is applied) in Sqm. No deduction shall be made for opening not exceeding 0.5 Sqm and ends of beams, joints, etc. also no payment shall be made for reveals, jams, soffits, sill of these openings. 50% deduction shall be made for opening exceeding 0.5 Sqm but not exceeding 3.0 Sqm each and no addition shall be made for reveals, jams, soffits, sills etc. In case of opening exceeding 3.0 Sqm each, deduction shall be made for	



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opening but jams, soffits, and reveals shall be measured and paid for.

Corrugated surfaces shall be measured flat and measured area shall be increased by 15%.

Painting of structural steel works shall be measured in M.T. unless specified otherwise.



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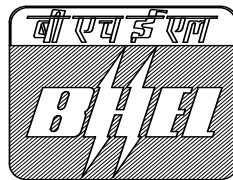
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Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL



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SHEET WORK IN ROOF AND SIDING

1.00.00

SCOPE

This section covers supply, cutting & fabrication and erection of corrugated/plain asbestos, corrugated galvanized iron, aluminum, permanently colour coated troughed zinc-aluminium alloy coated M.S. sheet or other sheet for covering to roof and sides at various elevations as specified.

2.00.00

INSTALLATION

2.01.00

Storage of Materials

All materials shall be stored by the Contractor in proper way to prevent all damage.

2.02.00

Workmanship

The workmanship shall be according to best construction practice to give a watertight finish to the satisfaction of the Engineer. Fixing of gutters and down pipes shall be according to IS: 2527.

2.02.01

Asbestos Sheeting

Asbestos sheets of profiles as specified shall be fixed with minimum 150 mm end lap and side laps as per manufacturer's specification. Hook bolts or J-bolts shall be 8 mm dia. at 305 mm centres. Six (6) mm dia. galvanized iron seam bolt and nut with G.I. flat washers and bitumen washers shall be used for stitching ridge cappings, corner pieces, ventilators, north light curves etc.

2.02.02

C.G.I. Sheeting and Aluminium Sheeting

Side laps shall be 2 corrugations for roof and one corrugation for side sheeting. End laps shall be minimum 150 mm for roof and 100 mm for side sheeting. In ridges and hips where plain sheets are used, the end laps shall be minimum 100 mm. Holes in C.G.I. sheets shall preferably be made on the ground. The sheets should be placed on purlins/trestles and holes punched in the ridge of the corrugation from the outside inward for obtaining proper seating of limpet washers. Sheets shall be secured to sheet framing by 8 mm dia. galvanised iron hooks or J-bolts and maximum spacing of the bolts shall be 305 mm. The length of the hook or J-bolts shall be to suit the sections of the bearers. Sheets shall also be bolted at the ends at every third corrugation with 6 mm dia. galvanized iron seam bolts and G.I. flat washers and bituminous washers.

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2.02.03

Fibre Glass Reinforced Plastic Sheeting

This shall be of thickness and profile as specified. Colour and light transmittance shall be as mentioned. Where used in conjunction with C.G.I. or asbestos sheeting, the end and side laps and fixing device shall be same as used for general sheeting. Where used in lieu of glass, the fixing shall be by means of timber or metal glazing beads. In all cases, the installation shall be completely watertight and able to withstand the designed wind-pressure.

2.02.04

PERMANENT COLOUR COATED SANDWICHED INSULATED METAL CLADDING SYSTEM

- Troughed zinc-aluminium alloy coated (both sides) M.S. sheet having 0.6mm minimum thickness (or high tensile steel sheet having minimum yield strength of 350 Mpa of 0.5mm minimum thickness) shall be used on external face (outer face) of cladding system. Weight of coating shall not be less than 275 gm/sq.m. The outer side (exposed face) shall be permanently colour coated with Polyfluro Vinyl Coating (PVF₂) of Dry Film Thickness (DFT) 20 microns (minimum) over primer. Inner side of external sheet shall be provided with suitable pre-coating of minimum 7 microns.
- Troughed zinc-aluminium alloy coated (both sides) M.S. sheets of minimum 0.6mm thickness shall be used as inner liner (internal face) of cladding system. The exposed face shall be permanently colour coated with silicon modified polyester paint of DFT 20 microns (minimum) over primer. Inner face of external sheet shall be provided with suitable pre-coating of minimum 7 microns. The weight of coating shall not be less than 275 gm/sqm.
- The permanent colour coated sheet shall meet the general requirements of IS:14246 and shall conform to class 3 for the durability.
- Inner sheet shall be fixed directly to side runners and Z spacers made out of at least 2 mm thick galvanized steel sheet of grade 375 as per IS:277. Inner sheet shall be fixed at the rate not more than 1.50M centre to centre to hold the insulation and external sheeting. The fasteners shall be of high quality corrosion resistant grade of self tapping / self drilling type provided with suitable cap.
- The insulation shall be of bonded mineral wool of minimum thickness 50mm conforming to IS:8183, having a density of 32 Kg/cu.m. for glass wool & 48 Kg/cu.m. for rock wool.

2.02.05

PERMANENT COLOUR COATED (NON-INSULATED) METAL CLADDING SYSTEM

- Troughed zinc-aluminium alloy coated not less than 275 gm/sq.m M.S. sheets having 0.6 mm minimum thickness (or High tensile steel sheet having

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minimum yield strength of 350 Mpa of 0.5mm minimum thickness) shall be used for the cladding system. The outer side (exposed face) shall be permanently colour coated with PVF₂ paint of minimum DFT 20 microns over primer and the inner side (internal face) shall be coated with same paint of minimum DFT 12 microns over primer. These shall be fixed directly to runners. The sheets shall meet the general requirement of IS:14246 and shall conform to class 3 for the durability.

ii. FLASHING, CAPS, TRIM CLOSURES ETC.

All flashings, trim closures caps etc. required for the metal cladding system shall be made out of plain sheets having same material and coating specification as mentioned above for the outer face of the sandwiched metal cladding.

3.00.00 ACCEPTANCE CRITERIA

The installations shall present a neat appearance and shall be checked for water tightness. The following shall be checked:

- a) Side and end laps
- b) Absence of cracks, holes or damages in sheet
- c) Spacing of bolts
- d) Provision of double washers (G.I. and asbestos or bituminous washers)
- e) Proper installation of flashing.

4.00.00 I.S. CODE

All work shall be carried out as per this specification and shall conform to the latest revision and/or replacements of the following or any other Indian Standard (IS) Codes, unless specified otherwise. In case any particular aspect of work is not specifically covered by Indian Standard Codes, any other standard practice, as may be specified by the Engineer, shall be followed.

