

TENDER SPECIFICATION

BHEL PSSR SCT 1835

FOR

PACKAGE A:

Handling of Materials at BHEL/ Client's Stores/ Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation and application of insulation, refractory including supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping , ESP, Gates, Duct support structures, structure for bunker, fans, bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, Auxiliary boiler & Auxiliaries and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 1

PACKAGE B:

Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation and application of insulation, refractory including supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping , ESP, Gates, Duct support structures, Structure for bunker, Fans, Bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 2.

AT

**2 X 660 MW, UDANGUDI STPP,
TUTICORIN DISTRICT, TAMIL NADU**

VOLUME –I BOOK – I

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

Book- I Consists of

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

Book-II consists of

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



BHARAT HEAVY ELECTRICALS LIMITED

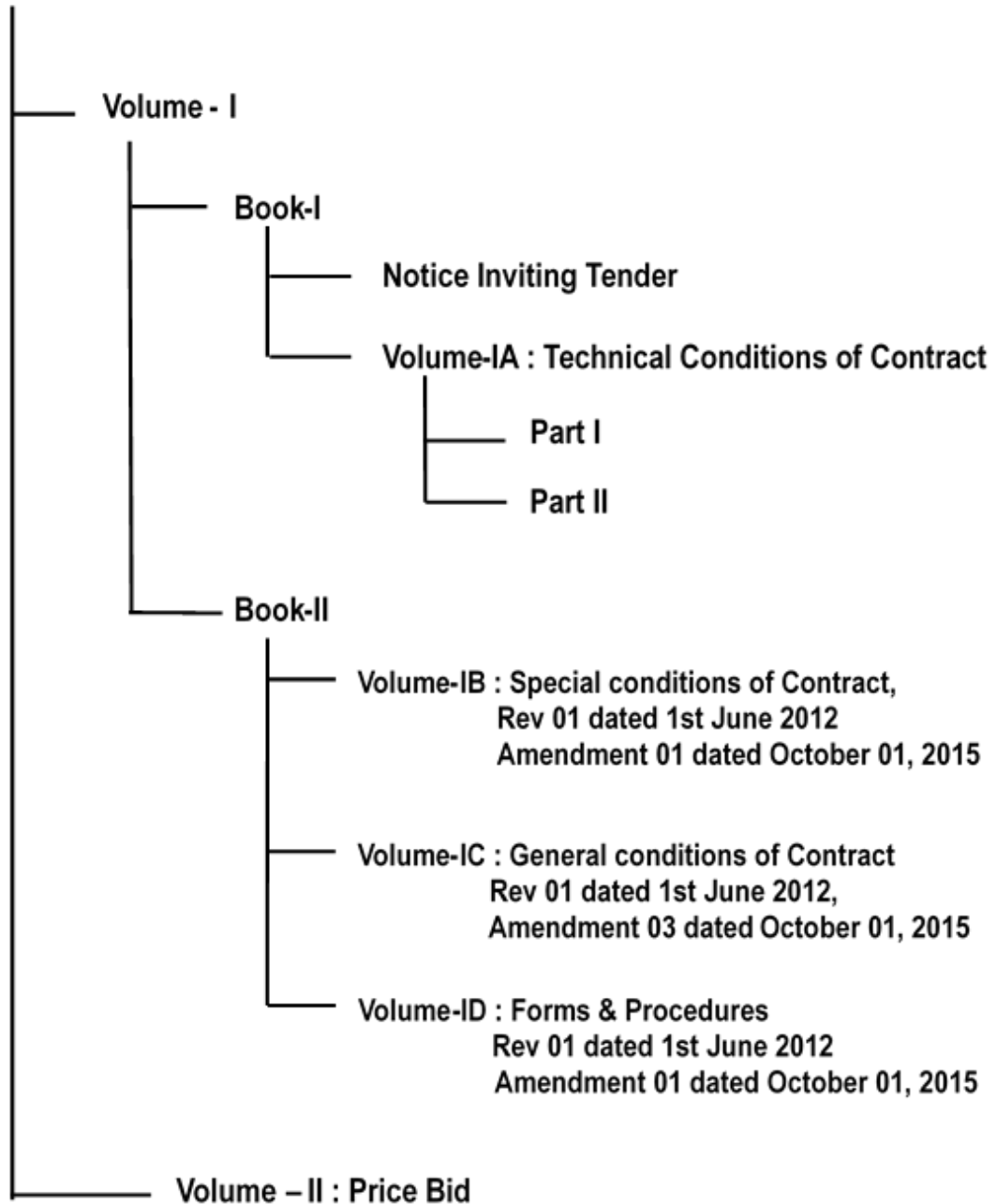
(A Government of India Undertaking)

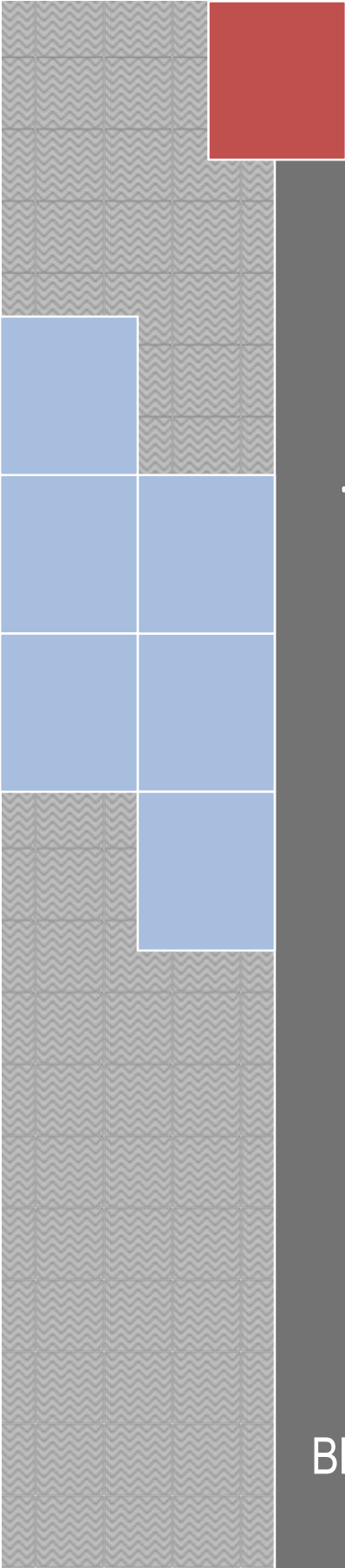
Power Sector – Southern Region

690, Anna Salai, Nandanam, Chennai – 600 035

TENDER SPECIFICATION CONSISTS OF

Tender Specification





NOTICE INVITING TENDER

Bharat Heavy Electricals Limited



NOTICE INVITING TENDER (NIT)
Submission only through E-Procurement Portal

<https://www.bhel.abcprocure.com>

Note: Bidder may download Tender Documents from web sites

To

Dear Sir / Madam

Sub: NOTICE INVITING TENDER

This tender shall be under category of National Competitive Bidding (NCB).

Online Sealed offers in two part bid system are invited from reputed & experienced bidders (meeting [PRE QUALIFICATION CRITERIA](#) as mentioned in Annexure-I) **through E-Procurement Portal <https://www.bhel.abcprocure.com> only**, for the subject job by the undersigned on the behalf of BHARAT HEAVY ELECTRICALS LIMITED as per the tender document. Following points relevant to the tender may please be noted and complied with.

1.0 Salient Features of NIT

Sl. No	ISSUE	DESCRIPTION
i	TENDER NUMBER	BHEL PSSR SCT 1835
ii	Broad Scope of job	PACKAGE A: Handling of Materials at BHEL/ Client's Stores/ Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation and application of insulation, refractory including supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, ESP, Gates, Duct support structures, structure for bunker, fans, bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, Auxiliary boiler & Auxiliaries and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 1 of 2x660 MW Udangudi STPP, Tuticorin District, Tamil Nadu PACKAGE B: Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for

NOTICE INVITING TENDER

		commissioning and Trial Operation and application of insulation, refractory including supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, ESP, Gates, Duct support structures, Structure for bunker, Fans, Bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 2 of 2x660 MW Udangudi STPP, Tuticorin District, Tamil Nadu	
iii	DETAILS OF TENDER DOCUMENT		
A	Volume-IA	Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	Applicable
B	Volume-IB	Special Conditions of Contract (SCC) Rev. 01 Dt. 01 Jun 2012 Amendment 01 dated October 01, 2015	Applicable
C	Volume-IC	General Conditions of Contract (GCC) Rev. 01 Dt. 01 Jun 2012 Amendment 03 dated October 01, 2015	Applicable
D	Volume-ID	Forms and Procedures Rev. 01 Dt. 01 Jun 2012 Amendment 01 dated October 01, 2015	Applicable
E	Volume-II	Price Schedule (Absolute value).	Applicable
iv	Issue of Tender Documents	1. This is an E-tender floated online through our E-Procurement Portal https://www.bhel.abcprocure.com 2. Sale Start: June 03, 2019 3. From BHEL website (www.bhel.com → Tender Notifications): Tender documents for bidder's reference can be downloaded from this website till due date of submission.	Applicable
v	Due Date & Time of Offer Submission	Date : June 17, 2019, Time : 15:00 Hrs The bidder should submit their offer online in e-Procurement portal at https://www.bhel.abcprocure.com Offers are invited in two-parts only. Bidders are requested to upload their offer well in advance in order to avoid last minute congestion at this website.	Applicable

NOTICE INVITING TENDER

		Hard copy bid or bids through E-mail / fax shall not be accepted.	
vi	Opening of Tender	Date : June 17, 2019, Time :15.30 Hrs Notes: (1) In case the due date of opening of tender becomes a non-working day, tenders shall be opened on next working day at the same time. (2) Bidder may depute representative to witness the opening of tender	Applicable
vii	EMD Amount	Rs. 81,70,000/- (Rupees Eighty one lakhs seventy thousand only) - Refer Volume-I A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I Book-I) for mode of payment of Earnest Money Deposit (EMD) - EMD Exemption for MSEs is not applicable for this tender. - One time EMD not applicable for this tender.	Applicable
viii	Cost of Tender	Rs 2000/- (Rupees Two thousand only)	Applicable
ix	Last Date For Seeking Clarification	Bidders may submit their queries in https://www.bhel.abcprocure.com at least 7 days before the due date of offer submission or two days before the scheduled date of pre-bid meeting whichever is earlier along with soft version also, addressing to undersigned & to others as per contact address given above.	Applicable
x	Schedule of Pre Bid Discussion (PBD)	Date: June 10, 2019, Time 11.00AM at BHEL:PSSR:Chennai-35	Applicable
xi	Integrity Pact & Details of Independent External Monitor (IEM)	Integrity Pact (IP) a) IP is a tool to ensure that activities and transactions between the company and its Bidders / Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been	Applicable

NOTICE INVITING TENDER

		appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL. Mrs. Pravin Tripathi, IA & AS (Retd.) D-243, Anupam Gardens, Lane IB, Neb Sarai, Sainik Farms, New Delhi – 110 068 E mail: pravin.tripathi@gmail.com b) The IP as per format given at Volume-I A Part-II Chapter-1 of Technical Conditions of Contract (Refer Volume-I Book-I) of this tender is to be submitted (duly signed by the authorized signatory) along with Techno Commercial Bid. Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this pact would be a preliminary qualification. Please refer section- 8 of the IP (refer the format given at Volume 1D Formats of this tender) for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender. Note: No routine correspondence shall be addressed to the IEM (Phone / Post / E mail) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. shall be posted in https://www.bhel.abcprocure.com. Any other queries may be addressed directly to the tender issuing (Procurement) department as mentioned below: <table><tr><td>Name</td><td>Shri.S.P.Sethuram an</td><td>Shri. Sandipan Biswas</td></tr><tr><td>Dept</td><td>Sub Contracts</td><td>Sub Contracts</td></tr><tr><td>Phone</td><td>+91 44 24330209, +91 44 28286764</td><td>+91 44 28286757</td></tr><tr><td>E mail</td><td>Sethu_sp@bhel.in</td><td>bsandipan@bhel.in</td></tr></table>	Name	Shri.S.P.Sethuram an	Shri. Sandipan Biswas	Dept	Sub Contracts	Sub Contracts	Phone	+91 44 24330209, +91 44 28286764	+91 44 28286757	E mail	Sethu_sp@bhel.in	bsandipan@bhel.in
Name	Shri.S.P.Sethuram an	Shri. Sandipan Biswas												
Dept	Sub Contracts	Sub Contracts												
Phone	+91 44 24330209, +91 44 28286764	+91 44 28286757												
E mail	Sethu_sp@bhel.in	bsandipan@bhel.in												
xii	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda,												

NOTICE INVITING TENDER

	Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com → Tender Notifications), and portal https://www.bhel.abcprocure.com . Bidders to keep themselves updated with all such information. This also form part of tender hence the same shall be enclosed with their offer.	

- 2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly signed & stamped on each page, as part of offer. **Rates / Price including discounts / rebates, if any, mentioned anywhere / in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.**
- 3.0 Unless specifically stated otherwise, bidder shall remit cost of tender inline with mode of payment applicable to EMD as mentioned in Vol-1A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I, Book-I) under the heading 'Modes of deposit of EMD'.
- 4.0 Unless specifically stated otherwise, bidder shall deposit **Earnest Money Deposit (EMD) as mentioned in Volume IA, Part-II, Chapter-1** of Technical Conditions of Contract (Volume-I Book-I). Please note that 'One Time EMD' shall not be considered. For mode of payment of EMD, bidder shall refer Vol-1A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I Book-I). **It is to be noted that proof of remittance for EMD shall be made available at BHEL PSSR Office prior to tender opening. One time EMD is not applicable.**
- 5.0 **Procedure for Submission of Tenders:** This is an E-tender floated online through our E-Procurement portal <https://www.bhel.abcprocure.com>. The bidder should respond by submitting their offer online only in our e-Procurement portal at <https://www.bhel.abcprocure.com>. Hard copy bid or bids through email/ fax shall not be accepted.

I. Pre-requisite for Offer Submission:-

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

The Tenderer should own and use the Digital Signature Certificate (Class 3 – SHA2 – 2048 BIT – Signing & Encryption) (DSC) issued on behalf of their

NOTICE INVITING TENDER

/ his – firm / organization / company / proprietor. Tenderer to register with E-Procurement Portal <https://www.bhel.abcprocure.com> with their DSC.

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

The contact details of the DSC Certifying Authority may be obtained from “Bidder Manual”, as available in <https://www.bhel.abcprocure.com>.

II. Digital Signing of e-Tender

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

i) The Requirement:

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

III. Details of E-procurement service Provider:-

The contact details of the service provider are given below:

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

Timing:

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

Contact: +91 79 68136819 / 809 / 862 / 867 / 823 / 872 / 842

E-Mail: bhel.support@abcprocure.com

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

IV. Documents Comprising the e-Tender

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

i) Technical Tender (Un priced Tender)

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

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

NOTICE INVITING TENDER

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

ii) Price Bid:

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

Note:

- i). It is the responsibility of tenderer to go through the Tender document to ensure furnishing all required documents in addition to above, if any. Any deviation would result in REJECTION of tender and would not be considered at a later stage at any cost by BHEL.
- ii). A person signing (manually or digitally) the tender form or any documents forming part of the contract on behalf of another shall be deemed to warrantee that he has authority to bind such other persons and if, on enquiry, it appears that the persons so signing had no authority to do so, the purchaser may, without prejudice to other civil and criminal remedies, cancel the contract and hold the signatory liable for all cost and damages.
- iii). A tender, which does not fulfil any of the above requirements and / or gives evasive information / reply against any such requirement, shall be liable to be ignored and rejected.
- iv). In case offer is sent through hard copy / fax / telex / cable / electronically in place of e-tender, same shall not be considered.
- v). **Vendors are also requested to go through Bidder Manual for BHEL Bidders available on <https://www.bhel.abcpurchase.com>**

V. DO NOT'S (Don'ts)

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

NOTICE INVITING TENDER

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

Sl. No	Description	Remarks
	Techno-Commercial Bid CONTAINING THE FOLLOWING:-	
i.	Covering letter / Offer forwarding letter of Tenderer.	To be uploaded under the form Techno-commercial Bid.
ii.	Duly filled-in 'No Deviation Certificate' as per prescribed format to be placed after document under Sl. No (i) above. Note: 1. In case of any deviation, the same should be submitted separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be attached along with document under Sl. No (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. 2. BHEL reserves the right to accept / reject the deviations without assigning any reasons, and BHEL decision is final and binding. (i) In case of acceptance of the deviations, appropriate loading shall be done by BHEL (ii) In case of unacceptable deviations, BHEL reserves the right to reject the tender.	
iii.	Supporting documents / annexure / schedules / drawing etc as required in line with Pre-Qualification criteria. (Technical & Financial) As detailed in Clause No. 25 of NIT, It shall be specifically noted that all documents as per above shall be indexed properly and credential certificates issued by clients shall distinctly bear the name of organization, contact phone no, FAX no, etc.	
iv.	All Amendments / Correspondences / Corrigenda / Clarifications / Changes / Errata etc pertinent to this NIT.	
v.	Integrity Pact Agreement (Duly signed by the authorized signatory) (As applicable)	To be uploaded under the form Techno-commercial Bid.
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification / NIT	
vii.	Notice inviting Tender (NIT)	

NOTICE INVITING TENDER

viii.	Volume – I A : Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	
ix.	Volume – I B : Special Conditions of Contract (SCC)	
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.	