- IS: 3007 : Code of practice for laying of asbestos cement sheets.
- IS: 2527 : Code of practice for fixing rainwater gutters and down pipes for roof drainage.
- IS: 1626 : Specification for asbestos cement building pipes, gutters and fittings.
- IS: 277 : Specification for galvanized steel sheets (plain and

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corrugated).		
5.00.00	RATES AND MEASUREMENT	
5.01.00	Rates	
	Rates shall be unit rate for complete item described in “Schedule of Items” and shall include all wastage.	
5.02.00	Measurement	
	Sheeting work in roof & sides shall be measured in Sq.M. for net area of the work done. Profiled sheeting shall be measured flat and not girthed. Opening less than 0.40 Sqm shall not be deducted. No extra shall be paid for extra labour in cutting and for wastage etc. No payment shall be made for laps in sheeting works.	



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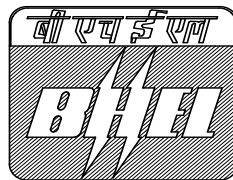
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DRAINAGE AND SANITATION

SPECIFICATION NO. PE-TS-392-600-C015



Bharat Heavy Electricals Limited
Project Engineering Management
Power Sector, BHEL



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STANDARD TECHNICAL SPECIFICATION FOR DRAINAGE AND SANITATION

1.0.0 SCOPE

1.1.0 This section covers the layout and construction of drains for roof water, surface water and sewage together with all fittings and fixtures and inclusive of ancillary works, such as connections, manholes and inspection chambers used within the building and from the building to the connection to a public sewer or to treatment work, septic tank and soak pit dispersion trenches.

2.0.0 INSTALLATION

2.0.1 General

All pipe lines, locations of fittings and fixtures, etc. shall be as per drawings or as directed by the Engineer. Correctness of lines, plumb, orientation, symmetry and levels shall be strictly ensured. All items shall be fully secured against movement in any direction and so located as to allow easy maintenance.

All pipe lines, fittings and fixtures shall be installed leakproof. When the works under scope of this specification linked up with works executed by others, the connections shall be such as to prevent any splashing or spilling or emission of foul odour and gases.

2.1.0 Rainwater Downcomers

Rainwater downcomers shall be standard Cast Iron Pipes. In case where specifically desired, M.S, UPVC, GI and HDPE pipes may also be used. M.S. pipes shall be painted outside with two coats of anticorrosive paints under a coat of primer.

Rainwater downcomers shall run along and be secured to walls, columns etc. where desired by the Engineer these may have to be installed in chases cut in the structure.

All pipes shall be well secured and supported by adequately strong brackets. The brackets may be wrought iron clevis type, split ring type or perforated strap iron type as approved by the Engineer. For vertical runs each pipe shall hang freely on its brackets fixed just below the socket. Suitable spacer blocks shall be provided against the vertical surface to which the pipe is fixed.

All bends and junctions shall be supplied with watertight cleanouts.

Roof and floor drains and yard gullies shall be installed, if required, by cutting into the structure and grouted with 1:2:4 cement concrete. All gutters shall be provided with removable gratings.

All horizontal pipes shall have a minimum fall of 1 in 100.



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2.2.0

Gutters

The gutters shall be made of G.I. All gutters shall be supplied by reputable specialised firms. Each section shall be sufficiently rigid, edges and corners straight and the slopes perfectly uniform. G.I. gutters shall have the edges strengthened by suitable means.

Unless noted otherwise the gutters shall have a minimum fall of 1 in 120. Adequate number of string supports shall be provided so that there is no reflection even when the gutter is full. Each joint must have a support. Unless otherwise specified the supports shall be fabricated M.S. brackets. All junctions shall be thoroughly watertight. The joints may be made by rivetting, bolting or soldering. All joints between successive lengths of gutters shall have an overlap of at least 5 cm. The drop in the overlap shall always be in the direction of the fall of the gutter. Ends of gutters shall be closed watertight. Junction with rainwater down comers shall be made fully watertight and secured.

2.3.0

Soil and Drainage Pipes

2.3.1

Gradients

If not specified the minimum gradients of soil and drainage pipe line shall be as follows :

100 mm nominal dia	:	1 in 35
150 mm nominal dia	:	1 in 65
230 mm nominal dia	:	1 in 120
300 mm nominal dia	:	1 in 200

2.3.2

Relation with water supply pipe lines

Unless specifically cleared by the Engineer, under no circumstances shall special drainage and soil pipes be allowed to come close to water supply pipelines.

2.3.3

Laying

Each separate pipe shall be individually set for line and for level. Where lengths of sewer or drain pipes are laid in trench, properly painted sight rails shall be fixed across the trench at a height, equal to length of the boning rod to be used, above the required invert level of the drain or sewer at the point where the sight is fixed. More sight rails shall be required at manholes, change of gradient and intermediate positions if the distance for sighting is more than 50 ft. apart. The excavation shall be boned in at least once in every 6 ft. The foot of the boning rod shall be set on a block of wood of the exact thickness of the wall of the pipe. Each pipe shall be separately and accurately boned between sight rails.



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2.3.4

Support and Protection on Pipelines

All pipes shall be laid with sockets leading uphill. Preferably the pipe shall rest on solid and even foundations for the full length of the barrel. However, the pipe manufacturer's instruction as approved by the Engineer shall be followed in the matter of support and jointing.

To achieve full and continuous support, concrete for bedding and packing is the best. Where pipes are not bedded on concrete, the floor shall be left slightly high and carefully placed so that the pipe barrels rest on undisturbed ground. If anywhere the excavation has been carried too low packing shall be done in concrete. Where laid on rock or very hard ground which cannot be easily excavated to a smooth surface, the pipes shall be laid on a cradle of fine concrete floor of gravel and crushed stone over laid with concrete or on a well consolidated gravel and crushed stone bed as desired by the Engineer. PVC or similar pipes shall be laid directly on stable soil and packed with selected soil.

The minimum support and protection for glazed stoneware pipes shall be as follows :

- a) When cover is less than 2 metre below ground level and where pipes are unavoidably exposed above ground surface, the pipes shall be completely encased or surrounded with concrete.
- b) Where pipes are laid on soft soil with the maximum water table laying at the invert of the pipe, the sewer shall be bedded on concrete.
- c) Where the pipes have to be laid on soft soil with the maximum water table rising above the invert of the pipe, but below the top of the barrel, the pipe sewer shall be haunched.
- d) Where maximum water table is likely to rise above the top of the barrel or wherever the pipe is laid on soft soil the pipe sewers shall be completely encased or surrounded with concrete.