Caution to Bidders:-

The duly signed & stamped copies of Volume – I Book I & Volume I Book-II are to be attached in their respective sections. For any further queries, refer "Bidder Manual for BHEL Bidders" available at <https://www.bhel.abcpocure.com>

	PRICE BID shall be as mentioned below:	
	Price / Total Amount corresponding to the total works as specified in 'Part-C: Bill of Quantities' in Volume II – PRICE BID (latest Revision) shall be quoted in the <u>Price Bid Form</u> available in e-Procurement portal. Bidders to note that documents uploaded under the form Price Bid shall be considered for commercial evaluation of offer only if they are in above format	To be uploaded under the form Price Bid. Refer "Bidder Manual for BHEL Bidders" available at https://bhel.abcpocure.com

SPECIAL NOTE:

- i) All documents / annexures submitted with the offer shall be properly attached / entered / uploaded in the respective sections. BHEL shall not be responsible for any missing documents.
- ii) Your offer & documents submitted along with offer shall be signed & stamped in each page by your authorized representative. No overwriting / correction in tender documents by bidders shall be allowed. However, if correction is unavoidable, the same may be signed by authorized signatory.

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

NOTICE INVITING TENDER

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

9.0 ASSESSMENT OF CAPACITY OF BIDDERS:

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

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

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

Total number of Packages in hand = Load (P)

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

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

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

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

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

NOTICE INVITING TENDER

- a) $P_1, P_2, P_3, P_4, P_5, \dots, P_N$ etc. be the packages (under execution/ executed during the 'Period of Assessment' in all Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions = P_T (i.e. $P_T = P_1 + P_2 + P_3 + P_4 + \dots + P_N$)
- b) Number of Months ' T_1 ' for which 'Monthly Performance Evaluation' as per relevant formats, should have been done in the 'Period of Assessment' for the corresponding similar package P_1 . Similarly T_2 for package P_2 , T_3 for package P_3 , etc. for the tendered scope. Now calculate cumulative total months ' T_T ' for total similar Packages ' P_T ' for all Regions (i.e. $T_T = T_1 + T_2 + T_3 + T_4 + \dots + T_N$)
- c) Sum ' S_1 ' of 'Monthly Performance Evaluation' Scores ($S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, S_{1-5}, \dots, S_{1-T_1}$) for similar package P_1 , for the 'period of assessment' ' T_1 ' (i.e. $S_1 = S_{1-1} + S_{1-2} + S_{1-3} + S_{1-4} + S_{1-5} + \dots + S_{1-T_1}$). Similarly, S_2 for package P_2 for period T_2 , S_3 for package P_3 for period T_3 etc. for the tendered scope for all Regions. Now calculate cumulative sum ' S_T ' of 'Monthly Performance Evaluation' Scores for total similar Packages ' P_T ' for all Regions (i.e. ' $S_T = S_1 + S_2 + S_3 + S_4 + S_5 + \dots + S_N$ ')
- 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
- Aggregate of Performance scores for all similar packages in all the Regions
- = -----
- Aggregate of months for each of the similar packages for which performance should have been evaluated in all the Regions
- $$= \frac{S_T}{T_T}$$
- e) Bidders to note that the risk of non-evaluation or non-availability of the 'Monthly Performance Evaluation' reports as per relevant formats is to be borne by the Bidder.

NOTICE INVITING TENDER

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 at least 6 evaluation scores for 'similar Package / Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment':

This shall be obtained by summing up the 'Monthly Performance Evaluation' scores obtained by the bidder in all Regions for ALL the

NOTICE INVITING TENDER

packages, divided by the total number of Package months for which evaluation should have been done. 'R_{BHEL}' shall be calculated subject to availability of 'performance scores' for at least 6 'package months' in the order of precedence below:

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

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

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

Sl. no.	Overall Performance Rating (R _{BHEL})	Corresponding value of 'L'
1	=60	NA
2	> 60 and ≤ 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 'I' above)

Note: For the transition period of 1 year (i.e. for all the NITs floated between 11th May 2019 to 10th May 2020), in addition to above, 'Assessment of

NOTICE INVITING TENDER

Capacity of Bidder' shall also be calculated considering 'performance scores' till 36 months as per Sl. no II ii).

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

IV. **Explanatory note:**

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

ii). Identified Packages (Unit wise)

Table-1

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

iii). Bidders who have not been evaluated for at least six package months in the last 24 months preceding and including the Cut-off month in the online

NOTICE INVITING TENDER

BHEL system for contractor performance evaluation in BHEL PS Regions, shall be considered “NEW VENDOR”.

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

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

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

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

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

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

NOTICE INVITING TENDER

shall also be considered qualified against criteria of 'Assessment of Capacity of Bidders'.

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

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

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

- vi). Contractor shall provide the latest contact details i.e. mail-ID and Correspondence Address to SCT Department, so that same can be entered in the Contractor Performance Evaluation System, and in case of any change/discrepancy same shall be informed immediately. Login Details for viewing scores in Contractor Performance Evaluation System shall be provided to the Contractor by SCT Department.
- vii). Performance Evaluation for Activity Month shall be completed in Evaluation Month (i.e. month next to Activity Month) or in rare cases in Post Evaluation Month (i.e. month next to Evaluation Month) after approval from Competent Authority. In case scores are not acceptable, Contractor can submit Review Request to GM Site/ GM Project latest by 25th of Evaluation Month or 3 days after approval of score, whichever is later. However, acceptance/rejection of 'Review Request' solely depends on the discretion of GM Site/GM Project. After acceptance of Review Request, evaluation score shall be reviewed at site and the score after completion of review process shall be acceptable and binding on the contractor.

NOTICE INVITING TENDER

- viii). Project on Hold due to reasons not attributable to bidder -
- a. **Short hold:** Evaluation shall not be applicable for this period; however, Loading will be considered.
 - b. **Long hold:** Short hold for continuous six months and beyond or hold on account of Force Majeure shall be considered as Long Hold. Evaluation as well as Loading shall not be considered for this period.
- ix). Performance evaluation in CL 9 above is applicable to Prime bidder and Consortium partner (or Technical tie up partner) for their respective scope of work.
- 10.0 Performance evaluation in Clause 9 above is applicable to Prime bidder and consortium partner (or Technical tie up partner) for their respective scope of work.
- 11.0 Since the job shall be executed at site, bidders must visit site / work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc. before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.
- 12.0 For any clarification on the tender document, the bidder may seek the same in writing or through e-mail, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.
- 13.0 BHEL may decide holding pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.
- 14.0 In the event of any conflict between requirement of any clause of this specification / documents / drawings / data sheets etc or requirements of different codes / standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages / other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting / submission of offer, else BHEL's interpretation shall prevail.

NOTICE INVITING TENDER

- 15.0 Unless specifically mentioned otherwise, bidder's quoted price shall be deemed to be in compliance with tender including PBD.
- 16.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), **if applicable**, along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. **The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (1) above.**
- 17.0 The Bidder has to satisfy the Pre-Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the pre-qualification criteria specified in this NIT as per Annexure-1 (as applicable) past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right NOT to consider offers of parties under HOLD.
- 18.0 In case BHEL decides on a 'Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful / Disqualified bidders under intimation to the respective bidders.
- 19.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise.
- 20.0 BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

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

The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. **The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed**

NOTICE INVITING TENDER

on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.

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

- 21.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.
- 22.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.
- 23.0 Void
- 24.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.
- 25.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements' duly self-certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents / proofs, these shall be submitted immediately.
- 26.0 The bidder may have to produce original document for verification if so decided by BHEL.
- 27.0 The offers of the bidders who are under suspension as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site "<http://www.bhel.com> → tender notification".
- 28.0 It may be noted that guidelines / rules in respect of 'Suspension of Business dealings' available on BHEL web site "<http://www.bhel.com> → Supplier Registration", 'Vendor evaluation format', Quality, Safety & HSE guidelines', etc. may undergo change from time to time and the latest one shall be followed.
- 29.0 The Bidder along with its associate / collaborators / sub-contractors / sub-vendors / consultants / service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website <http://www.bhel.com> and shall

NOTICE INVITING TENDER

immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice.

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

30.1 Commitment by BHEL:

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

30.2 Commitment by Bidder / Supplier / Contractor:

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

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

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

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

31.0 Bid should be free from correction, overwriting, using corrective fluid, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for rejection.

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

NOTICE INVITING TENDER

- 32.0 For this procurement, Public Procurement (Preference to Make in India), Order 2017 dated June 15, 2017 and May 28, 2018 and subsequent Orders issued by the respective Nodal Ministry shall be applicable even if issued after issue of this NIT but before finalization of contract / PO / WO against this NIT.

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

33.0 Mode of award of work:

- 33.1 This Tender consists of two packages, Package A & Package B and shall be awarded to two Bidders.

- 33.2 Price Bid will be invited only for Package A and the successful bidder against this quote will be awarded the contract for Package A.

- 33.3 The finalized contractor for Package A will not be eligible for Package B.

- 33.4 The ratio of the total amounts for Package A and Package B shall be 1 and 0.987447 (Explanatory statement: If the total amount of Package A is considered as 1, then the total amount of package B shall be considered as 0.987447)

- 33.5 Based on the awarded value of Package A, the value of Package B shall be arrived as below:

Value of Package B = 0.987447 X Awarded value of Package A.

The value of Package B thus arrived at may be offered to the next lowest bidder in the order of competitiveness i.e., L2, L3 and so on till H1 in that order, for matching. However, BHEL reserves the right to not award Package A in this manner at its sole discretion, without furnishing any reason to the Bidders.

- 33.6 Incase BHEL, at its discretion opts to go for re-tendering for award of work of Package B, then the bidder who is awarded with the works of Package A shall not be considered.

- 33.7 Each package will be treated as a separate contract.

34.0 Order of Precedence:

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

- a. Amendments / Clarifications / Corrigenda / Errata etc. issued in respect of the tender documents by BHEL
- b. Notice Inviting Tender (NIT)
- c. Price Bid

NOTICE INVITING TENDER

- d. Technical Conditions of Contract (TCC)—Volume-1A
- e. Special Conditions of Contract (SCC) —Volume-1B,
Rev. 01 Dt. 01 Jun 2012, Amendment 01 dated October 01, 2015
- f. General Conditions of Contract (GCC) —Volume-1C
Rev.01 Dt. 01 Jun 2012; Amendment 03 dated October 01, 2015
- g. Forms and Procedures —Volume-1D
Rev. 01 Dt. 01 Jun 2012, Amendment 01 dated October 01, 2015

For and on behalf of BHARAT HEAVY ELECTRICALS LTD

Additional General Manager / SCT

Enclosure

- 1. Annexure-1: Pre Qualifying criteria.
- 2. Annexure-2: Check List.
- 3. Annexure-3: Not applicable.
- 4. Annexure-4: Annexure to Pre-Qualifying Criteria.
- 5. Annexure-5: Tender Schedule.
- 6. Annexure-6: Declaration for Reverse Auction
- 7. Other documents as per this NIT.

NOTICE INVITING TENDER

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	PACKAGE A: Handling of Materials at BHEL/ Client's Stores/ Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation and application of insulation, refractory including supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, ESP, Gates, Duct support structures, structure for bunker, fans, bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, Auxiliary boiler & Auxiliaries and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 1 of 2x660 MW Udangudi STPP, Tuticorin District, Tamil Nadu PACKAGE B: Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation and application of insulation, refractory including supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, ESP, Gates, Duct support structures, Structure for bunker, Fans, Bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 2 of 2x660 MW Udangudi STPP, Tuticorin District, Tamil Nadu
Tender No.	BHEL PSSR SCT 1835

Sl. No.	PRE QUALIFICATION CRITERIA	Bidders claim in respect of fulfilling the PQR Criteria	
		Name and Description of qualifying criteria	Page no of supporting document. Bidder must fill up this column as per applicability
A	Submission of Integrity Pact duly signed (if applicable) (Note: To be submitted by Prime Bidder & Consortium / Technical Tie up partner	Applicable	

NOTICE INVITING TENDER

	jointly in case Consortium bidding is permitted, otherwise by the sole bidder)		
B	<u>Technical</u> The Bidder should have executed the Erection and Commissioning of at least one Boiler of a unit of 400 MW or above, consisting of Structures, Pressure Parts of the same unit as standalone Bidder, in the last seven years ending on the latest Date of Bid Submission. Note: The term Executed in Technical PQR means achievement of the milestone Boiler Light Up.	Applicable	To be filled in Annexure-4
C: C-1	<u>FINANCIAL</u> <u>Turnover</u> Bidders must have achieved an average annual financial turnover (Audited) of Rs.21,50,00,000.00 (Rs. Twenty one crores fifty lakhs) or more over last three Financial Years (FY) i.e, 2015-16, 2016-17 and 2017-18.	Applicable	To be filled in Annexure-4
C-2	<u>Networth</u> Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive	Applicable	To be filled in Annexure-4
C-3	<u>Profit</u> Bidder must have earned profit in any one of the three Financial Years as applicable in the last three Financial Years defined in 'C-1' above based on latest Audited Accounts.	Applicable	To be filled in Annexure-4
C-4	Bidder must not be under Bankruptcy Code Proceedings (IBC) by NCLT or under Liquidation / BIFR, which will render him ineligible for participation in this tender, and shall submit undertaking to this effect.	Applicable	Undertaking to be enclosed with the offer
D	Assessment of Capacity of Bidder to execute the work as per Sl. No 9 of NIT (if applicable)	Applicable	BY BHEL
E	<u>Approval of Customer (if applicable)</u> <u>Note:</u> Names of bidders who stand qualified after compliance of criteria A to D shall be forwarded to customer for their approval.	Applicable	BY BHEL

NOTICE INVITING TENDER

F	Price Bid Opening Note: Price Bids of only those bidders shall be opened who stand qualified after compliance of criteria A to E	Applicable	BY BHEL
G	Consortium criteria (if applicable)	Not Applicable	
<u>Explanatory Notes for the PQR (unless otherwise specified in the PQR):</u> - Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated against C-1 above along with all annexures. - In case audited Financial statements have not been submitted for all the three years as indicated against C-1 above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e total divided by three. - If Financial Statements are not required to be audited statutorily, then instead of audited financial statements are required to be certified by Chartered Accountant. - C-2:-NETWORTH: Shall be calculated based on the latest Audited Accounts as furnished for C-1 above. Net worth = Paid up share capital* + Reserves. (Net worth is required to be evaluated in case of companies). Note:- (* : Share Capital OR Partnership Capital OR Proprietor Capital as the case may be) - C-3:- PROFIT: Shall be PBT earned during any one year of last three financial years as in 'C-1' above. - For evaluation of PQR, the credentials of the Bidder alone, and not that of the Group Company shall be considered. Also refer Annexure-3 for further clarity. - Completion date for achievement of the technical criteria specified in the Common QR should be in the last 7 years ending on the 'latest date of Bid Submission' of Tender irrespective of date of the start of work. - Boiler means HRSG or WHRB or any other types of Steam Generator. - Power Cycle piping means Main Steam, Hot Reheat, Cold Reheat, HP Bypass. - For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5 TPH where ever rating of HRSG / BOILER is mentioned in MW. Similarly, where ever rating of Gas Turbine is mentioned in terms of Frame size, ISO rating of the same in terms of MW shall be considered for evaluation.			