Cast iron pipes and concrete pipes may be supported on suitable concrete or brick support, where specified. The supports shall be unyielding and strong enough. At least one support shall be located close to ends. Spacing of intermediate supports shall be as decided by the Engineer. Pipes shall be secured to the supports by approved means.

Anchoring of pipes where necessary shall be achieved by suitable concrete encasing designed for the expected thrust.

2.3.5

Entry into structures



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For entry of the pipe lines into any building of structure suitable conduits under the structure or sleeves shall be used. The conduits and sleeves shall be such as to allow easy repairs and replacement of the pipes. When openings or chases are required to be made in the structure for entry of pipe lines, locations and sizes shall be marked and checked by the Engineer. After laying of the pipeline the openings and chases shall be mended.

2.3.6 Ducts

Where solid, waste and ventilating pipes are accommodated in ducts, access to cleaning areas shall be provided. Connection to drain shall be through a gully with sealed cover to guard against ingress of sewer gas, vermin or backflow.

2.3.7 Traps and Ventilating Pipes

Pipes are carrying off the waste from water closets and waste water and overflow water from baths, wash basins, sinks to drains shall be trapped immediately beneath such fixtures. Traps shall have minimum water seal of 50 mm and shall be ventilated whenever such ventilation is necessary to maintain water seal of the trap.

Ventilating pipes shall be carried up vertically from the drain to a height of at least 600 mm above the outer covering of the roof of the building or as shown on drawings. All vertical ventilating, anti-syphonage and similar pipe shall be covered on top with a cowl. The cowl shall be made of C.I. unless desired otherwise by the Engineer.

2.3.8 Manhole and Inspection Chambers

The maximum distance between manholes shall be 30 meter unless specially permitted otherwise. In addition, at every change of alignment gradient or diameter there shall be a manhole or inspection chamber. The distance between manhole or inspection chamber and gully chamber shall not exceed 6 metres unless desired otherwise.

Manhole shall be constructed so as to be watertight under test. The bending at the sides shall be carried out in such a manner as to provide no lodgement for any splashings in case of accidental flashing of the chamber. The channel or drain at the bottom of chamber shall be plastered with 1:2 cement, sand mortar and finished smooth to the grade. The channels and drains shall be shaped and laid to provide smooth flow.

Connecting to existing sewer lines shall be through a manhole.

Manholes shall be provided with standard C.I. covers. The covers shall be close fittings so as to prevent gases from coming out. Suitable heavy duty covers shall be used where necessary as decided by the Engineer.

2.3.9 Cutting of Pipes



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2.3.10

Jointing

Manufacturer's instructions shall be followed for cutting of pipes where necessary. Suitable and approved tools shall be used for the cutting so as to leave surface clean and square to the axis of the pipe.

Jointing of laid pipes shall be so planned as to avoid completely any movement or strain to the joints already made. If any joint is suspected to be damaged it shall be opened out and redone.

All joints between pipes, pipes and fittings and manholes shall be gas-tight when above ground and water-tight when underground. Method of jointing shall be as per instructions of the pipe and fittings manufacturer and as approved by the Engineer. However, in the absence of any instruction available from the manufacturer the methods as detailed hereunder shall be used.

a) Cast Iron Pipes

Socket and spigot pipes shall be jointed by the cast lead joints. The spigot shall be centered in the socket of the next pipe by tightly caulking in sufficient turns of tarred gasket or hemp yarn to have unfilled half the depth of socket. When the gasket or hemp yarn has been caulked tightly a jointing shall be placed round the barrel and tightened against the face of the socket to prevent airlock. Molten lead shall then be poured in to fill the remainder of the socket and caulked with suitable tools right round the joint to make up for shrinkage of the molten metal on cooling and shall be finished 3 mm behind the socket face.

Joints in cast iron pipes with special jointing arrangements like 'Tyton' joints etc. shall follow the instructions of the manufactures.

In special cases if flanged joints are accepted by the Engineer the joints shall be made leakproof by inserting approved type of rubber gaskets. The bolts shall be secured in stages to avoid uneven strain.

b) Concrete Pipes

Care shall be taken to place the collar centrally over the joint.



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2.4.0

Trenches and other excavations

Width of the trench at the bottom shall be such as to provide 200 mm clearance on either side of the pipe for facility of laying and jointing.

Excavated material shall be stacked sufficiently away from the edge of the trench and the side of the spoil bank shall not be allowed to endanger the stability of the excavation. Spoil may be carted away and used for filling the trench behind the work.

Turf, top soil or other surface material shall be set aside, turf being carefully rolled and stacked for use in reinstatement.

All excavation shall be properly timbered, where necessary.

Efficient arrangements for dewatering during excavation and keeping it dry till backfilling shall be made to the satisfaction of the Engineer. Sumps for dewatering shall be located away from the pipe layout.

Where the excavation proceeds through roads necessary permissions shall be secured by the Contractors from the appropriate authorities.

Special care shall be taken not to damage underground services, cables etc. These when exposed shall be kept adequately supported till the trench is backfilled.

The backfilling shall be done only after the pipeline has been tested and approved by the Engineer. Special care shall be taken under and sides of the pipe during handpacking with selected material. At least 300 mm over the pipe shall also be filled with soft earth or sand. Consolidation shall be done in 150 mm layers. The surface water shall be prevented from getting into the filled up trench. Traffic shall not be inconvenienced by heaping up unduly the backfilling material to compensate future settlement. All future settlements shall be made good regularly to minimise inconvenience of traffic where applicable.

2.5.0

Fixtures

The Tenderer shall mention in his bid the type and make of the fixtures he intends to use enclosing manufacturer's current catalogues. In the absence of any such agreement, the Engineer shall be at liberty to choose any type and make.

All fixtures and fittings shall be of approved quality and type manufactured by well known manufacturers. All items brought to the site must bear identification marks of the type of the manufacturer. Procurements shall be made well in advance and inspected and approved immediately by the Engineer. All fixtures shall be adequately protected, covered and plugged till handed over.



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All fittings, gratings, fasteners, unless specified otherwise, shall be chromium plated. The connecting lead pipes and bends shall weigh at least 3 kg. per 25 mm dia per meter length. Where PVC or similar pipes are allowed the Contractor shall produce the test reports and convince the Engineer about their durability.