NOTICE INVITING TENDER

	11. Scope for Capital overhaul of STG shall cover Bearing Inspection work and overhauling of all cylinders of the Turbine. 12. In case the Experience/PO/WO certificate enclosed by bidders do not have separate break up of prices for the E&C portion for Electrical and C&I works (i.e. the certificates enclosed are for composite order for supply and erection of Electrical and C&I and other works if any), then value of Erection & Commissioning for the Electrical and C&I portion shall be considered as 15% of the price for supply & erection of Electrical and C&I.

Note to Bidder:

- a) Authenticity of Credentials submitted by the Bidder against 'Pre-Qualifying Criteria' shall be verified from the Issuing Authority, by BHEL. In case, any credential(s) is / are found to be unauthentic, offer of the bidder is liable to be rejected. BHEL reserves the Right to Initiate any further action as per the "Guidelines for Suspension of Business Dealings with Suppliers / Contractors" (Published in http://www.bhel.com/vender_registration/vender.php) and "Fraud Prevention Policy" (Published in <http://www.bhel.com/home.php>) as applicable.
- b) Bidder shall submit pre-qualification criteria format (Refer Annexure-4), duly filled-in, specifying respective annexure number against each criteria and furnish relevant document inclusive of work order and work completion certificate etc. In the respective annexures in their offer.
- c) **Regarding Technical PQR:**

For the purpose of qualification, after successful execution of two similar works in consortium with the same consortium partner(s) under direct orders from BHEL, the prime bidder in such contracts shall be eligible for becoming a standalone bidder for this tender work, subject to certification from end user / purchaser about the active involvement of the prime bidder for satisfactory execution of works in such contracts.

NOTICE INVITING TENDER

ANNEXURE - 2

CHECK LIST

NOTE: - Tenderers are required to either fill in or submit separately the following details. No column should be left blank.

1	Name and Address of the Tenderer					
2	Details about type of the Firm / Company					
3a	Details of Contact person for this Tender: Name : Mr. / Ms. Designation: Telephone No: Mobile No: Fax No: E-mail ID:					
3b	Details of alternate Contact person for this Tender: Name : Mr. / Ms. Designation: Telephone No: Mobile No: Fax No: E-mail ID:					
4	EMD DETAILS (Remittance of EMD should be in line with Mode of Deposit as detailed in Volume-1A, Part-II, Chapter-1 of Technical Conditions of Contract (Volume-I Book-I))	Sl. No	Ref No.	Detail	Amount	Remarks
5	Validity of Offer	To be valid for six months from due date				
					Applicability (By BHEL)	Bidder Reply
6	Whether the format for compliance with PRE QUALIFICATION CRITERIA (ANNEXURE-I & ANNEXURE-IV) is understood and filled with proper supporting documents referenced in the specified format				Applicable	Yes / No
7	Submission of Copy of Balance sheet and Audited profit and Loss Account for the last three years				Applicable	Yes / No
8	Submission of Copy of PAN Card				Applicable	Yes / No

NOTICE INVITING TENDER

9	Whether all pages of the offer documents are signed by the person authorized to sign this offer	Applicable	Yes / No
10	Whether all pages of the Tender documents including annexures, appendices etc., are read understood and signed	Applicable	Yes / No
11	Submission of Integrity Pact	Applicable	Yes / No
12	Submission of Declaration by Authorized Signatory	Applicable	Yes / No
13	Submission of No Deviation Certificate	Applicable	Yes / No
14	Submission of Declaration confirming knowledge about Site Conditions	Applicable	Yes / No
15	Submission of Declaration for relation in BHEL	Applicable	Yes / No
16	Submission of Non-Disclosure Certificate	Applicable	Yes / No
17	Submission of Copy Bank Account Details for E-Payment	Applicable	Yes / No
18	Submission of Capacity Evaluation of Bidder for current Tender	Applicable	Yes / No
19	Submission of Tie Ups / Consortium Agreement are submitted as per format	Not Applicable	Yes / No
20	Submission of Power of Attorney for Submission of Tender / Signing Contract Agreement	Applicable	Yes / No
21	Submission of Analysis of Unit rates	Applicable	Yes / No
22	Submission of Unquoted price bid	Applicable	Yes / No
23	Tabular column showing Category- wise, month wise, man power deployment sub package wise planned for the execution of the scope of works.	Applicable	Yes / No
24	Declaration by bidder for price opening through reverse auction (Refer Annexure-6 of Notice Inviting Tender)	Applicable	Yes / No
25	Copy of Organization Chart	Applicable	Yes / No
26	Copy of Registration / Incorporation certificate, Partnership Deed (Certified by Notary Public) as applicable for firm	Applicable	Yes / No

NOTE :

1. STRIKE OFF 'YES' OR 'NO', AS APPLICABLE.
2. Tender not accompanied by the prescribed above applicable documents are liable to be summarily rejected.
3. For Sl.No 11 of above, refer the format published in chapter 14 of part II of Technical Conditions of Contract (Volume-I Book-I).
4. For Sl. No. 12 to 21 above, the formats are available in "Volume ID of Volume-I Book-II – Forms and Procedures" of this tender specification.

DATE:

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

NOTICE INVITING TENDER

ANNEXURE- 3 is not applicable for this tender

ANNEXURE - 4

Additional Format to be submitted by Bidders separately as "Annexure to Pre-Qualifying Criteria". Non submission of this additional format will make the bid liable for rejection

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

Sl. No.	PQR Ref	PQR (Reproduced from Annexure – 1 ~~and 3~~)	Qualify ng Experie nce	Work order Ref with page no in Offer for supporting documents	Completion certificate ref for the referred Work with page no in Offer for supporting documents	Details of work with Project, Unit, Quantity / rating & Period	Rem arks
1	<u>B.</u> <u>Technical</u>	The Bidder should have executed the Erection and Commissioning of at least one Boiler of a unit of 400 MW or above, consisting of Structures, Pressure Parts of the same unit as standalone Bidder, in the last seven years ending on the latest Date of Bid Submission. Note: The term Executed in Technical PQR means achievement of the milestone Boiler Light Up.					

NOTICE INVITING TENDER

Sl. No.	PQR Ref	PQR (Reproduced from Annexure – 1 ~~and 3~~)	Qualifying Experience	Work order Ref with page no in Offer for supporting documents	Completion certificate ref for the referred Work with page no in Offer for supporting documents	Details of work with Project, Unit, Quantity / rating & Period	Remarks
2	<u>Financial</u> C-1	Turnover Bidders must have achieved an average annual financial turnover (Audited) of Rs.21,50,00,000.00 (Rs. Twenty one crores fifty lakhs) or more over last three Financial Years (FY) i.e., 2015-16, 2016-17 and 2017-18.					
3	<u>Financial</u> C-2	Net worth Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive.					
4	<u>Financial</u> C-3	Profit Bidder must have earned profit in any one of the three Financial Years as applicable in the last three Financial Years defined in 'C-1' above based on latest Audited Accounts.					
5	<u>Financial</u> C-4	Bidder must not be under Bankruptcy Code Proceedings (IBC) by NCLT or under Liquidation / BIFR, which will render him ineligible for participation in this tender, and shall submit undertaking to this effect.	Undertaking to be enclosed with the offer				

NOTICE INVITING TENDER

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

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

Tender Schedule

Description	Schedule	Remarks
Technical Bid Opening	As mentioned in Notice Inviting Tender.	
Communication from BHEL for Clarifications, if any, required by BHEL	Within three days from tender opening date	
Last date for Bidders to submit the clarifications / documents required	Within five days from tender opening date	Bidders to note that their competent representative to be readily available in this week for offering clarifications / submitting the further documents, if any, required.
If Reverse Auction is applicable, then the tentative date for conducting Reverse Auction	Tenth day from tender opening date	Exact date of reverse auction shall be informed to the bidders through BHEL's reverse auction agency. Bidders to note that their competent representative to be readily available at one day notice for Reverse Auction.

Note:

1. Bidders to note that the above schedule should be adhered to and no further extension will be given. To adhere to the schedule indicated below, Bidders should ensure the adequacy of the documents submitted in their offer, with proper validation.

DECLARATION BY BIDDER FOR PRICE OPENING THROUGH REVERSE AUCTION

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

To,

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

Dear Sir,

Sub : Declaration by Bidder for Price opening through Reverse Auction

Ref : 1) NIT / Tender Specification No:,

2) Participation in the Reverse Auction

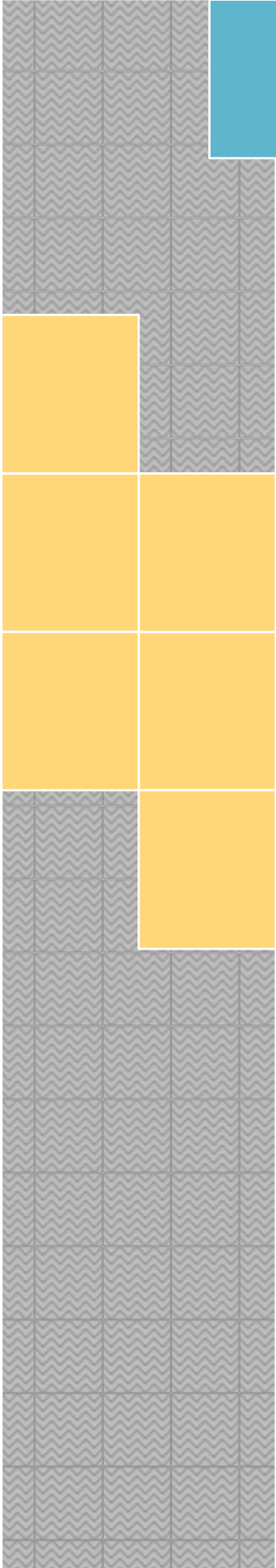
We have studied and understood the clauses of Reverse auction published in the tender specification.

Strike out either (1) or (2) of the following whichever is not applicable.

1. I / We, hereby declare that I / we **shall be** participating in the Reverse Auction in case BHEL opts for opening the price bid through Reverse auction.
2. I / We, hereby declare that I / we **shall not be** participating in the Reverse Auction in case BHEL opts for opening the price bid through Reverse auction.

Yours faithfully,

Date: (Signature, Date & Seal of Authorized Signatory of the Bidder)



VOLUME – IA

Part I & II

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Bharat Heavy Electricals Limited



TECHNICAL CONDITIONS OF CONTRACT (TCC)

CONTENTS

Sl. no	DESCRIPTION	Chapter	No. of Pages
Vol I A	Part-I: Contract specific details		
1	Project Information	Chapter-I	02
2	Scope of works	Chapter-II	05
3	Facilities in Scope of Contractor / BHEL (Scope Matrix)	Chapter-III	08
4	T&Ps and MMEs to be deployed by Contractor	Chapter-IV	05
5	T&Ps and MMEs to be deployed by BHEL on sharing basis	Chapter-V	03
6	Time Schedule	Chapter-VI	02
7	Terms of Payment	Chapter-VII	07
8	Taxes and other Duties	Chapter-VIII	02
9	Bill of Quantity	Chapter-IX	56
10	General	Chapter-X	09
11	Progress of work	Chapter-XI	02
12	Foundation & Grouting	Chapter-XII	03
13	Material Handling, Transportation and Site Storage	Chapter-XIII	02
14	Fabrication and Erection	Chapter-XIV	30
15	Welding, heat treatment & Radiography and Non-destructive testing	Chapter-XV	07
16	Hydraulic test	Chapter-XVI	05
17	Testing & Commissioning	Chapter-XVII	10
18	Painting	Chapter-XVIII	04
19	Accounting of materials issue	Chapter-XIX	04
Vol I A	Part-II: Technical specifications		
1	Corrections / Revisions in Special Conditions of Contract, General Conditions of Contract and Forms & Procedures	Chapter-1	19
2	Welding Schedule	Chapter-2	28
3	Drawing for Mill and Bunker Building	Chapter-3	02
4	Technical Specification - BHEL	Chapter-4	58
5	TANGEDCO Specification	Chapter-5	16
6	Painting Schedule for Boiler, valves etc.,	Chapter-6	12
7	Painting schedule for APH, Fans, Gates etc	Chapter-7	19
8	Painting Schedule for Bowl mills	Chapter-8	06
9	Painting Schedule for Auxiliary Boiler	Chapter-9	11
10	Revised forms - Form 14 and Form 15	Chapter-10	15

TECHNICAL CONDITIONS OF CONTRACT (TCC)

11	Procedure 2.3 of Arbitration & Conciliation	Chapter-11	10
12	Integrity Pact	Chapter-12	06
13	Health, Safety and Environment Plan for Site Operation By Subcontractors” (Doc. No. HSEP:14 Rev 00),	Chapter-13	72
14	Hire charges on issue of capital tools & Plants (Only corresponding charges)	Chapter-14	14
15	Guidelines for Welding	Chapter-15	98
16	Guidelines for Heat treatment	Chapter-16	18
17	General Guidelines for Insulation works	Chapter-17	54
18	Proforma of Bank Guarantee for Earnest Money	Chapter-18	03

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME - IA PART – I CHAPTER – I PROJECT INFORMATION

UDANGUDI SUPERCRITICAL TPS UNITS- 1 & 2 (2 x 660 MW) is being set up by TAMILNADU GENERATION AND DISTRIBUTION CORPORATION at a site in Kallamoli village of Tiruchendur Taluk, Tuticorin District., Tamilnadu, India. The information given here in under is for general guidance and shall not be contractually binding on BHEL / Owner. All relevant site data / information as may be necessary shall have to be obtained / collected by the Bidder.