Unless specified in the contract the fixtures shall be as specified hereinafter.

2.5.1

Water closet

a) Raised type

It shall include glazed vitreous china basin with siphon, open front solid plastic seat and plastic cover, low level 12.5 litre PVC flushing cistern (same colour of wc) with valveless fittings, supply connections and necessary fittings. All fittings shall be chromium plated. Colour of basin, wc, cistern, seat and cover shall be as desired by the Engineer.

b) Squatting type

It shall include glazed vitreous china pan with foot rests and low level 12.5 litre PVC flushing cistern with valveless fittings, supply connections and necessary fittings. All fittings shall be chromium plated. The foot rests shall be made of white glazed vitreous china with chequered surface. Colour of basin, wc, cistern, shall be as desired by the Engineer.

2.5.2

Urinals

It shall consist of wall type glazed vitreous china urinals, photo voltaic control flushing cistern complete with supply connections, flush pipe, lead pipes, gratings, traps and all other necessary fittings. All fittings shall be chrome plated.

2.5.3

Wash basin

It shall be made of glazed vitreous china. The basin shall be flat back, wall hung by painted cast iron brackets and complete with pattern with hot and cold brass faucets with nylon washers, waste chain, waste washers, lead waste pipes with traps, perforated waste complete with necessary fittings. All fittings including faucets shall be chromium plated. Colour of wash basin shall be as desired by the Engineer.

2.5.4

Sink



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It shall be made of vitreous china. It shall be wall hung by painted cast iron brackets and complete with one brass faucet with nylon washers, waste chain, waste washers, lead waste pipes with traps, perforated waste with necessary fittings. All fittings including faucets shall be chromium plated.

2.5.5 Bathroom mirror

It shall be made of the best quality 6 mm thick glass and produced by a reputed mirror manufacturer. It shall be wall mounted with adjustable revolving brackets. The brackets, screws and other fittings shall be chromium plated.

2.5.6 Glass shelves

Glass shelves shall consist of 6 mm thick clear glass with guard rails and shall be wall mounted with brackets. All brackets, guard rails and screws shall be chromium plated.

2.5.7 Towel rail

Towel rails shall be 20 mm dia chromium plated MS pipes wall mounted with steel brackets. The brackets, screws etc. shall also be chromium plated.

2.5.8 Soap holder

It shall be made of chromium plated strong members. The holders shall be wall mounted with chromium plated screws.

2.5.9 Liquid soap dispenser

It shall be round and easily revolving with removable threaded nozzle. The body, bracket for wall mounting and screws shall be chromium plated.

2.5.10 Toilet roll holder

It shall be made of glazed vitreous china with suitable cover cum cutter. Wall mounting screws shall be chromium plated.

2.5.11 Installation

All plumbing fittings and fixtures shall be installed in most workmanlike manner by skilled workers. These shall be perfect in level, plumb, plane, location and symmetry. All items shall be securely anchored to walls and floors. All cuttings in walls and floors shall be made good by the Contractor.

2.6.0 Septic tank & effluent disposal

2.6.1 Septic tank

Septic tank shall consist of the tank itself with inlet and outlets therefrom complete with all necessary earthwork and backfilling. The details of septic tank shall be as shown on drawings. This item shall also include ventilating pipe of at least 100 mm dia whose top shall be provided with a suitable mosquito proof wiremesh and cowl. Ventilating pipe shall extend to a height of about 2 meter when the septic tank is at least 15 meter away from the nearest building and to a height of 2 meter above



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the top of building when it is located closer than 15 meter. Ventilating pipes can be connected to the normal soil ventilating system of the building where allowed.

2.6.2 Effluent Disposal

The effluent from the septic tank shall be disposed by allowing it into an open channel or a body of water if the concerned authority approves or into a soak pit for absorption by soil or shall be allowed to be absorbed by soil through open jointed CI pipes laid in a trench filled with broken bricks.

2.6.3 Soak pit / Chlorination Chamber

The soak pit shall be complete as shown on drawing. It shall consist of a 900 mm dia pit 1000 mm in depth below the invert level of the inlet pipe. The pit shall be lined with stone, brick or concrete blocks set in cement mortar (1:6) and filled with brick bats. Inlet pipe shall be taken down to a depth of 900 mm from the top as an anti-mosquito measure.

2.6.4 Joining C.I. Pipes / dispersion trenches

Minimum dia of the CI pipe shall be 150 mm nominal. The trench for laying the pipes shall be minimum 600 x 600 mm pipes. The joints of the pipes shall be made with lead. The entire length of the pipe within the trench shall be buried in a 250 mm layer gravel or crushed stone of uniform size. On top of gravel/crushed stone layer is a 150 mm bed of well graded coarse aggregate. Ordinary soil is used for filling the top of trench.

2.6.5 Commissioning septic tank and Soak pit/Chlorination Chamber

After the septic tank has been proved watertight and the sewage system is checked the tank shall be filled with water to its outlet level before the sewage is let into the tank. It shall be seeded with well digested sludge obtained from septic tank or sludge digestion tank. In the absence of digested sludge a small quantity of decaying organic matter such as digested cow-dung may be introduced.

3.0.0 TESTING AND ACCEPTANCE

3.1.0 Inspection before installation

All pipes, fittings and fixtures shall be inspected, before delivery at the site to see whether they conform to accepted standards. The pipes shall again be inspected on site before laying by sounding to disclose cracks. All defective items shall be clearly marked and forthwith removed from the site.

3.2.0 Testing of Pipelines

Comprehensive tests of all pipe lines shall be made by simulating conditions of use. The method of actual tests shall be decided by the Engineer. All test data shall be recorded and submitted to the Engineer for review and instruction. The Engineer's discretion regarding tolerance shall be final.



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General guidance for the tests are given below :

a) **Smoke test**

All soil pipes, waste pipes and vent pipes and all other pipes when above ground shall be approved gastight by a smoke test conducted under a pressure of 25 mm of water and maintained for 15 minutes after all trap seals have been filled with water. The smoke is produced by burning oily waste or tar paper or similar material in the combustion chamber of a smoke machine. Chemical smokes are not satisfactory.

b) **Water test**

For pipes other than Cast Iron

Glazed ware and concrete pipes shall be subjected to a test pressure of at least 1.5 m head of water at the highest point of the section under tests. The tolerance figure of two litres per centimeter of diameter per kilometer may be allowed during a period of 10 (ten) minutes. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections, if any, and filling the system with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of the vertical pipe jointed to it so as to provide the required test head or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation.