1.1	Name of the Project	Udangudi Thermal Power Station
1.2	Station Capacity	2X660 MW
1.3	Owner	Tamil Nadu Generation and distribution Corporation Limited (TANGEDCO)
1.4	Site Location	Kallamoli-628203, Thiruchendur Taluk, Tuticorin District, Tamil Nadu
1.5	Nearest Village	Udangudi
1.6	Nearest Town	Tuticorin at 41 km
1.7	Nearest Railway Station	Thiruchendur at 12 km
1.8	Nearest Airport	Tuticorin Domestic AirPort at 41 km
1.9	Nearest Seaport	Tuticorin Port at 45 km
	Nearest Road access	ECR Connecting Tuticorin and Kanyakumari – state highway -176
2.0	Meteorological Condition	
2.1	Climate	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
2.2	Site Elevation	(+)varying from +0.6m to 2.8Meter above Mean Sea Level
2.3	Ambient Temperature	
a.	Annual Maximum Mean Temperature	41°C
b.	Annual Minimum Mean Temperature	22.3°C
c.	Dry bulb Temperature(DBT) for Design Purpose	Max 41°C & Min 17°C
2.4	Relative Humidity for Design purpose	Max 84% & Min 62%
2.5	Annual Rainfall	Max 718.2mm & Min 384.4mm

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.6	Basic Design Wind Pressure	Design wind speed is 39 m/sec as per IS: 875 Part III Mean Wind Speed (max): 20.6 km/h as per IS: 875 (Latest Edition)
2.7	Seismic zone	Zone: II as defined in IS:1893-2002
2.8	High Flood Level	High Flood Level for site: RL 2.450 m
3.0	<u>Tide Levels</u> The recorded tide levels with respect to the chart Datum (CD) near the identified intake point are as follows:	
	Mean high water- Spring	CD + 0.99 m
	Mean high water- Neap	CD + 0.71 m
	Mean low water- Neap	CD + 0.55 m
	Mean low water- Spring	CD + 0.29 m
	Mean sea level	CD + 0.64 m
	Highest High tide level	CD + 1.026 m
	Lowest Low tide level	CD + 0.11 m

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.2.1 The work to be carried out under the scope of these specifications is broadly as under:

PACKAGE A:

Handling of Materials at BHEL/ Client's Stores/ Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation including supply and application of insulation, refractory, supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, ESP, Gates, Duct support structures, structure for bunker, fans, bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, Auxiliary boiler & Auxiliaries and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 1 of 2x660 MW Udangudi STPP, Tuticorin District, Tamil Nadu

PACKAGE B:

Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection, Erection, Testing & Assistance for commissioning and Trial Operation including supply and application of insulation, refractory, supply & application of final Painting etc. of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, ESP, Gates, Duct support structures, Structure for bunker, Fans, Bowl mills, Rotation Equipment's, Fuel Oil System auxiliaries, and their insulation, etc. and Detailed Engineering, Fabrication, Erection of Bunker including initial and final painting along with supply & installation of items as per BOQ of Unit 2 of 2x660 MW Udangudi STPP, Tuticorin District, Tamil Nadu

- 1.2.2 The work to be carried out at quoted / accepted rates by the Contractor under the scope of these specifications covers the complete work of handling, loading and transporting of materials from project stores sheds / storage yards to site of erection or preassembly yard and unloading at pre-assembly area/erection site, checking, cleaning chipping and leveling of foundations, providing packers and shims/pre-assembling of equipment at the pre-assembly yard, inspection, minor rectification, preservation, erection, leveling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/ MPI/ UT testing wherever needed, heat treatment based on the customer approved erection welding schedule, carrying out air

TECHNICAL CONDITIONS OF CONTRACT (TCC)

tightness test by soap solution / kerosene, hydraulic test, steam / air blowing, light up, chemical cleaning, passivation, steam blowing and safety valve floating including inter connection of all the termination points, erection and dismantling of all temporary piping, valves, pumps, tanks etc., required for the above operations, all pre-commissioning tests and trial runs of the Boiler & Aux, Rotating Equipments, ESP including supply and application of final painting.

- 1.2.3 The quantities indicated in the tender specification are approximate and are liable for variation and alteration at the discretion of BHEL. The quoted unit rate shall be applicable for any additional product group also, if included at a later date integral to the main scope of work / package envisaged. The work executed shall be measured and priced as per the unit rate arrived at for each work area as mentioned in the relevant clauses.
- 1.2.4 The PG wise breakup of Boiler and Auxiliaries, rotating machinery, ESP etc. are indicated in the relevant chapters of this tender specification, but the contractor is required to erect actual tonnage which may be necessary to complete the work in all respects as detailed in the tender specifications, for which payments shall be released on finally settled rates. The weights and dimensions of material shown are approximate and are liable to vary. No increase in quoted / accepted rates / prices shall be allowed due to change in weights and dimensions of the equipment / materials.
- 1.2.5 **The weights given in the Volume-II (Price Bid) are approximate and these are subject to change as per site conditions.**
- 1.2.6 During the course of execution of work, certain rework / modification / rectification / repairs / fabrication etc. will be necessary on account of feedback from various relevant source, and also on account of design discrepancies/ alterations, manufacturing defects, site operations/ maintenance requirements. Contractor shall carry out such rework / modification / rectification / fabrication / repairs etc. promptly and expeditiously. Daily log sheets indicating the details of work carried out, man-hours etc. shall be maintained by the contractor and got signed by BHEL engineer every day. Claims of contractor, if any, for such works will be dealt as per conditions of contract and payments will be released as per the agreed rates.
- 1.2.7 Supervisors / Engineers, T&Ps, consumables etc., required for the scope of work shall be provided by the contractor. All the expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor's quoted rates should be inclusive of all such contingencies.
- 1.2.8 It shall be specially noted that the contractor's labour and staff may have to work round the clock to meet the completion schedules / plans, which may

TECHNICAL CONDITIONS OF CONTRACT (TCC)

involve payment of considerable overtime. The contractor's quoted rates should be inclusive of all such contingencies.

- 1.2.9 The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained / decided by BHEL and that is final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals. Carrying out work as per the specification between equipment constituting terminal points, whether the terminal equipment fall within the scope of work/specification, contractor shall carry out the terminal joints at either end. Also where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. In case piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end, by suitably resorting to heat correction or other method as instructed by BHEL Engineer, with in the quoted rate.
- 1.2.10 The contractor shall submit a copy of license to undertake construction / repair of Boilers & Piping issued by Boiler inspectorate before commencement of Pressure Parts / Piping Erection.
- 1.2.11 The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.
- 1.2.12 The work covered under this specification is of highly sophisticated nature requiring the best quality of workmanship, engineering and construction management. The contractor should ensure timely completion of the work. The contractor must have the adequate quantity of tools, construction aids, equipment, etc., in his possession. He must also on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.
- 1.2.13 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals for boiler pressure parts, structures etc., which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any failure to comply with the above might lead to rework and the cost for the same shall be borne by the contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.

- 1.2.14 Contractor has to work in close co-ordination with other erection agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the milestone events like boiler light up, steam blowing, SV Floating etc., are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.
- 1.2.15 No member of the already erected structure / platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 1.2.16 The storage yard is located within the plant boundary. ODC consignments will be unloaded near to erection site. Some other materials may also be unloaded near to erection site as per space availability. All other materials have to be transported from storage yard to construction area by the contractor at his own cost.
- 1.2.17 **Painting:** The scope of work shall include supply and application of final painting for all the components under the scope of work.

1.2.18 For Fabrication and Erection of Bunker Structures

- 1.2.18.1 The works to be performed under this contract consist of providing all labour, supervision, material as indicated in BOQ / Price bid, scaffolding, construction equipment's, tools and plants, temporary works, supplies including POL (Petrol, Oil & Lubricants), transportation and all incidental items not shown or specified but reasonably implied or necessary for the proper completion of work in all respects. Testing of all materials, preparation of fabrication drawings etc. are included on the rates of items of work. Works shall only be carried out with approved structural fabrication drawings. Steel required for fabrication will be provided by BHEL free of cost.
- 1.2.18.2 Only basic structural drawing will be provided to the contractor by BHEL. Contractor shall prepare detailed engineering structural and fabrication drawings and get approval from BHEL before fabrication and erection of the same respectively. The cost of preparation of the drawings shall be within the quoted rates of the contract
- 1.2.18.3 All the works areas shall be adequately flood lighted to the satisfaction of the Engineer-in-Charge when the work is in progress during the night shifts.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.2.18.4 The unit rates shall include all material equipment, fixtures, labour, construction T&Ps, temporary works and everything whether of permanent or temporary nature necessary for the completion of job in all respects.
- 1.2.18.5 The unit rates quoted for various items of Rate Schedule shall include all the stipulations mentioned in technical specifications and nothing extra over Rate Schedule rates shall be payable.
- 1.2.18.6 Drawings showing enough details for the construction as per the specification shall be furnished to the contractor in a phased manner.
- 1.2.18.7 The bidder should fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, local conditions, soil strata and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may have not been specifically brought out in the specifications.

1.2.18.8 Painting:

The scope of work shall include supply and application of initial & final painting for all the components under the scope of work.

Note:

FOR FURTHER DETAILED SCOPE OF WORKS, REFER RELEVANT CHAPTERS IN THIS BOOK

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

Sl. No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1	PART I			
1.3.1.1	ESTABLISHMENT			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
1.3.1.1.1.1	Open space for office	Yes		Free
1.3.1.1.1.2	Open space for storage	Yes		Free
1.3.1.1.1.3	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
1.3.1.1.1.4	Bidder's all office equipment, office / store / canteen consumables		Yes	
1.3.1.1.1.5	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
1.3.1.1.1.6	Firefighting equipment like buckets, extinguishers etc.		Yes	
1.3.1.1.1.7	Fencing of storage area, office, canteen etc. of the bidder		Yes	
1.3.1.1.2	FOR LIVING PURPOSES OF THE BIDDER			
1.3.1.1.2.1	Open space		Yes	
1.3.1.1.2.2	Living accommodation		Yes	
1.3.1.2	ELECTRICITY			
1.3.1.2.1	Electricity of Voltage 415 / 440 V For construction purposes			
1.3.1.2.1.1	Single point source	Yes		Chargeable. Refer clause 1.3.4
1.3.1.2.1.2	Further distribution for the work to be done which include supply of materials and execution		Yes	
1.3.1.2.2	Electricity for the office, stores, canteen etc. of the bidder which include:		Yes	
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.2.4	Demobilization of the facilities after completion of works		Yes	
1.3.1.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc. on the above lines.(in case BHEL provides this facility, the scope should be given without ambiguity)		Yes	
1.3.1.3	WATER SUPPLY			
1.3.1.3.1	For construction purposes:			
1.3.1.3.1.1	Making the water available at single point		Yes	
1.3.1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc.			
1.3.1.3.2.1	Making the water available at single point		Yes	
1.3.1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4	LIGHTING			
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site / area		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.5	COMMUNICATION FACILITIES for site operations of the bidder	-		
1.3.1.5.1	Telephone, Fax, internet, intranet, email etc.		Yes	
1.3.1.6	COMPRESSED AIR SUPPLY			
1.3.1.6.1	Supply of Compressor and all other equipment required for compressor & compressed air system including pipes, valves, storage systems etc.	-	Yes	
1.3.1.6.2	Installation of above system and operation & maintenance of the same	-	Yes	
1.3.1.6.3	Supply of the all the consumables for the above system during the contract period		Yes	

Sl. No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
	PART II			
	CONSTRUCTION FACILITIES			
1.3.2.1.0	Engineering works for construction			
1.3.2.1.1	Providing the construction drawings for all the equipments covered under this scope	Yes		
1.3.2.1.2	Drawings for construction methods		Yes	In consultation with BHEL
1.3.2.1.3	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	"
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes	Yes	"
1.3.2.1.5	Preparation of site construction schedules and other input requirements		Yes	"
1.3.2.1.6	Review of performance and revision of site construction schedules in order to achieve the end dates and other commitments		Yes	
1.3.2.1.7	Weekly construction schedules based on Sl. No 1.3.2.1.5		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
	PART II			
1.3.2.1.8	Daily construction / work plan based on Sl. No 1.3. 2.1.7		Yes	For daily monitoring meeting at site
1.3.2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works is completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
1.3.2.1.10	Preparation of preassembly bay		Yes	
1.3.2.1.11	Laying of racks for gantry crane if provided by BHEL or brought by the contractor / bidder himself			Not applicable

1.3.3 Open Space:

- 1.3.3.1 Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, fabrication yard and storage area at the job site, contractor's stores shed(s).
- 1.3.3.2 Any development of fabrication yard, storage area, etc. shall be done by the contractor within the quoted rates of the contract.
- 1.3.3.3 Location and area requirement for office/storage sheds/ fabrication yard shall be discussed and mutually agreed to.
- 1.3.3.4 BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements. Contractor has to make his own arrangements for labour colony.

1.3.4 ELECTRICITY:

- 1.3.4.1 Construction power will be provided to the contractor at one point within plant area by BHEL on chargeable basis at the applicable rate of TANGEDCO under LT tariff VI at the nearest substation. The present LT tariff VI rate of TANGEDCO is

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

The TANGEDCO tariff and tax may vary from time to time. The required Energy meter for measuring the consumption shall be provided and installed by the contractor. Any dispute regarding consumption, the BHEL engineer's

TECHNICAL CONDITIONS OF CONTRACT (TCC)

decision is final. The contractor shall make his own arrangement for further distribution with necessary isolator / LCB etc.

- 1.3.4.2 The required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the contractor.
- 1.3.4.3 Provision of distribution of electrical power from the given single common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.
- 1.3.4.4 Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
- 1.3.4.5 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.
- 1.3.4.6 Contractor has to make his own arrangements for his electricity requirement for his labour colony at his cost.
- 1.3.4.7 BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.
- 1.3.4.8 **POSSESSION OF GENERATORS**

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

1.3.5 **CONSTRUCTION WATER / SERVICE WATER**

The contractor shall make his own arrangements of **water suitable for construction purpose** to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Water required for curing of the grout shall be under the scope of the contractor. Potable water used for curing as per IS 456.

1.3.6 DRINKING WATER

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

1.3.7 Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

1.3.8 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM (SCMS):

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

1.3.9 CONSUMABLES:

1.3.9.1 Such of those consumables as indicated as consumables provided by BHEL alone will be provided to the contractor by BHEL free of charge for erection activities. Other required consumables like electrodes, all gases, and other materials for this scope of work are to be arranged by the contractor at their cost.

1.3.9.2 All the required electrodes (in his scope) as approved by BHEL shall be arranged by contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.

1.3.9.3 Only TIG welding wires for CS, AS & SS welding will be supplied by BHEL free of cost for Boiler for applicable Pressure Parts as provided by manufacturing units. All other electrodes including stainless steel electrodes required for shall be arranged by the contractor at his cost. However, BHEL will provide imported electrodes as provided by manufacturing units. The bidder shall use the Customer approved quality welding electrodes only. The utilization of the TIG welding wires issued by BHEL shall be duly accounted for exercising maximum care and ensuring economical usage for minimum wastage. If during erection, it is found that the consumption of filler wire is more than the actual requirement due to improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor.

1.3.9.4 The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless

TECHNICAL CONDITIONS OF CONTRACT (TCC)

steel), all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding and pre-assembly materials, hardware items etc. required for temporary works such as supports, scaffoldings, bed are to be arranged by him. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by him.

1.3.9.5 All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

1.3.10 MATERIAL SUPPLY:

BHEL will supply the materials / equipment indicated in the weight schedule from their respective manufacturing units which are to be executed / incorporated in the permanent system. In addition, the material such as lube oil, grease required for commissioning the erected equipment and chemicals required for chemical cleaning of equipment will be supplied free of cost by BHEL. The structural steel required for fabrication of bunker shell will be provided free of cost by BHEL.

1.3.11 LIGHTING FACILITY:

Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, pre assembly yard and contractor's material storage area etc. at his cost.

1.3.12 GASES:

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

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.3.13 ELECTRODES SUPPLY AND STORAGE

- 1.3.13.1 The bidder shall use the BHEL / Customer approved quality welding electrodes only.
- 1.3.13.2 It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
- 1.3.13.3 Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate.
- 1.3.13.4 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.
- 1.3.13.5 All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at his cost.
- 1.3.13.6 In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's first subsequent bills at market value plus departmental charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.
- 1.3.13.7 BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at his cost without loss of time.

1.3.14 OTHER FACILITIES

Adequate water less urinals (at least 2 No.s per level) and toilets (at least 2 No.s) shall be arranged by the contractor within quoted rates, at site of construction at different level, with proper disposal arrangement

1.3.15 BID DRAWINGS

Bid drawings published in this tender specification are for information and this may get revised during execution.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – IV

T&Ps and MMEs TO BE DEPLOYED BY CONTRACTOR FOR EACH PACKAGE

- 1.4.1 The following minimum major Tools & Plants (T&P) shall be arranged by the Contractor for execution of items mentioned in Chapter IX of Technical Conditions of Contract of this tender within the quoted rate.