Subsidence of test water may due to one or more of the following cases :

- a) Absorption by pipes and joints
- b) Sweating of pipes or joints
- c) Leakage at joints or from defective pipes
- d) Trapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the test proper should commence. Any leakage and the defective part of the work shall be cut out and made good.

For cast iron pipes



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Cast iron sewers and drains shall be tested as for glazedware and concrete pipes. The drain plug shall be suitably strutted to prevent their being forced out of the pipe during the test.

c) **For straightness**

- i) By inserting at the high end of the sewer or drain a smooth ball of a diameter 13 mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball will roll down the invert of the pipe and emerge at the lower end; and
- ii) By means of a mirror at one end of the line and lamp at the other. If the pipe line is straight, the full circle of light may be observed. The mirror will also indicate obstruction in the barrel if the pipe line is not straight.

3.3.0 **Testing Septic Tank**

The septic tank shall be tested for watertightness. It shall be filled up with water and allowed to soak for 24 hours. Then, it shall be topped up and allowed to stand again for 24 hours and loss of level recorded. The fall shall not be more than 15 mm.

3.4.0 **Fixtures etc.**

All fixtures and fittings shall be connected by watertight joints. No dripping shall be accepted.

4.0.0 **CODES AND STANDARDS**

Some of the important Codes and Standards relevant to this specification shall be followed : Latest editions shall always be consulted.

IS:1172 - Code of basic requirements for water supply drainage and sanitation.

IS:1200 - Laying of water and sewer lines including appurtenant items.
(Pt. XVI)

IS:1239 - Mild Steel Tubes and Mild Steel Tubulars and other wrought steel pipe fittings.
(Pt. I & II)

IS:1536 - Centrifugally cast (Spun) iron pressure pipes for water gas and sewage.

IS:1537 - Vertically cast iron pressure pipe for water, gas & sewage.

IS:3486 - Cast Iron spigot & socket drain pipes.

IS:1742 - Code of Practice for building drainage.



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- IS:5329 - Code of Practice for sanitary pipe work above ground for buildings.
- IS:2470 - Code of Practice for designs and construction of septic tank for small and large installations.
- IS:3076 - Low density polythelene pipes for potable water supplies.
- IS:4984 - High density polythelene pipes for potable water supplies.
- IS:1537 - Vertically cast iron pressure pipes for water, gas and sewage.
- IS:1538 - Cast Iron fittings for pressure pipes for water, gas & sewage.
- IS:1230 - Cast Iron rain water pipes and fittings.
- IS:3889 - Centrifugally cast (spun) iron spigot & socket soil waste and ventilating pipes, fittings and accessories.
- IS:1729 - Sand cast iron spigot & socket soil, waste and ventilating pipes and accessories.
- IS:1626 - Asbestos cement building pipes, gutters and fittings (spigot & socket types).
- IS:458 - Concrete pipes (with and without reinforcement)
- IS:783 - Code of Practice for laying of concrete pipes.
- IS:784 - Prestressed concrete pipes.
- IS:651 - Salt glazed stoneware pipes & fittings.
- IS:4127 - Code of practice for laying of glazed stoneware pipes.
- IS:1726 - Cast Iron manhole covers and frames intended for use in drainage works.
- IS:5961 - Cast Iron gratings for drainage purposes.
- IS:5219 - 'P' & 'S' traps.
(Part-I)
- IS:771 - Glazed earthen-ware sanitary appliance.
- IS:772 - General requirements of enamelled cast iron sanitary appliances.
- IS:774 - Flushing cistern for water closets & urinals (valveless siphonic type).
- IS:775 - Cast Iron brackets & supports for wash basins and sinks.
- IS:2548 - Plastic water closet seats & covers.



TECHNICAL SPECIFICATION FOR DRAINAGE AND SANITATION

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VOLUME - II B

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IS:2527 - Code of Practice for fixing rain water gutters and down-pipes for roof drainage.

IS:2556 - Vitreous sanitary appliances.



TITLE:

**TECHNICAL SPECIFICATION FOR
FABRICATION OF STRUCTURAL
STEEL WORK**

SPECIFICATION NO. PE-TS-392-600-C017

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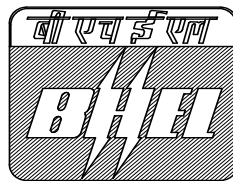
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FABRICATION OF STRUCTURAL STEEL WORK

SPECIFICATION NO. PE-TS-392-600-C017



Bharat Heavy Electricals Limited

Project Engineering Management

Power Sector, BHEL



TITLE:

**TECHNICAL SPECIFICATION FOR
FABRICATION OF STRUCTURAL
STEEL WORK**

SPECIFICATION NO. PE-TS-392-600-C017

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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

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	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)	

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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 locknuts (dia, range 6 to 39 mm) IS : 1367 - Technical supply conditions for threaded fasteners IS : 1442 - Covered electrodes for the metal arc 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 IS : 4759 - Specifications for Hot-Dip Zinc Coatings on Structural Steel					

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	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. 2.05.02 Steel	

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	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 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 structural steels	

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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 contract shall conform to the Indian Standard Specification IS: 2074 - Ready mixed Paint, Red oxide Zinc Chromate Priming.

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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.I & 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.	

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2.08.00	ELECTRO FORGED STEEL GRATINGS	
2.08.01	Factory made fabricated electro forged gratings unit with steel conforming to IS: 2062 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.	
2.08.10	Grating units shall be provided with all necessary clips, bolts, nuts and lock	

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	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: 2 15 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 these defects noticed on visual or microscopic inspection shall render the	

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	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 'bumping'. 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 2.10.01 Material Stainless steel hopper of grade SS 304/409 M as manufactured by SAIL or equivalent shall be provided in the lower portion of bunker hopper. 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	

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	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 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 through out. 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 edge s 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.	

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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 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		

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	g) Paints : Manufacturer's certificate, physical inspection reports h) 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. 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: a) Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections. b) Dimensional drawings of base plates, foundation bolts location etc. c) Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings. d) Complete Bill of Materials and detailed drawings of all sections as also their billing weights.	

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e) 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, 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.		

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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. 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	

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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 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.

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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 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		

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	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. 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.	

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	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 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-butt 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.	