Sl. No	Description	Quantity Package A	Quantity Package B
1.	70 / 75 MT Crawler crane First crane to be made available at site from the start of work till the actual event of Boiler Hydro Test (Drainable) Second crane - from 3rd month from the start of work till the completion of all ducting, handling system, Rotating equipment, etc.	Minimum 2 No.	Minimum 2 No.
2.	40 T Crane The crane shall be made available at site from commencement of work till completion of all ducting & the actual event of full load	Minimum 1 No.	Minimum 1 No.
3.	Pick and carry crane (Capacity of minimum 10 MT) from the commencement of work	As required (minimum 4 Nos)	As required (minimum 4 Nos)
4.	Tractor Trailer 60T / 30T from the commencement of work	Minimum 1 no. each of 60T and 30T	Minimum 1 no. each of 60T and 30T
5.	DG set-250 kVA (Stand by for P91welding)	1 No.	1 No.
6.	Tube Expander (For Aux Boiler only)	1 No.	-
7.	Boiler furnace inside maintenance platform (Sky climber make or equivalent)	2 Nos	2 Nos
8.	Resistance Heating Based Local Pre/Post WHT Equipment with Flexible Ceramic Pad	As Required	As Required
9.	Ultrasonic hardness testing machine (Ultrasonic contact impedance (UCI))	1 No.	1 No.
10.	Ultrasonic Flaw detector with recording facility for Boiler & Bunker works	As required	As required
11.	Passenger cum Goods Lift – Capacity 1 MT	01 No.	01 No.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Note: The age of the contractor deployed cranes upto 150 MT should be within 15 years as on date of deployment. Contractor has to provide documentary proof for the age of the crane at the time of deployment to the BHEL Engineer. Fitness certificate from a third party and the crane load test has to be conducted as per statutory guidelines.

- 1.4.2 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. Besides the T&P mentioned in section "T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS", which is being made available to the contractor on free of hire charges, any additional crane and other T & P which may be required for successful and timely execution of the work, covered within the scope of this tender shall be arranged by the contractor at his cost. In case if the contractor fails to provide such equipment, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary even during contract period.
- 1.4.3 T&Ps mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity / numbers as mutually agreed at site for major T&Ps, have to be adhered to. Numbers / time of requirement of T&Ps will be reviewed time to time by BHEL site and contractor will provide required T&Ps / equipments to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation and certification regarding capacity etc. prior to dispatch of heavy equipments. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P's during the contract period will be mutually agreed in line with construction requirement.
- 1.4.4 The contractor shall arrange operator, diesel, petrol and other consumables required for the tools and plants, equipment etc. Preventive and routine maintenance of T & P are also to be arranged by the contractor at his cost without any delay. Required number of experienced mechanics and helpers for routine maintenance of the above cranes shall be provided by the contractor within his quoted rate.
- 1.4.5 In the event of need of change of type of any of major T&Ps, approval shall be taken from BHEL Engineer in-charge prior to mobilization. The decision of number of T&P required due to replacing the enlisted T&P as per above table, shall be taken after analysing the production capacity and suitability of both the T&Ps.
- 1.4.6 In the eventuality of contractor not deploying cranes / abnormal down time of cranes in his scope during the period specified above, and BHEL arranges for

TECHNICAL CONDITIONS OF CONTRACT (TCC)

the same (either BHEL's own cranes / hired cranes), **prevailing BHEL Corporate Crane hire charges (may vary from time to time) shall be recovered from the contractor's running bills.** Corresponding pages of Corporate Crane hire charges are published in chapter 14 of part II of Technical Conditions of Contract (Volume-I Book-I). (Please note that these charges are as valid up to **May 31, 2021** and may get revised further).

- 1.4.7 For loading and transportation, all necessary T&P such as Trailers, Cranes, Winches, slings, jacks, sleepers, rails etc., are to be arranged by the contractor.
- 1.4.8 For transportation, material handling, loading & unloading of heavier components / equipment like Ceiling girders, large dia. pipes etc., the contractor has to make his own arrangements at his own cost. BHEL will not provide any crane / T & Ps for unloading the above components.
- 1.4.9 The contractor has to furnish a list of Tools and plants including cranes / tractors / trailers / trucks etc. which he has proposed to deploy for this work.
- 1.4.10 CRANE OPERATOR
 - 1.4.10.1 Must be capable of independently operating Hydraulic / Mechanical Crawler / Tyre mounted Cranes of respective categories.
 - 1.4.10.2 Must have minimum 2 years' experience in Operation of Hydraulic / Mechanical Crawler / Tyre Mounted Cranes in respective categories & hold valid HMV / TRANS license. Should be able to read and interpret the operation and maintenance manual, boom load chart, boom angle and other indicating devices.
 - 1.4.10.3 Operator shall have latest Physician's certification for their physical fitness in vision with / without Lenses & adequate hearing with or without hearing aid.
 - 1.4.10.4 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.4.11 Pre-Assembly Yard area shall be allotted by the customer. Due to constraint in area of land available for storage / pre-fabrication, available area of land shall be allotted for pre-fabrication amongst the contractors. Approach road from Pre-Assembly yard to the erection area will be under the scope of the contractor. Supply of Bed materials such as Beam, Channel, Angles & flats for Pre-Fabrication shall be under the scope of the contractor.
- 1.4.12 The contractor has to erect the passenger cum goods lift (temporary lift), as per instruction of BHEL Engineer. Civil Foundations for the passenger cum goods lift (temporary lift) shall be made ready by the contractor. Necessary grouting including supply of grout materials are in the scope of the contractor. The contractor has to arrange operators, technicians for round the clock

TECHNICAL CONDITIONS OF CONTRACT (TCC)

operation and maintenance is to be carried out by the contractor at his cost. The operation and maintenance shall be carried out till the end of contract period, or the date on which the lift is dismantled as per the directives of BHEL, whichever is earlier.

1.4.13 The contractor has to arrange for all the necessary T&Ps but not limited to Plate Bending machine, Blast cleaning equipment with closed shed, painting equipment with all accessories, Ultra sonic testing machine with recording facility for carrying out fabrication & erection of bunker.

1.4.14 FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P91 WELDING

1.4.14.1 Required number of operators / Technicians / Electrician for installation, commissioning & operating continuously.

1.4.14.2 Gas Burners arrangement with required gas for maintaining temperature in the event of power failure.

1.4.14.3 Ultrasonic Flaw detector with recording device & complete accessories (Digital Type – Krautkramer Model USN 50 or equivalent) capable of storing calibration data. All recordable indications will be stored in memory of digital flaw detector and in PC (to be provided by the contractor) for review at later period.

1.4.14.4 GE or Kraut Kramer or Microdur make or reputed branded ultrasonic hardness testing machine {Ultrasonic contact Impedance(UCI)}

1.4.14.5 Only one set of annealing cables will be provided by BHEL. Additional annealing cables required, if any, till total work completion, shall be procured by the contractor, at his cost.

1.4.14.6 Spot welding machine to weld the thermocouple to be arranged by contractor within quoted rate.

1.4.14.7 Compensating Cables shall be arranged by contractor within quoted rate.

1.4.14.8 The contractor shall provide necessary cables & switches, fuel and operator.

1.4.14.9 MPI / LPI kits with required consumables.

1.4.14.10 Consumables:

- Glass fibre cloth – 1mm x 1000mm – Temp rating – 1260 °C.
- Glass fibre cord – Dia 3mm (twisted) Temp rating – 1260 °C.
- Ceramic fibre Blanket – RT Grade, density 96kg/m³ - Temperature rating – 1260 °C.
- Ceramic fibre rope – Fibre Glass braided, Dia 12mm - Temperature rating – 1260 °C.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated.
- Heavy duty TC connectors for - K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated.
- All other consumables / equipment required to carry out the work.

1.4.15 Also refer following clauses published in Technical conditions of Contract Volume IA (Volume I Book I):

1.4.15.1 Clause no 1.3.8 on SCMS in chapter III.

1.4.15.2 Clause no 1.5.4 on steel plates for crane movement in chapter V.

1.4.15.3 Clause no 1.5.7 on replacement of spares for BHEL's T & P in chapter V.

1.4.15.4 Clause no 1.5.15 on Facility to be provided by BHEL for P91 in chapter V.

1.4.15.5 Relevant clauses in Volume 1A -Special Conditions of Contract (SCC) shall also be referred.

Note to Chapter –IV:

- i) The induction heating equipment and other equipment shall be drawn from BHEL stores, transported and installed & commissioned wherever required. For routine maintenance & attending all type of break-down maintenance, contractor shall deploy sufficient manpower, tools and plant within the quoted rate.
- ii) The contractor shall provide electrical cables & switches required for extending power supply to the induction heating equipment. All the equipment shall be protected by providing covers or sheds at site by the contractor with in the quoted rate.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - V

T&Ps & MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

- 1.5.1 List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis for execution of those items within the scope of work of this Tender are as below:

Sl. No	Description	Quantity per package
1	Cranes above 150 MT (On sharing basis)	As decided by BHEL
2	150/135 MT Crane	1 No.
3	Hydraulic Pressure Testing Pump with accessories	As Required
4	Chemical Cleaning Pumps with Motor	As Required
5	Boiler fill pump	As Required
6	Induction Heating Machine	As Required
7	Air Blower for Air Leak Test	As Required
8	Huck bolting machine	As required
9	Venturimeter	1 No.

- 1.5.2 All the T&Ps mentioned in clause 1.5.1 above shall be given to contractor on sharable basis and the allotment is made by BHEL on need basis.
- 1.5.3 BHEL will provide cranes only for materials whose weight cannot be lifted with 70 / 75MT Crane to the required height.
- 1.5.4 Levelled ground in Boiler area will be provided by BHEL for the cranes. Consolidation of the ground, if required for placing crane for operation shall be done by the contractor, at his cost. Necessary plates / sleepers required for marching operation shall also be provided by the contractor within quoted rates. **REQUIRED NUMBERS OF MILD STEEL PLATES OF 40 MM THICK AND 12 METRE LENGTH X 3 METRE WIDTH (AROUND 6 NUMBERS) FOR THE ABOVE PURPOSE IS TO BE ARRANGED BY CONTRACTOR WITHIN HIS QUOTED RATE.**
- 1.5.5 BHEL may provide either owned cranes or hired cranes at their discretion. BHEL shall provide operators, free of charges for the owned cranes and hired cranes.
- 1.5.5.1 In the event of providing BHEL owned Cranes:
- 1.5.5.1.1 Fuel and lubricants are to be arranged by the contractor within the quoted rate.
- 1.5.5.1.2 Tentative List of consumables required to be provided by contractor within the quoted rate, is as below:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1. Engine Oil 15 W 40
2. Fuel Filters
3. Air Filters
4. Hydraulic Filters
5. Hydraulic Oil –Servo 68
6. Gear Oil- Servo 90
7. Engine oil Filter
8. Oil Separator Filter
9. Rope- CRG 100 Grease
10. Grease - Servo Multi-Purpose Grease

1.5.5.1.3 Maintenance for the BHEL crane shall be carried out by BHEL. Bidder shall extend man power support (if required) required for routine maintenance works.

1.5.5.2 In the event of providing hired cranes:

1.5.5.2.1 Fuel for cranes is to be arranged by the contractor within the quoted rate.

1.5.6 Cranes are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.

1.5.7 The day-to-day and routine maintenance including replacement of spares for the BHEL T&Ps (excepting cranes) will be carried out by the contractor at his own cost. However, BHEL shall supply spare parts free of charges for normal wear and tear only. Contractor shall provide required manpower assistance as per the instruction of BHEL Engineer for carrying out the above works.

1.5.8 All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at his cost.

1.5.9 The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.

1.5.10 Any loss / damage to any or part of the BHEL T&Ps by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.

1.5.11 Water required for curing of the grout shall be under the scope of the contractor. Potable water used for curing as per IS 456.

1.5.12 Filling pump for other than main boiler, for hydro test shall be arranged by the contractor, if required. For testing LP lines, necessary Hydraulic Test Pumps / Hand pumps are to be arranged by the contractor.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.5.13 In case of non-availability of these equipment, due to any reason i.e., unavoidable breakdown, major overhaul or any other reason etc., the contractor should make arrangement at his own cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.
- 1.5.14 BHEL will provide Huck bolting machine with one set of 12mm and 16mm jaws. Further requirement of jaws to be arranged by the contractor at his cost. Consumables like O-ring, backup ring, springs, hydraulic fluid for top-up etc., required for maintenance of the huckbolting machine to be arranged by contractor at his cost
- 1.5.15 **FACILITY TO BE PROVIDED BY BHEL FOR P91 Welding.**
- 1.5.15.1 Induction Heating machine.
- Note: (1) The induction heating equipment and other equipment shall be drawn from BHEL stores, transported and installed & commissioned wherever required. For routine maintenance & attending all type of break-down maintenance, contractor shall deploy sufficient manpower, tools and plant within the quoted rate.
- (2) The contractor shall provide electrical cables & switches required for extending power supply to the induction heating equipment. All the equipment shall be protected by providing covers or sheds at site by the contractor with in the quoted rate.
- 1.5.15.2 Only one set of annealing cable shall be provided by BHEL. Additional annealing cables required, if any, till total work completion, shall be procured by the contractor, at his cost.
- 1.5.15.3 Welding Electrodes for P91 welding
- 1.5.15.4 Filler wires supplied in PG MA / Packages by BHEL Manufacturing Units will be issued.

VOLUME-IA PART-I CHAPTER - VI
TIME SCHEDULE FOR EACH PACKAGE

1.6.1. TIME SCHEDULE

- 1.6.1.1. The entire work of Boiler and auxiliaries, rotating machines, ESP, Ducts & Dampers, Duct supporting structures, fabrication, erection of Bunkers along with supply of items as per BOQ and completion of painting & insulation as detailed in the Tender Specification shall be completed within **25 (twenty five) months** from the date of commencement of work at site.
- 1.6.1.2. During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events. The work fronts for construction will get released progressively during the course of execution at site. The required documents / drawings for construction will be progressively issued to the contractor during the course of execution at site
- 1.6.1.3. The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.
- 1.6.1.4. The contractor is required to refer "Form 15: Monthly Performance Evaluation of Contractor" for all the instructions to be taken immediately after receipt of LOI. Please note that the Form -15 in the Volume 1D - Forms and Procedures is revised. For details please refer Sl. No.17 of Part-II, Chapter-1 of Technical Conditions of Contract (VOLUME-IA PART- II) of this booklet

1.6.2. COMMENCEMENT OF CONTRACT PERIOD

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

1.6.4. MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING ETC.,

- 1.6.4.1. The activities for erection, testing etc. shall be started as per directions of Construction manager of BHEL.
- 1.6.4.2. The contractor has to augment his resources in such a manner that following major milestones of erection & commissioning are achieved on specified schedules:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

FOR PACKAGE A & PACKAGE B

Milestone Activity	Milestone Month (Tentative)
Start of Erection (Tentative)	June 2019 (First month)
Completion of Ceiling Girder Erection, Roof structure, Silencer Erection and all approach Platforms of Ceiling Girder	6 th Month
Boiler Hydro Test (Drainable)	16 th Month
Boiler Light Up	20 th Month
Synchronization (with Coal)	22 nd Month
Trial Operation	23 th Month
Completion of contractual obligation	25 th Month

In order to meet the schedule in general, and any other intermediate targets set, to meet customer / project schedule requirements, Contractor shall arrange and augment all necessary resources from time to time on the instructions of BHEL Engineer.

Intermediate Milestones:

M1 and M2 shall be the intermediate milestones for this work.

Sl. No	Description	Completion from the contractual date of start of the work at site	Intermediate Milestone
1	Boiler Hydro Test (Drainable)	16 th Month	M1
2	Synchronization (with Coal)	22 nd Month	M2

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

1.6.4 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **25 (Twenty Five) months** from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier for completion of the entire work.

1.6.5 GUARANTEE PERIOD

The guarantee period of 24 (**Twenty Four**) months for workmanship shall commence from the date of handing over of Unit to Customer or 6 (six) months from the date of floating of all safety valves, whichever is earlier (Provided all erection, testing, and commissioning works are completed in all respects).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - VII

TERMS OF PAYMENT

(Applicable for Package A and Package B)

1.7 Terms of payment:

The progressive payment for erection, testing and commissioning on accepted price / rates of contract value will be released as mentioned below in Cl 1.7.1 to 1.7.5

1.7.1 Progressive Payment against monthly running bills will be made upto 85 % of the value of the erected tonnage (boiler and Rotating machines except Air Preheater and bunkers) Pro-rata as per Cl no 1.7.1.1 to 1.7.1.19 of the following table.