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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.	
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	

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	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. 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 otherwise riveted or welded as specified on the Drawings. b) Heads of rivets on surfaces carrying 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 shall 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 sufficient 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.	

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3.16.00

Galvanizing

3.16.01

General

Structural steelwork for switchyard or other structures as may be specified in the contract shall be hot dip galvanized in accordance with the American Society for Testing and Materials Specification ASTM-A 123 or IS: 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and steel. Where the steel structures are required to be galvanized the field connection materials like bolts, nuts and washers shall also be galvanized.

3.16.02

Surface Preparation

All members to be galvanized shall be cleaned, by the process of pickling of rust, loose scale, oil, grease, slag and spatter of welded areas and other foreign substances prior to galvanizing. Pickling shall be carried out by immersing the steel in an acid bath containing either sulphuric or hydrochloric acid at a suitable concentration and temperature. The concentration of the acid and the temperature of the bath can be varied, provided that the pickling time is adjusted accordingly.

The pickling process shall be completed by thoroughly rinsing with water, which should preferably be warm, so as to remove the residual acid.

3.16.03

Procedure

Galvanizing shall be carried out by hot dip process in a proper and uniformly heated bath. It shall meet all the requirements when tested 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 & other allied products.

After finishing the threads of bolts, galvanizing shall be applied over the entire surface uniformly. The threads of bolts shall not be machined after galvanizing and shall not be clogged with zinc. The threads of nuts may be tapped after galvanizing but care shall be taken to use oil in the threads of nuts during erection.

The surface preparation for galvanizing and the process of galvanizing itself, shall not adversely affect the mechanical properties of the materials to be galvanized. Where members are of such lengths as to prevent complete dipping in one operation, great care shall be taken to prevent warping.

Materials on which galvanizing has been damaged shall be acid stripped and re-galvanized unless otherwise directed, but if any member becomes damaged after leaving been dipped twice, it shall be rejected. Special care shall be taken not to injure the skin on galvanized surfaces during transport, handling, and

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	erection. Damages, if occur, shall be made good in accordance or as directed by the Engineer. 4.00.00 INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY 4.01.00 Inspection Unless specified otherwise, inspection to all, work shall be made by the or Engineer's representative at the place of manufacture prior to delivery. The Engineer or his representative shall have free access at all reasonable times to those parts of the manufacturer's works which are concerned with the fabrication of the steelwork under this Contract and he shall be afforded all reasonable facilities for satisfying himself that the fabrication is being done in accordance with the provisions of this Specification. The Contractor shall provide free of charge, such labour, materials, electricity, fuel, water, stores, tools and plant, apparatus and instruments as may be required by the Engineer to carry out inspection and/or tests in accordance with the Contract. The Contractor shall guarantee compliance with the provisions of this Specification. 4.02.00 Testing and Acceptance Criteria 4.02.01 General The Contractor shall carry out sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own Cost. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the test results in triplicate within 3 (three) days after completion of the test. 4.02.02 Steel All steel supplied by, the Contractor shall conform, to the relevant Indian Standards. Except otherwise mentioned in the contract, only tested quality steel having mill test reports shall be used. In case unidentified steel materials are permitted to be used by the Engineer, random samples of materials will be taken from each unidentified lot of 50 M.T or less of any particular section for tests to conform to relevant Indian Standards. Cost of all tests shall be born by the contractor. All material shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. 4.02.02 Welding	

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4.05.02	Marking Each separate piece of fabricated steelwork shall be distinctly marked on all surfaces before delivery in accordance with the markings shown on approved erection drawings and shall bear such other marks as will further facilitate identification and erection. 4.05.03	Shipping Shipping shall be strictly in accordance with the sequence stipulated in the agreed Programme. Contractor shall dispatch the materials to the e worksite securely protecting and packing the materials to avoid loss or damage during transport by rail, road or water. All parts shall be adequately braced to prevent damage in transit. Each bundle, bale or package delivered under this contract shall be marked on as many sides as possible and such distinct marking (all previous irrelevant markings being carefully obliterated) shall show the following: a) Name and address of the consignee b) Name and address of the consignor c) Gross weight of the package in tonnes and its dimensions d) Identification marks and/or number of the package e) Custom registration number, if required All markings shall be carried out with such materials as would ensure quick drying and indelibility. Each component or part or piece of material when shipped, shall be indelibly marked and/or tagged with reference to assembly drawings and corresponding piece numbers. Each packing case shall contain in duplicate in English a packing list pasted on to the inside of the cover in a water-proof envelope, quoting especially - a) Name of the Contractor b) Number and date of the Contract c) Name of the office placing the contract d) Nomenclature of stores e) A schedule of parts or pieces, giving the parts or piece number with

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reference to assembly drawings and the quantity of each. The shipping dimensions of each packing shall not exceed the maximum dimensions permissible for transport over the Indian Railways/Roads. After delivery of the materials at site, all packing materials shall automatically become the property of the Owner. Notwithstanding anything stated hereinbefore, any loss or damage resulting from inadequate packing shall be made good by the Contractor at no additional cost to the Owner. When facilities exist, all shipments shall be covered by approved Insurance Policy for transit at the cost of the Contractor. The contractor shall ship the complete materials or part on board a vessel belonging to an agency approved by the Owner or on rail and/or road transport as directed. The Contractor shall take all reasonable steps to ensure correct appraisal of freight rates, weights and volumes and in no case will the Owner be liable to pay any warehouse, wharfage, demurrage and other charges. If, however, the Owner has to make payment of any of the above-mentioned charges, the amount paid will be deducted from the bills of the Contractor. Necessary advise regarding the shipment with relevant details shall reach the Engineer at least a week in advance. 5.00.00 INFORMATION TO BE SUBMITTED 5.01.00 With Tender The following information is required to be submitted with the Tender: a) Progress Schedule The Contractor shall quote in his Tender a detailed schedule of progress of work and total time of completion, itemizing the time required for each of the following aspects of work. i) Preparation and approval of fabrication drawing ii) Procurement of Materials iii) Fabrication and shipping of all anchor bolts iv) Fabrication and shipping of main steelwork. v) Fabrication and shipping of steelwork for bunkers, tanks and/or silos as applicable.		