Cl. No	Contract (Main Package) Identification -->	BOILER			Rot. M/c	ESP		Refractory & Insulation (1.8, 1.9, 1.10, 1.11)
	Rate schedule Identification→	Structures (1.1)	Pr. Parts (1.2)	Non Pr. Parts (Boiler outlet funnel to ESP) (1.3)	Rot. M/c & Handling Eqpts. (1.4 & 1.5)	ESP (1.6)	Non Pr. Parts (ESP outlet funnel to Chimney) (1.7)	
	PRO RATA PAYMENTS (85%)							
1.7.1.1	On pre-assembly wherever applicable (if not applicable, this portion shall be clubbed with placement in position)	20%	20%	25%	15%	15%	15%	--
1.7.1.2	Placement in position	15%	10%	10%	20%	20%	10%	50%
1.7.1.3	Alignment	15%	15%	10%	20%	15%	15%	15%
1.7.1.4	Welding / Bolting / Fixing	15%	20%	15%	20%	20%	30%	20%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Cl. No	Contract (Main Package) Identification -->	BOILER			Rot. M/c	ESP		Refractory & Insulation (1.8, 1.9, 1.10, 1.11)
	Rate schedule Identification-->	Structures (1.1)	Pr. Parts (1.2)	Non Pr. Parts (Boiler outlet funnel to ESP) (1.3)	Rot. M/c & Handling Eqpts. (1.4 & 1.5)	ESP (1.6)	Non Pr. Parts (ESP outlet funnel to Chimney) (1.7)	
1.7.1.5	Completion of non-destructive examination & stress relieving / heat treatment (if not applicable, then this portion to be paid along with welding)	5%	10%	-	-			
1.7.1.6	Completion of attachment welding, fin welding, supports	-	5%	-	-			
1.7.1.7	Completion of roof skin casing	-	5%	-	-			
1.7.1.8	Installation of temporary piping	-	-	-	-			
1.7.1.9	Dismantling of temporary piping, edge preparation and return to BHEL stores, area cleaning	-	-	-	-			
1.7.1.10	Hangers & supports etc. wherever necessary as per drawing	-	-	25%	-		15%	
1.7.1.11	Completion of furnace alignment and fire ball checking	5%	-	-	-			
1.7.1.12	Completion of back pass alignment	5%	-	-	-			
1.7.1.13	Completion of vibration snubbers, mechanical spacers, cassette baffles, steam cooled spacers	5%	-	-	-			
1.7.1.14	Completion of hoppers along with all doors, heating elements, poking doors, etc		--	--	--	5%	--	--

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Cl. No	Contract (Main Package) Identification -->	BOILER			Rot. M/c	ESP		Refractory & Insulation (1.8, 1.9, 1.10, 1.11)
	Rate schedule Identification→	Structures (1.1)	Pr. Parts (1.2)	Non Pr. Parts (Boiler outlet funnel to ESP) (1.3)	Rot. M/c & Handling Eqpts. (1.4 & 1.5)	ESP (1.6)	Non Pr. Parts (ESP outlet funnel to Chimney) (1.7)	
1.7.1.15	Completion of inner, outer roof insulator housing, rectifier transformers, pent house mono rails, hoists etc		--	--	--	5%	--	--
1.7.1.16	Erection of emitting and collecting rapping system with all drives		--	--	--	5%	--	
1.7.1.17	Equipment trial operation	-	-	-	10%			
1.7.1.18	Hydraulic test or pneumatic test	-	-	-	-			
1.7.1.19	Floating of lines, final adjustment of supports for cold and hot values (if not applicable, this portion to be clubbed along with hydraulic test / pneumatic test)	-	-	-	-			
	Total for pro rata payments (Total 85%)	85%	85%	85%	85%	85%	85%	85%

1.7.2 Progressive Payment against monthly running bills for **air pre heater** will be made up to 85 % of the value of the erected tonnage Pro-rata as per Cl no 1.7.2.1 to 1.7.2.8 of the following table.

Cl. No	AIR PRE HEATERS (PG 52) From the total amount payable for the erected PGMA weight at tonnage rates, payment will be regulated as under:	Rate Schedule Id.No. (1.2)
1.7.2.1	Completion of Support steel squareness and levelling, Expansion arrangement, Housing panel erection and alignment, Erection, alignment and welding of pedestals	11%
1.7.2.2	Completion of Erection, alignment and welding of Support Bearing, Guide Bearing, Rotor post, Bottom and Top centre	14%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

	sections, Hot and cold end connecting plates	
1.7.2.3	Completion of erection and alignment of modules	15%
1.7.2.4	Completion of erection, alignment and welding of Pin Rack assembly and Drive assembly	12%
1.7.2.5	Completion of seals setting	17%
1.7.2.6	Erection, alignment and welding of Lube oil systems, Cleaning Device, Fire sensing device, Deluge and water wash lines, Observation port and lighting assemblies and other accessories	13%
1.7.2.7	Completion of PGMA	1%
1.7.2.8	Air pre heater Trial Run	2%
	Total for pro rata payments (Total 85%)	85%

1.7.3 Further 15 % payment on pro-rata basis common to all PGs of Boiler & Bunker erection (BHEL Supplied items) shall be released on achievement of the following stage / milestones events (as per CI no 1.7.3.1 to 1.7.3.19 of the following table) for the tonnage erected.

Cl. No.	Contract (Main Package) Identification ---->	BOILER				Rotating Machine	ESP		Refractory & Insulation (1.8, 1.9, 1.10, 1.11)
	Rate schedule Identification	Structure (1.1)	Pr. Parts (1.2)	Non Pr. Parts (Boiler outlet funnel to ESP) (1.3)	Air Pre Heater (1.2)	RM & Handling Eqpt. (1.4 & 1.5)	ESP (1.6)	Non Pr. Parts (ESP funnel outlet to Chimney) (1.7)	
	Stage / Milestone Payments (15%)								
1.7.3.1	Air & Gas Tightness Test	-	-	5%	-	-	1%	5%	-
1.7.3.2	Completion of Air & Gas Tightness Test for Furnace		2%				1%	--	-
1.7.3.3	Boiler Hydraulic Test (Drainable)		2%				4%	--	
1.7.3.4	Boiler Hydraulic Test (Non Drainable)		1%						
1.7.3.5	Reheater Coils Hydraulic Test		2%						
1.7.3.6	Clean Air Flow test					1%			

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Cl. No.	Contract (Main Package) Identification ---->	BOILER				Rotating Machine	ESP		Refractory & Insulation (1.8, 1.9, 1.10, 1.11)
	Rate schedule Identification	Structure (1.1)	Pr. Parts (1.2)	Non Pr. Parts (Boiler outlet funnel to ESP) (1.3)	Air Pre Heater (1.2)	RM & Handling Eqpt. (1.4 & 1.5)	ESP (1.6)	Non Pr. Parts (ESP funnel Chimney) (1.7)	
1.7.3.7	Boiler Light Up		1%		2%	1%			1%
1.7.3.8	ABO / Chemical cleaning		1%	1%	2%	1%	--	1%	1%
1.7.3.9	Steam Blowing			2%	1%	1%	--	--	1%
1.7.3.10	Safety Valve Floating	-	2%	-	2%	-	--	--	1%
1.7.3.11	Coal Firing	-	-	2%	2%	2%	2%	2%	1%
1.7.3.12	Full Load	-	-	-	-	1%	--	--	1%
1.7.3.13	Trial Operation of Unit	-	-	-	-	2%	1%	2%	2%
1.7.3.14	Completion of sheet covering for Boiler roof, burner roof, lift shaft cladding, completion of gutters	3%	-	-	-	-			
1.7.3.15	Painting	6%		1%	1%	2%	2%	1%	
1.7.3.16	Area cleaning, temporary structures cutting / removal and return of scrap	1%	1%	1%	1%	1%	1%	1%	3%
1.7.3.17	Punch List points / pending points liquidation	2%	1%	1%	2%	1%	1%	1%	1%
1.7.3.18	Material Reconciliation	2%	1%	1%	1%	1%	1%	1%	2%
1.7.3.19	Completion of Contractual Obligation	1%	1%	1%	1%	1%	1%	1%	1%
	Total for stage / milestone payments	15%	15%	15%	15%	15%	15%	15%	15%
	TOTAL of clause 1.7.1 to 1.7.3	100%	100%	100 %	100%	100%	100%	100%	100%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.7.4 The terms of payment for **Bunker structures supplied by BHEL Tiruchy** shall be as below:

1.7.4.1 On pre-assembly wherever applicable (if not applicable, this portion shall be clubbed with placement in position)- 15 %

1.7.4.2 Placement in position - 10%

1.7.4.3 Alignment- 15%

1.7.4.4 Welding / bolting / fixing - 30%

1.7.4.5 Completion of non-destructive examination & stress relieving / heat treatment (if not applicable, then this portion to be paid along with welding)- 10%

1.7.4.6 Hangers & supports etc., Readiness of floors for concrete pouring as applicable– 5%

1.7.4.7 **Milestone payments – 15% as below:**

1.7.4.7.1 Readiness for feeding coal- 2%

1.7.4.7.2 Coal Firing - 2%

1.7.4.7.3 Painting - 6%

1.7.4.7.4 Area cleaning, temporary structures cutting / removal and return of scrap - 1%

1.7.4.7.5 Punch List points / pending points liquidation - 2%

1.7.4.7.6 Material Reconciliation - 1%

1.7.4.7.7 Completion of Contractual obligation- 1%

1.7.5 **The terms of payment for all Bunker items excepting those mentioned in clause 1.7.4 above shall be as below:**

1.7.5.1 On Completion of items - 93% of the item rate.

1.7.5.2 For this 93 %, BHEL Site Engineer, at discretion, may operate the part rate of the items depending on material supply by BHEL or Contractor, receipt of the contractor supplied materials at site, installation etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.7.5.3 5% of the item rate shall be released after submission of the quality check formats / documents as per the quality plan for the quantum of work billed and duly certified by engineer.
- 1.7.5.4 2% on completion of material reconciliation and certified by BHEL Engineer.

Notes to Terms of payment:

Note:

For PVC, ORC, RA Bill payment, compensation for Quantity variation, Retention amount and Performance Security Deposit, please refer Part-II, Chapter-1: Corrections / Revisions in Special Conditions of Contract, General Conditions of Contract and Forms & Procedures of Technical Conditions of Contract (Volume-I Book-I).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

1.8.1 Goods and service Tax (GST) & Cess

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

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

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

BHEL GSTN - 33AAACB4146P2ZL

NAME - BHARAT HEAVY ELECTRICALS LIMITED

ADDRESS - BHEL Site Office

2X660MW Udangudi Thermal Power Project

Kallamoli, Tiruchendur Taluk,

Tuticorin District., Tamilnadu-628203

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

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

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

1.8.1.7 Tax invoice / debit Note / revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.

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

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

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

1.8.2 All taxes and duty other than GST & Cess

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

1.8.3 Statutory Variations

Statutory variations are applicable under the GST Acts, against production of proof. The changes implemented by the Central / State Government during the tenure of the contract viz. increase / decrease in the rate of taxes, applicability, etc. and its impact on upward revision / downward revision are to be suitably paid/ adjusted from the date of respective variation. The bidder shall give the benefit of downward revision in favour of BHEL. No other variations shall be allowed during the tenure of the contract.

1.8.4 New Taxes / Levies –

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

1.8.5 Direct Tax

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER IX

BILL OF QUANTITY

1.9.1. Summary of Bill of Quantity (BOQ)

1.9.1.1. BOQ for Boiler & its Auxiliaries and ESP

Rate Schedule Id.	DESCRIPTION	Package A (Unit 1) Weight [MT]	Package B (Unit 2) Weight [MT]
1.1	Boiler - Structures	17,092.66	17,013.66
1.2	Boiler - Pressure Parts	11,997.78	11,855.34
1.3	Boiler - Non Pressure Parts (Upto ESP inlet funnel)	4282.27	3,957.14
1.4	Boiler - Rotating Machines	1,652.45	1,636.64
1.5	Boiler - Handling Equipment	78.91	78.91
1.6	ESP	6,764.00	6,764.00
1.7	ESP – Non Pressure parts (ESP outlet funnel to Chimney)	3,345.01	3,345.01
1.8	Insulation- Castable & Pourable Refractory	252.90	220.00
1.9	Insulation- Mineral wool mattress including acoustic insulation	1626.33	1611.43
1.10	Insulation- Fixing (Iron) components / steel enclosures etc.	228.33	221.38
1.11	Insulation- Aluminium Sheets / Sealing compound	182.36	181.03
	Sub Total (MT)	47502.98	46884.53

1.9.1.2. BOQ for Bunker

Rate Schedule Id.	DESCRIPTION	Unit of Measurement	Package A (Unit 1)	Package B (Unit 2)
2	BUNKER			
2.1	Fabrication & Erection	MT	1495	1495
2.2	Blast Cleaning	MT	1495	1495
2.3	Supply of epoxy paints & Painting	MT	1495	1495
2.4	Supply and fixing in position of permanent MS bolts	kg	100	100
2.5	Supply and fixing in positing of high strength structural bolts	kg	100	100

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Rate Sched ule Id.	DESCRIPTION	Unit of Measu rement	Package A (Unit 1)	Package B (Unit 2)
2.6	Supply, fabrication and erection SS liner of grade SS:409M	MT	100	100
2.7	Providing and fixing in position PTFE type sliding bearings			
a	20 Tons	Nos	3	3
b	25 Tons	Nos	3	3
c	40 Tons	Nos	6	6
d	50 Tons	Nos	6	6
e	60 Tons	Nos	6	6
f	100 Tons	Nos	3	3
2.8	Supply & fixing of neoprene bellows	RM	150	150

Note to clause 1.9.1.1 above:

1. The weights mentioned above are approximate and liable to vary as per design consideration. There will be change in PG, weight, description etc. However, payments will be made for the tonnage actually erected at the quoted rate. Quantity Variation will be dealt as per clause 2.14 of General Conditions of Contract (Volume I Book II).
2. Besides PG / PGMA indicated in the weight schedule, there is likelihood of addition of product groups integral to Boiler [both Main and Auxiliary], ESP and their auxiliaries. The quoted rates shall be applicable for such product groups also.
3. The erection & dismantling of temporary piping, pumps, tanks, dummy plates & other miscellaneous equipment etc. for pre-commissioning and commissioning activities like hydraulic test, chemical cleaning, oil flushing, steam blowing, gas tightness test etc. for the above scope of the contract are covered and shall be carried out as a part of work. There will not be any separate payment for this works. T
4. The Erection of HT MOTORS & HVR Transformers are covered in this scope of contract. However, dry out, testing and commissioning is not in the scope of this contract.
5. Fixing components for Insulation: The scope of work covers welding of all attachment on the pressure parts for fixing insulation & refractory.
6. The erection and dismantling of air blowers and connecting pipes and ducts, providing blanks / dummies at the required locations and conducting gas tightness test is in the scope of the contract and shall be carried out within the quoted rate.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

7. For aux. boiler, tube expansion as per the drawing is in the scope of contract. Modification / rectification of tubes before tube expansion shall be carried out by the contractor with in the quoted rate.
8. PG MA items (Item description is suffixed with Partial in BOQ) which are common between Boiler-Non Pressure Parts & ESP-Non Pressure Parts are equally divided. The items between Boiler Outlet Funnel to ESP comes under Boiler-Non Pressure Parts and the items between ESP outlet funnel and Chimney comes under ESP-Non Pressure Parts. The decision of BHEL Engineer will be final in deciding the items to be billed under the above heads. Payment will be made based on actuals at site.