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	vi) Fabrication and shipping of all other remaining steelwork including miscellaneous steelwork. vii) Final date of completion of all shipments. b) Shop Location of the Tenderer's fabrication workshop giving details of equipment, manpower, the total capacity, and the capacity that will be available exclusively for this contract shall be submitted. 5.02.00 After Award After award of the Contract the successful Tenderer is to submit the following: a) Complete fabrication drawings, material lists, cutting lists, rive and bolt lists, field welding schedules based on the approved design drawings prepared by him in accordance with the approved schedule. b) Monthly Progress Report with necessary photographs in six (6) copies to reach the Engineer on or before the 7th day o. each month, giving the up-to-date status of preparation of detailed shop drawings, bill of materials, procurement of materials, actual fabrication done, shipping and all other relevant information. c) Detailed monthly material reconciliation statements relevant to the Work done and reported in the Progress Report, giving the stock at hand of raw steel, work in progress, finished materials. d) Results of any test as and when conducted and as require by the engineer. e) Manufacturer's mill test report in respect of steel materials, rivets, bolts, nuts, and electrodes as may be applicable. 6.00.00 RATES AND MEASUREMENT 6.01.00 Rates 6.01.01 The items of work in the Schedule of items describe the work in brief. The various items of the Schedule of items shall be read in conjunction with these specifications including amendments and additions, general conditions of contract, special conditions of contracts, and other tender documents, if any. For each item of Schedule of Items, the bidder's rates shall include the activities covered in the description of the item as well as all necessary operations described in the Specifications.	

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	finish paint. 6.01.10 The bidder's rates for electro-forged gratings (if specified) shall include supply, fabrication, transportation to the site, erection and alignment of factory made electro-forged gratings, all taxes, duties thereon etc. The rates shall also include preparation of grating design for different spans and load intensifies, preparation of design and fabrication drawings, edge preparation, blast cleaning followed by finish paint. 6.01.11 The bidder's rates for galvanization of factory made electro-forged gratings (if specified) shall include the application of hot dipped galvanization as finish over the fabricated gratings and the treatment to be given for prevention of white storage stains, as per the technical Aspiration. 6.01.12 The bidder's rates for permanent mild steel bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types of Structural Steel works, as per the technical specification. 6.01.13 The bidder's rates for high strength structural bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types, of Structural Steel works, as per the technical specification. 6.01.14 The bidder's rates for dismantling, additions to, alterations in and/or modifications shall be inclusive of all operations such as lowering of material, carriage etc., as mentioned in the technical specification. Unutilised steel pieces cut/removed shall be returned to the project stores free of charge. Non-return of unutilized steel pieces to the Owner's store would be considered as wastage and recovery would be affected as per the provision of contract for structural steel consumption. This shall not include the weight of temporarily dismantled/supported members, connected member. 6.01.15 The bidder's rates for re-erection of erection marks after additions to, alterations in and/or modifications shall be inclusive of all operations mentioned in technical specification for the calculated weight of the rectified/modified erection mark rejected at site. This shall not include the weight of temporarily dismantled/supported members, connected member. All the operations mentioned above for restoring such members shall be carried out at no extra cost. The work of erection of any erection mark which has not been dismantled but have been modified/rectified before erection shall not be paid under this item but shall be paid under relevant item of fabrication and erection of steel work of Schedule of items for the modified weight. 6.01.16 The bidder's rates for PTFE shall include design, supply, transportation of the complete assembly with guides and dust protection cover and installation of bearings in position drilling, bolting, erecting aligning etc. along with any taxes, duties thereon etc.	

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6.01.17	The bidder's rates for Stainless Steel hopper (if specified) shall include fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, all other operations mentioned in the technical specification. The rates shall also include for erection scheme, alignment, making cutting plan, cutting, jointing, bending, rolling, grinding, drilling, bolting, assembly, edge preparation, welding including pre-heating, post-heating, testing of welders, inspection of welds, inspection and testing, protection against damage in transit, stability of structures, installation of temporary structures etc. The rates shall also be inclusive of providing and installing temporary structures, transport of Owner issue material from store, return of surplus / waste steel materials including cut pieces/waste steel, provision of additional butt / weld joint to reduce the wastage and all other general, special, such requirements as may be required, for the successful completion of the work.	
6.01.18	The bidders rates for preformed flexible open ended bellow strap of neoprene (if specified) shall include supply and transportation, installation in position, drilling, bolting, aligning etc. complete along with any taxes, duties thereon etc.	
6.01.19	The bidder's rates for Stainless Steel Hand Rail (if specified) shall include complete Hand Rail including, stainless steel beading, stainless steel cleats, stainless steel fasteners, neoprene gaskets, preparation of shop drawing but excluding the cost of glazing. The Owner for this item of work shall supply no material.	
6.02.00	MODE OF MEASUREMENT	
6.02.01	The measurement for the item of foundation bolts assembly including that of nuts; locknuts shall be based on the calculated weight of steel installed in Metric Tonne, corrected to second place of decimal. The weight of the foundation bolt shall be calculated in the same way as that done for the item of fabrication, erection, alignment of structural steel. The weight of the nut / locknut shall be taken as per actual weight supplied by the contractor and accepted by the Engineer.	
6.02.02	The measurement for the item of fabrication, erection, alignment, welding, etc. of structural steel work shall be based on the approved weight of steel nearest to a Kg, by applying the unit weight as adopted at the time of issue of structural steel on the measurements worked out as given below.	
6.02.03	For ISMB, ISMC, ISA, flats, round bars, square bars and pipes, length shall be taken as per distance between planes normal to the axis of the member passing through the extreme points of the section.	
6.02.04	Gussets plates in trusses, and bracings, brackets plates, stiffeners, and skew cuts if any in plates for butt welds the area shall be assumed as the minimum	

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	circumscribed rectangle. 6.02.05 For bunker wall plates the minimum-circumscribing rectangle of the individual plate/pieces out of which these wall plates are assembled by butt-welding, shall be measured. Care shall be taken to ensure maximum utilization of cut-pieces generated by providing extra butt joints (for which no extra payment shall be made). 6.02.06 For all other plates, where the area of any notch/skew cut in the plate is less than 0.2 sq.m. the area of the plate shall be assumed as that of the minimum circumscribing rectangle for the purpose of measurement and calculation of area for the purpose of payment. However, if the area of any notch/skew cuts in a plate is more than 0.2 sq.m. the actual profile of the plate shall be considered for the purpose of payment. 6.02.07 No deduction shall be made for the hole in the members, if the area of individual hole is less than 0.2 sq.m. The weight shall be calculated by deducting the area of holes, if area of individual hole is more than 0.2 sq.m. 6.02.08 All cut-pieces and scrap generated due to cutting of holes, skew-cuts of plates, gussets, brackets, stiffeners, etc. shall be stacked separately and handed over to the project stores without being considered for material accounting as the circumscribing rectangle has been considered for payment. 6.02.09 The splice plate shown in the fabrication drawing or approved by the Engineer shall only be measured for payment. 6.02.10 The weight of permanent bolts, washers and nuts and welds shall not be included in the weights of the members. No extra payment shall be made for welding/bolting. 6.02.11 The bolts and nuts required for erection purpose shall not be paid for and may be taken away by the Contractor after final welding for members. Erection boltholes left after removal of erection bolts shall be suitably plugged with welds. 6.02.12 The measurement for the item of application of inorganic primer including blast cleaning of steel surfaces shall be based on the weight on which the zinc silicate primer is applied, after blast cleaning in Metric Tonne, corrected to third place of decimal. The weight shall be the weight as approved, for erection mark/element of the mark painted, for payment of the item of fabrication and erection of structural steel works. 6.02.13 The measurement for the item of application of finish primer system shall be based on the weight on which the epoxy based finish primer is applied in Metric Tonne, corrected to third place of decimal. The weight shall be the weight as approved, for erection mark/element of the mark painted, for	

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	payment of the item of fabrication and erection of structural steel works. 6.02.14 The measurement for the item of gratings shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor, and accepted by the Engineer. Nothing extra shall be payable for making cutouts, notches, openings of any profile, trimming profiles etc. in the grating units. 6.02.15 The measurement for the item of hot dipped galvanization of gratings shall be based on the actual weight in Kgs, corrected to second place of decimal of gratings galvanized by the Contractor and accepted by the Engineer. 6.02.16 The measurement for the item of permanent bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules. 6.02.17 The measurement for the item of High Strength Structural bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules. 6.02.18 The measurement for the item of the work of dismantling, additions, alterations, reerection etc. shall be as given below 6.02.19 For dismantling, the unmodified weight of the actually dismantled erection marks shall only be measured. 6.02.20 For the work of addition to, alteration in and / or modification of 'erection marks' either in erected position or in the fabrication yard, measurement of weight for payment purpose shall be calculated as the arithmetic sum of weight of steel cut and removed from the erection mark, weight of steel reutilised out of such cut and removed pieces and weight of additional new steel pieces added to the erection mark. 6.02.21 For re-erection the weight of the modified erection mark shall only be measured. 6.02.22 The weight shall be measured nearest to kg. and shall be arrived in a manner similar to the measurement for the item of fabrication, erection, alignment and welding of structural steel. 6.02.23 The measurement for the item of PTFE bearings shall be based on the actual weight in MT, corrected to third place of decimal, supplied by the contractor and as accepted by the Engineer and as per the approved bearing schedule, for the total vertical load carrying capacity, for all bearings.	



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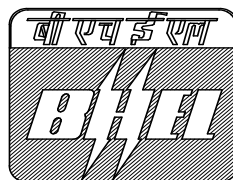
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Bharat Heavy Electricals Limited
Project Engineering Management
Power Sector, BHEL



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SUB-SECTION – D XVIII

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, plumbing, 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

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	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 o the Engineer. 2.05.00 Material	

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2.05.01	General All fabricated steel structures and connection materials shall be supplied by the Contractor to the site. The Contractor shall take delivery from railway wagons or trucks at site, and unload the materials and perform all formalities like checking of materials and attend to insurance matters in accordance with Sub-Clause 2.01.00 and as specified hereinbefore. 2.05.02 Materials to conform to Indian standards All materials required to be supplied by the Contractor under this contract shall conform to the relevant Indian Standard specifications. 2.06.00 Storage of Materials 2.06.01 General All material shall be so stored as to prevent deterioration and to ensure the preservation of their quality and fitness for use in the works. Any material which has been deteriorated or damaged beyond repairs and has become unfit for use shall be removed immediately from the site, failing which, the engineer shall be at liberty to get the materials removed by agency and the cost incurred thereof shall be realised from the Contractor's dues. 2.06.02 Yard The Contractor will have to establish a suitable yard in an approved location at site for storing the fabricated steel structures and other raw steel materials such as structural sections and plates as required. The yard shall have facilities like drainage, lighting, and suitable access for large cranes, trailers, and other heavy equipments. The yard shall be fenced all around with security arrangement and shall be of sufficiently large area to permit systematic storage of the fabricated steel structures without overcrowding and with suitable access for cranes, trailers and other equipment for use in erection work in proper sequence in accordance with the approved Programme of work. 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 designed racks and platforms off the ground in a properly covered store building to be built at the cost of the Contractor.	

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2.07.00	Quality Control The contractor shall establish and maintain quality control procedures for different items of work and materials as may be directed by the Engineer to assure compliance with the provisions of the Contract and shall submit the records of the same to the Engineer. The quality control operation shall include but not be limited to the Following items of work : i) Erection: Lines, levels, grades, plumbs, joint characteristics including 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 necessary 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 submit claims to insurance or other 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 same are erected in place and accepted. The Contractor 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 adequacy of all erection tools and plant and equipment proposed to be used shall be thoroughly verified. They shall be efficient, dependable, in good working condition and shall have the approval of the Engineer.	
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	

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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 bracings 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.					
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				



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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 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



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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 14.7 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.

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	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 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.	

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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 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.	

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	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 tow 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. 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.	

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4.01.01	Stiffness Test In this test, the structure or member shall be subjected, 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. 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 time 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.	

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	than ± 7 mm per 30m length. 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 a) Deviation at centre of span of upper chord member from vertical plane running through least. Trusses b) Lateral displacement of top chord at center of span from vertical plane running through center of supports. Crane Cirders a) Difference in levels of crane rail measured between adjacent columns. b) Deviation to crane rail-gauge c) Relative shifting of ends of adjacent crane rail in plan and elevation after thermite welding. d) Deviation of crane rail axis from centre line of web. Setting of Expansion gaps At the time of setting of the expansion gaps, due regard shall be taken of	± 9.0 mm on true span. ± 3.0 mm 3.0 mm 1/1500 of the span or greater than 10mm whichever is the 1/250 of depth of truss or 20 mm which ever is the - least. 2.0 mm. ± 3.0 mm 1.0 mm. ± 3.5 mm

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	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. 5.01.02 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. 5.01.03 Erection Yard	

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	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. 5.02.00 After award of the Contract After award of the contract, the Contractor shall submit the following: 5.02.01 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. 5.02.02 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.	