9. Extra work rates for welding in Boiler and Auxiliary Boiler:

The welding joints indicated in the EWS / FWS are approximate and is liable for variation in PG, description, size, materials, NDT requirements etc., The indicated joints will be grouped into category of carbon steel (inclusive of SA106GrC or equivalent) and Alloy steel (inclusive of T91/P91) and convert them in to equated joints (Dia 63.5x6.3mm) as per the formula below:

$$\begin{aligned}\text{No of Equivated Joints} &= \text{DIA} \times \text{Thickness} / (63.5 \times 6.3) \\ &= \text{DIA} \times \text{Thickness} / 400.05\end{aligned}$$

The rate quoted for executing pressure parts shall also include welding joints. No additional payments shall be made upto 125% of equated joints over and above in each category (Carbon Steel (CS) & Alloy Steel (AS)) indicated in the tender. In case of variation in equated joints exceeds beyond 125% in each category, the quantity exceeding 125% of the tendered quantity of each category

- a) will be paid as below: One extra Equivated joints of Carbon Steel (CS) = Rs 254/-
- b) One extra Equivated Joints of Alloy Steel (AS) = Rs 561/-

Non Destructive Testing (NDT) and Stress Relieving (SR) if applicable shall be carried out by the contractor within these rates.

Please refer POWER PLANT MATERIAL SPECIFICATION LIST attached with this tender for classification of Alloy steel and carbon steel.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.9.2. BREAK UP OF BILL OF QUANTITY (BOQ)

Refer clause 1.9.2.1, 1.9.2.2, 1.9.2.3, 1.9.2.4 and 1.9.2.5 for PACKAGE A

Refer clause 1.9.2.1, 1.9.2.6, 1.9.2.7 and 1.9.2.8 for PACKAGE B

1.9.2.1. : (Common for Package A and Package B)

ST NO	Item Description	Unit of Measurement	Quantity	Rate Schedule Id.
2300	STRUCTURAL WORKS: Structural steel works including all labour, material (unless otherwise specified in BOQ / contract specification), equipments unless otherwise specified, transportation, handling etc. at all level as per specification, drawings and as directed by engineer - in - charge.			
2301	Transportation, Fabrication, erection and alignment of structural steel 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 including 2 coats of red oxide zinc-chromate primer (one coat at shop and one coat after erection), connection design & preparation of fabrication drgs, collection of steel from stores, fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, welding, electrodes and other consumables, alignment, erection bolts & nuts (weight of erection bolts, nuts and welds not payable), assembly, 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,	MT	1495	2.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ST NO	Item Description	Unit of Measurement	Quantity	Rate Schedule Id.
	production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of structures, installation of temporary structures, setting column bases, surface preparation by means of manual or mechanical power tools as per IS:1477 part 1, touch-up painting, rectification, dismantling and removal of all temporary structures (weight of temporary structures not payable), return of surplus / waste steel materials to store etc all complete. Including appointment of a separate agency, approved by BHEL, for review and approval of fabrication drgs, in consultation with BHEL (BHEL to supply steel free of cost).			
A 2302	Extra over ST NO. 2301 for blast cleaning by shot / metal blasting of steel structures to near white metal surface(Sa 2 1/2) as per SIS05-5900 and applying 2 coats of zinc silicate primer (one coat at shop and one coat after erection) instead of primer coat of red oxide zinc-chromate, including touch-up painting etc all complete as per specification.	MT	1495	2.2
A 2305	Providing and applying two coats of High built epoxy finish paint of approved brand over steel sections already having primer coats. Dry film thickness of each finish coat shall be 90 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness with primer shall not be less than 300 microns. The item includes protection, cleaning, scaffolding, touch-up painting etc. all complete as per specification.	MT	1495	2.3
2311	Providing and 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 300mm long for structural steel work etc all complete.	KG	100	2.4
2312	Providing and 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.	KG	100	2.5

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ST NO	Item Description	Unit of Measurement	Quantity	Rate Schedule Id.
A 2316	Supply, fabrication and erection of minimum 6 mm thick stainless steel liner of grade SS:409M on M.S. plate for inside surfaces cylindrical/conical portion of bunkers including 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 etc. all complete.	MT	100	2.6
2318	Providing and 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.			2.7
a	20 Tons	EACH	3	2.7.1
b	25 Tons	EACH	3	2.7.2
c	40 Tons	EACH	6	2.7.3
d	50 Tons	EACH	6	2.7.4
e	60 Tons	EACH	6	2.7.5
f	100 Tons	EACH	3	2.7.6
2319	Providing and 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.	RM	150	2.8

Note to Clause 1.9.2.1:

1. For further details, refer price bid

1.9.2.2. BOILER & AUX - UNIT 1

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
34	100	BUNKER BAY COLUMNS	663.00	1.1
34	200	BUNKER SUPPORT BEAMS	520.00	1.1
34	300	BUNKER BAY HORIZONTAL BRACINGS	22.50	1.1
34	390	Misc. Structures	171.30	1.1
34	400	Bunker Bay Horz.Beams	394.76	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
34	500	Bunker Bay Vertical Bracings	242.04	1.1
34	810	FLOOR GRILLS	6.90	1.1
34	820	STAIRS	4.70	1.1
34	850	HAND RAILS	10.80	1.1
PG 34 TOTAL			2036.00	1.1
35	010	FOUNDATION MATERIALS	33.83	1.1
35	111	Main Columns Left 1st Pass	319.16	1.1
35	112	Main Columns Left 2nd Pass	452.40	1.1
35	121	Main columns Right 1st Pass	307.50	1.1
35	122	Main Columns Right 2nd Pass	452.39	1.1
35	130	Main Columns Middle	349.48	1.1
35	140	Auxiliary Columns-Left Side	791.75	1.1
35	150	Auxiliary Columns-Rightside	650.97	1.1
35	190	GIRDER PIN CONNECTIO	20.55	1.1
35	211	CEILING STRUCTUREMAI	398.99	1.1
35	212	CEILING STRUCTUREMAI	475.70	1.1
35	213	CEIL STRUCT -CROSS W	129.65	1.1
35	214	CEIL STRUCT -CROSS W	84.23	1.1
35	221	CEILING STRUCTURE RO	49.62	1.1
35	222	CEILING STRUCTURE RO	45.68	1.1
35	231	CEILING STRUCTURE HO	66.04	1.1
35	232	CEILING STRUCTURE HO	54.05	1.1
35	311	HORIZONTAL BRACING I	28.69	1.1
35	312	HORIZ BRACING II PAS	26.05	1.1
35	321	HORIZ BRACING I PASS	22.93	1.1
35	322	HORIZ BRACING II PAS	36.02	1.1
35	331	HORIZ BRACING I PASS	34.35	1.1
35	332	HORIZ BRACING II PAS	23.97	1.1
35	341	HORIZ BRACING I PASS	62.23	1.1
35	342	HORIZ BRACING II PAS	45.48	1.1
35	351	HORIZ BRACING I PASS	28.28	1.1
35	352	HORIZ BRACING II PAS	23.61	1.1
35	361	HORIZ BRACING I PASS	35.06	1.1
35	362	HORIZ BRACING II PAS	38.96	1.1
35	381	Landing & Connecting Platforms Tier-1	67.36	1.1
35	382	Landing & Connecting Platforms Tier-2	31.73	1.1
35	383	Landing & Connecting Platforms Tier-3	107.72	1.1
35	384	Landing & Connecting Platforms Tier-4	26.33	1.1
35	385	Landing & Connecting Platforms Tier-5	27.09	1.1
35	386	Landing & Connecting Platforms Tier-6	51.96	1.1
35	387	Landing & Connecting Platforms Tier-7	42.13	1.1
35	390	MISC STRUCTURES	32.46	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
35	441	Horil Beams First Pass-Tier-1	113.62	1.1
35	442	Horil Beams First Pass-Tier-2	70.20	1.1
35	443	Horil Beams First Pass-Tier-3	108.25	1.1
35	444	Horil Beams First Pass-Tier-4	60.71	1.1
35	445	Horil Beams First Pass-Tier-5	68.33	1.1
35	446	Horil Beams First Pass-Tier-6	87.48	1.1
35	447	Horil Beams First Pass-Tier-7	46.83	1.1
35	451	Hor Beam-Second Pass- Tier-1	86.42	1.1
35	452	Hor Beam-Second Pass- Tier-2	70.70	1.1
35	453	Hor Beam-Second Pass- Tier-3	109.92	1.1
35	454	Hor Beam-Second Pass- Tier-4	46.44	1.1
35	455	Hor Beam-Second Pass- Tier-5	68.49	1.1
35	456	Hor Beam-Second Pass- Tier-6	66.91	1.1
35	457	Hor Beam-Second Pass- Tier-7	55.45	1.1
35	511	Front Bracing-Tier-1	50.08	1.1
35	512	Front Bracing-Tier-2	12.99	1.1
35	513	Front Bracing-Tier-3	24.58	1.1
35	514	Front Bracing-Tier-4	21.90	1.1
35	515	Front Bracing-Tier-5	17.43	1.1
35	516	Front Bracing-Tier-6	26.05	1.1
35	517	Front Bracing-Tier-7	13.58	1.1
35	521	Side Bracing-Tier-1	67.03	1.1
35	522	Side Bracing-Tier-2	45.60	1.1
35	523	Side Bracing-Tier-3	82.03	1.1
35	524	Side Bracing-Tier-4	45.32	1.1
35	525	Side Bracing-Tier-5	37.63	1.1
35	526	Side Bracing-Tier-6	43.67	1.1
35	527	Side Bracing-Tier-7	32.14	1.1
35	531	Rear Bracing-Tier-1	134.56	1.1
35	532	Rear Bracing-Tier-2	34.61	1.1
35	533	Rear Bracing-Tier-3	40.56	1.1
35	534	Rear Bracing-Tier-4	31.29	1.1
35	535	Rear Bracing-Tier-5	26.86	1.1
35	536	Rear Bracing-Tier-6	33.42	1.1
35	537	Rear Bracing-Tier-7	24.27	1.1
35	700	HSFG FASTENERS	72.00	1.1
35	701	HSFG FASTENERS	5.37	1.1
35	811	FLOOR GRILLS AND GUARD PLATE	151.12	1.1
35	812	Edge Strip And Guard Plate	15.45	1.1
35	821	STAIRS - LOWER	8.67	1.1
35	822	STAIRS - MIDDLE	9.32	1.1
35	823	STAIRS - UPPER	11.55	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
35	851	HAND RAILS AND POSTS	31.68	1.1
35	993	CONSUMABLES AND ERECTI	10.34	1.1
35	995	CHUTE PIPE AND LADDE	34.06	1.1
PG 35 TOTAL			7729.09	1.1
36	110	COLUMNS NEAR AIR PRE	1222.64	1.1
36	130	Middle Columns In Boiler	559.43	1.1
36	150	BEAMS AND BRACINGS NEA	736.77	1.1
36	311	MAIN FLOOR I MBL 1ST	23.59	1.1
36	312	MAIN FLOOR I MBL 2ND	35.92	1.1
36	313	NON-MBL FLOOR BETWEE	79.08	1.1
36	314	NON-MBL FLOOR BETWEE	87.22	1.1
36	315	NON-MBL FLOOR BETWEE	74.19	1.1
36	316	NON-MBL FLOOR BETWEE	149.56	1.1
36	321	MAIN FLOOR II MBL 1ST	31.51	1.1
36	322	MAIN FLOOR II MBL 2ND	23.91	1.1
36	323	NON-MBL FLOOR BETWEE	38.32	1.1
36	324	NON-MBL FLOOR BETWEE	114.67	1.1
36	325	NON-MBL FLOOR BETWEE	61.72	1.1
36	326	NON-MBL FLOOR BETWEE	31.79	1.1
36	331	MAIN FLOOR III MBL 1	59.42	1.1
36	332	MAIN FLOOR III MBL 2	54.33	1.1
36	333	NON-MBL FLOOR BETWEE	87.47	1.1
36	334	NON-MBL FLOOR BETWEE	91.39	1.1
36	335	NON-MBL FLOOR BETWEE	115.82	1.1
36	336	NON-MBL FLOOR BETWEE	22.87	1.1
36	337	NON-MBL FLOOR BETWEE	52.79	1.1
36	338	NON-MBL FLOOR BETWEE	53.51	1.1
36	341	MAIN FLOOR IV MBL 1ST	25.34	1.1
36	342	MAIN FLOOR IV MBL 2ND	17.02	1.1
36	343	NON-MBL FLOOR BETWEE	46.70	1.1
36	344	NON-MBL FLOOR BETWEE	45.76	1.1
36	345	NON-MBL FLOOR BETWEE	58.18	1.1
36	346	NON-MBL FLOOR BETWEE	25.53	1.1
36	351	MAIN FLOOR V MBL 1ST	35.19	1.1
36	352	MAIN FLOOR V MBL 2ND	20.96	1.1
36	353	NON-MBL FLOOR BETWEE	70.78	1.1
36	354	NON-MBL FLOOR BETWEE	56.71	1.1
36	355	NON-MBL FLOOR BETWEE	85.83	1.1
36	356	NON-MBL FLOOR BETWEE	38.04	1.1
36	361	MAIN FLOOR VI MBL 1ST	61.42	1.1
36	362	MAIN FLOOR VI MBL 2ND	42.47	1.1
36	363	NON_MBL FLOOR ABOVE	39.72	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
36	364	NON MBL FLOOR ABOVE MBL VI	38.29	1.1
36	365	NON MBL FLOOR ABOVE MBL VI	20.52	1.1
36	366	NON MBL FLOOR ABOVE MBL VI	46.16	1.1
36	391	MISCELLANEOUS PLATFO	148.86	1.1
36	392	MISCELLANEOUS PLATFO	100.45	1.1
36	393	APH, SCAPH, HANDLING	30.39	1.1
36	394	MISCELLANEOUS PLATFO	0.27	1.1
36	395	MISCELLANEOUS PLATFO	178.21	1.1
36	610	BOILER ROOF STRUCTUR	213.51	1.1
36	611	BOILER ROOF SHEETING	51.67	1.1
36	613	RAIN WATER PIPES and	24.81	1.1
36	620	BOILER SIDE CLADDING	84.83	1.1
36	621	BOILER SIDE CLADDING	25.00	1.1
36	700	Hsfg Bolts	2.80	1.1
36	740	POSTS AND HANGERS	5.79	1.1
36	811	FLOORGRILLSANDGUARDP	177.65	1.1
36	812	FLOORGRILLSANDGUARDP	119.73	1.1
36	813	FLOORGRILLSANDGUARDP	85.40	1.1
36	814	FLOORGRILLSANDGUARDP	32.72	1.1
36	820	STAIRS AND LADDERS	31.17	1.1
36	851	HANDRAILS AND POSTS	73.54	1.1
36	852	HANDRAILS AND POSTS	31.51	1.1
36	853	HANDRAILS AND POSTS	26.23	1.1
PG 36 TOTAL			6027.05	1.1
38	210	INTER CONN PLATFORMS	31.05	1.1
38	299	MILL HANDLING MONORA	175.26	1.1
38	310	CONN PLATFORMS TO MI	40.95	1.1
38	381	ECO HANDLING STRUCTU	50.25	1.1
38	410	MILL MAINTANANCE PLA	117.36	1.1
38	510	LIFT BEAMS AND BRACI	74.73	1.1
38	610	ELEVATOR CLADDING ST	91.26	1.1
38	611	ELEVATOR CLADDING SH	59.41	1.1
38	710	LIFT MACHINE ROOM DE	74.24	1.1
38	810	FLOORGRILLS AND GUAR	166.71	1.1
38	820	STAIRS AND LADDERS	59.16	1.1
38	850	HAND RAILS AND HAND	49.77	1.1
PG 38 TOTAL			990.14	1.1
39	301	STRUC AND PLATFORM F	1.86	1.1
39	302	STRUC FOR MOTOR HOOD	9.24	1.1
39	304	FAN HANDLING STRUCTU	32.15	1.1
39	305	FAN HANDLING STRUCTU	6.53	1.1
39	306	FAN HANDLING STRUCTU	82.42	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
39	700	HSFG FASTENERS FOR P	0.63	1.1
39	810	FLOOR GRILL	33.88	1.1
39	820	STAIRS	18.41	1.1
39	850	HAND RAIL AND HAND R	35.99	1.1
39	993	CONSUMABLES AND EREC	10.27	1.1
PG 39 TOTAL			231.38	1.1
STRUCTURALS TOTAL			17013.66	
04	147	Supports for Collector & Separator Vessel	22.00	1.2
04	321	VERTICAL SEPARATOR	26.00	1.2
04	323	STORAGE TANK	43.50	1.2
04	347	Separator/Collecting Vessel Supp DD	0.30	1.2
04	547	Separator/Collecting Vessel Supp Shop	2.20	1.2
PG 04 TOTAL			94.00	1.2
05	137	EVAPORATOR INLET HDR - FRNT	15.50	1.2
05	147	FUR LWR REAR INLET HDR	15.50	1.2
05	155	FUR LWR SIDE INLET HDRS	13.00	1.2
05	227	FUR UPPER REAR OUTLET HDR	12.00	1.2
05	231	FUR UPPER FRNT OUTLET HDR	9.00	1.2
05	251	FUR UPPER SIDE OUTLET HDRS	16.00	1.2
05	327	FUR INTERMEDIATE REAR HDR	11.00	1.2
05	330	FUR INTERMEDIATE FRNT HDR	11.00	1.2
05	350	FUR INTERMEDIATE SIDE HDRS	20.00	1.2
PG 05 TOTAL			123.00	1.2
06	400	FUR BURNER PANELS	41.00	1.2
06	401	Burner Panel- OS	0.20	1.2
06	431	Front Upper Ww Panel Attachment	0.20	1.2
06	434	Front Intermediate WW Panel -OS	15.00	1.2
06	437	Front WW Lower Panel-OS	40.00	1.2
06	441	Rear Upper WW Panel -OS	0.05	1.2
06	444	Rear Intermediate WW Panel -OS	40.00	1.2
06	447	Rear Lower WW Panel -OS	35.00	1.2
06	451	Side Upper Ww Panel Attachment	0.20	1.2
06	453	Side Intermediate WW Panel -OS	60.00	1.2
06	455	Side Lower WW Panel -OS	9.54	1.2
06	500	FUR SOFA PANELS	13.00	1.2
06	501	Sofa Panels -OS	0.21	1.2
06	515	Corner SOFA panels	13.00	1.2
06	731	FUR VERTICAL WALL PANELS - FRNT	55.00	1.2
06	732	FRONT WW PNL + ATT	55.00	1.2
06	734	FUR UPPER FRNT SPIRAL PANEL	80.00	1.2
06	735	FUR FRNT SPIRAL TO VERTICAL TRANS. PANEL	7.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
06	737	FUR LWR FRNT SPRL PNL WITH I/T TERM TUBE	45.00	1.2
06	741	FUR REAR ARCH PANELS	50.00	1.2
06	744	FUR UPPER REAR SPIRAL PANEL	80.00	1.2
06	745	FUR REAR SPIRAL TO vert TRANSITION PANEL	7.50	1.2
06	747	FUR LWR RR SPRL PNL WITH I/T TERM TUBES	55.00	1.2
06	751	FUR VERTICAL WALL PANELS - SIDE	70.00	1.2
06	752	FUR LWR VERTICAL WALL PANELS - SIDE	100.00	1.2
06	753	FUR UPPER SIDE SPIRAL PANELS	122.50	1.2
06	755	FUR LWR SIDE SPIRAL PANELS	45.00	1.2
06	759	FUR SIDE SPIRAL TO VERT TRANSITION PANEL	12.00	1.2
PG 06 TOTAL			1051.40	1.2
07	102	LINKS FROM SEPARATOR TO STORAGE TANK	27.00	1.2
07	110	DOWNCOMER TO CONNECTING SPHERE	7.50	1.2
07	125	Connecting Sphere	3.00	1.2
07	223	FUR SCREEN AND HANGER ASSEMBLY	70.00	1.2
07	231	FUR SPIRAL WALL OUTLET TERM TUBES	2.30	1.2
07	232	FUR VERTICAL WALL INLET TERM TUBES	10.00	1.2
07	302	Ww Front Header Suspn DD Item	0.01	1.2
07	309	Furnace Wall Supports Front-DD	1.00	1.2
07	315	FUR SIDE RISERS	37.00	1.2
07	316	FUR REAR RISERS	22.39	1.2
07	317	FURN STORAGE TANK VENT LINK	5.00	1.2
07	318	FUR FRNT RISERS	12.00	1.2
07	331	Riser Tube Support DD Item	0.03	1.2
07	361	Furnace Wall ₂ Support Rear DD Item	1.30	1.2
07	362	Furnace Wall ₂ Support Side L&R DD Item	0.60	1.2
07	393	Consumables & Erection Materials-DD	0.07	1.2
07	402	WW FRT HDR SUSPN	3.00	1.2
07	403	WW SIDE HDR SUSPN	1.30	1.2
07	405	WW SCR.HDR SUSPN.	25.00	1.2
07	409	Furnace wall Supports front	28.00	1.2
07	423	Furnace Screen Tubes Attachment	1.00	1.2
07	431	RISER TUBE SUPPORT	4.00	1.2
07	460	Furnace Spiral Wall supports Misc items	19.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
07	461	Furnace wall Supports rear	15.00	1.2
07	462	Furnace wall Supports Sides L & R	22.00	1.2
07	502	Ww Front Header Suspns Shop Item	1.15	1.2
07	503	Ww Side Header Suspension Shop Item	1.00	1.2
07	505	Ww Screen Header Suspns Shop Item	21.00	1.2
07	509	MISC PR.PART COMPNTS	0.67	1.2
07	531	Riser Tube Support Shop Item	1.50	1.2
07	560	Furnace Spiral Wall Support Shop Item	1.00	1.2
07	561	Furnace Wall ₂ Support Rear Shop Item	0.30	1.2
07	991	Welding Electrodes-Part-1	0.12	1.2
07	992	Welding Electrodes	0.23	1.2
07	993	EREC MATLS, CONSUMES	1.00	1.2
PG 07 TOTAL			345.47	1.2
08	001	FURN UPR BKSTYS-F&R	74.00	1.2
08	003	FURN UPR BKSTYS-SIDE	140.00	1.2
08	006	FURN INT BKSTYS	400.00	1.2
08	007	FURN LWR BKSTYS	55.00	1.2
08	111	FURN REAR ARCH BKSTYS	40.00	1.2
08	380	FURN BOT SUPRTS	170.00	1.2
08	382	H&S For Start-Up System - Boi Items	190.00	1.2
08	501	FURN B P BKSTYS-F&R	200.00	1.2
08	503	FURN B P BKSTYS-SIDE	230.00	1.2
08	901	FURN KEY BKSTYS-UPR	14.00	1.2
08	907	H&S For Start-Up System - Boi Items	1.10	1.2
08	910	EX.MOVT MEAS COMP	1.25	1.2
08	911	Bulk Bps Items-Upper	0.15	1.2
08	912	Bulk Bps Items-Inter	1.30	1.2
08	913	Bulk Bps Items-Lower	2.00	1.2
PG 08 TOTAL			1518.80	1.2
09	003	MATL FOR INST TAPPG	1.00	1.2
09	004	SEAL BOX FURN OPENG	15.60	1.2
09	005	SEAL BOX INST OPENG	3.40	1.2
09	303	Material For Instrument Insert Dd Item	0.10	1.2
09	304	Seal Boxes For Furnace Openings-DD	0.10	1.2
09	503	Material For Instrument Insert Shop Item	0.70	1.2
PG 09 TOTAL			20.90	1.2
10	135	FUR ARCH SUPPPORT INLET HDR	13.50	1.2
10	174	FINISH SH INLET HDR	25.00	1.2
10	178	SH PLATEN INLET HDR	25.00	1.2
10	182	BP LWR REAR HDR	16.00	1.2
10	183	BP UPPER SIDE INLET HDR	20.00	1.2
10	184	BP EXTENDED SIDE INLET HDR	12.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
10	185	BP LWR FRNT HDR	20.00	1.2
10	191	SH FUR ROOF INLET HDR	15.00	1.2
10	195	SH DIVN PANEL IN HDR	16.00	1.2
10	235	FUR ARCH SUPPPORT OUTLET HDR	14.00	1.2
10	274	FINISH SH OUTLET HDR	45.00	1.2
10	278	SH PLATEN OUTLET HDR	20.00	1.2
10	283	BP LWR SIDE HDRS	24.00	1.2
10	284	BP EXT FLOOR OUTLET HDR WITH TERM TUBES	10.00	1.2
10	285	BP FRNT OUTLET HDR	25.00	1.2
10	291	SH FUR ROOF OUTLET HDR	30.00	1.2
10	295	SH DIVN PANEL OUTHDR	2.00	1.2
PG 10 TOTAL			332.50	1.2
11	074	FINISH SH FRNT ASSY WITH I/T TERM & COT	421.00	1.2
11	078	SH PLATEN ASSY WITH TERM TUBES - LEFT	215.00	1.2
11	095	SH DIVN PANEL LEFT	50.00	1.2
11	374	FINISH SH REAR ASSY WITH O/T TERM & COT	350.00	1.2
11	378	SH PLATEN ASSY WITH TERM TUBES - RIGHT	70.00	1.2
11	395	SH DIVN PANEL RIGHT	50.00	1.2
11	406	SH Frnt Upper Pnl Attachment	0.50	1.2
11	416	SH Rear Uppr Pnl Attachment	0.10	1.2
11	467	SH Sc Side Pnl Upper Left Attachment	0.01	1.2
11	469	SH Sw Panels Lower Front (L&R)-OS	0.05	1.2
11	474	SH Vertical Spaced Coil Attachment	0.38	1.2
11	487	BP LTRH Hanger Tube Attchment	0.37	1.2
11	491	SH Radient Roof Tubes (Left)-OS	0.05	1.2
11	494	SH Extended Bottom Panels-OS	0.01	1.2
11	606	BP FRNT WALL PANELS	70.00	1.2
11	684	BP EXTENDED SIDE FIN WELDED PANEL	28.00	1.2
11	694	BP EXTENDED SIDE FLOOR FIN WELDED PANEL	20.00	1.2
11	716	BP UPPER REAR PANEL	54.00	1.2
11	718	BP LWR REAR PANEL	55.00	1.2
11	767	BP UPPER SIDE PANEL-LEFT	55.00	1.2
11	768	BP INTER SIDE PANEL - LEFT	31.25	1.2
11	769	BP LWR SIDE PANEL - LEFT	38.75	1.2
11	787	BP REAR ROOF PANELS	50.00	1.2
11	791	SH FUR ROOF FIN WELDED PANEL	40.00	1.2
11	967	BP UPPER SIDE PANEL-RIGHT	50.60	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
11	968	BP INTER SIDE PANEL - RIGHT	28.75	1.2
11	969	BP LWR SIDE PANEL - RIGHT	35.60	1.2
11	991	SH FUR ROOF TUBES	40.00	1.2
PG 11 TOTAL			1754.42	1.2
12	178	LINK TO SH DESUPERHEATER	40.00	1.2
12	179	LINK TO FINISH SH INLET HDR	22.00	1.2
12	181	FUR ARCH SUPPORT LINKS	25.00	1.2
12	184	BP EXTENDED SIDE CONNECTION LINK	20.00	1.2
12	187	SH BYPASS PIPES	15.00	1.2
12	306	SH Spprt For Lines And Links DD Item	0.10	1.2
12	314	Suspns of SH R.Roof Headers DD Item	0.02	1.2
12	317	Suspns of R.Roof Headers DD Item	0.07	1.2
12	324	Suspension of SH Rear Wall DD Items	1.05	1.2
12	327	Suspension of SH Rear Wall DD Items	0.50	1.2
12	328	Suspension of SH Rear Wall DD Items	2.25	1.2
12	344	Suspns of Vert. Spaced Assy DD Item	0.03	1.2
12	348	Suspns of Vert. Spaced Assy DD Item	0.30	1.2
12	354	Suspns of Vert. Spaced Assy DD Item	0.04	1.2
12	368	RH Vert Platen Frnt Coil Left DD Item	25.00	1.2
12	393	SH Misc Components DD Item	0.21	1.2
12	395	SH DIVN PNL IN TUBE	15.00	1.2
12	403	SH Sc Spacer Tube Attachment	0.20	1.2
12	405	SH Hanger Tube Attachment	0.25	1.2
12	495	SH DIVN PNL OUT TUBE	19.50	1.2
12	514	Suspns of SH R.Roof Hdrs Shop Item	3.50	1.2
12	517	Suspns of R.Roof Headers Shop Item	0.95	1.2
12	524	Suspension of SH Rear Wall Shop Item	5.00	1.2
12	528	Suspension of SH Rear Wall Shop Item	0.15	1.2
12	544	Suspns of Vert. Spaced Assy Shop Item	2.00	1.2
12	548	Suspns of Vert. Spaced Assy Shop Item	1.45	1.2
12	554	Suspns of Vert. Spaced Assy Shop Item	3.50	1.2
12	568	RH Vert Platen Frnt Coil Left Shop Item	0.15	1.2
12	800	SH DESUP-STAGE II	8.00	1.2
12	803	SH STEAM COOLED SPACER TUBES	3.25	1.2
12	805	BP FRNT WALL SCREEN TUBES	45.00	1.2
12	850	SH CONNECTING PIPE	20.00	1.2
12	852	LINKS TO SH PLATEN INLET HDR	30.00	1.2
12	900	SH DESUPERHEATER	6.00	1.2
12	903	SH MISCL COMPONENTS	5.00	1.2
12	906	SH LINK SUPPORTS	2.70	1.2
12	907	RAD&RR ROOF SUPPORTS	4.00	1.2
12	914	EXPNSH RAD ROOF HDR	5.50	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
12	917	SUSPN OF RADINT ROOF	17.50	1.2
12	924	SUSPN-SH BAKPASS HDR	22.00	1.2
12	927	SUSPN OF REAR ROOF	16.00	1.2
12	928	SUSPN - SH REAR WALL	40.00	1.2
12	944	SUSPN-SH PLATEN HDRS	4.00	1.2
12	948	SUSP-VERT SPACD ASSY	100.00	1.2
12	954	SUSP-VERT SPACD HDRS	3.50	1.2
12	968	SUSPN OF PLATEN ASSY	5.20	1.2
12	991	Welding Electrodes-Part-1	0.50	1.2
12	993	EREC MATLS, CONSUMES	6.15	1.2
12	994	PORT IN FOR THK MSMT	0.05	1.2
PG 12 TOTAL			547.56	1.2
15	136	LTRH INLET HDR	10.00	1.2
15	178	FINISH RH INLET HDR	12.00	1.2
15	236	LTRH OUTLET HDR	11.00	1.2
15	278	FINISH RH OUTLET HDR	30.00	1.2
PG 15 TOTAL			63.00	1.2
16	079	RH VERPLN FR COIL LT	229.00	1.2
16	201	LTRH UPPER ASSEMBLY	188.00	1.2
16	202	LTRH INTERMEDIATE ASSEMBLY	442.00	1.2
16	203	LTRH LWR ASSEMBLY WITH INLET TERM TUBES	190.00	1.2
16	270	LTRH PENDANT ASSY WITH O/T TERM TUBES	216.00	1.2
16	379	RH VERPLN FR COIL RT	27.00	1.2
PG 16 TOTAL			1292.00	1.2
17	174	LINK TO RH DESUPERHEATER	75.00	1.2
17	304	RH Spprts For Lines And Links DD Item	0.03	1.2
17	306	RH Suprt For Lines And Links DD Item	0.02	1.2
17	319	RH Frnt Suspension DD Item	0.04	1.2
17	474	RH Cross Over Links-OS	0.50	1.2
17	476	RH V.S. Centre Cross Over Tube Attchmt	0.50	1.2
17	504	RH Suprts For Lines And Links Shop Item	3.50	1.2
17	506	RH Suprt For Lines And Links Shop Item	0.20	1.2
17	519	RH Frnt Suspension Shop Item	4.00	1.2
17	900	RH DESUPERHEATER	8.00	1.2
17	903	RH MISCL COMPONENTS	100.00	1.2
17	904	RH HDR SUPRT AB ROOF	15.00	1.2
17	906	RH SUPRT LINES & LIN	6.00	1.2
17	919	RH FRONT SUSPENSION	50.00	1.2
17	991	Welding Electrodes-Part-1	1.00	1.2
17	992	Welding Electrodes	1.13	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
PG 17 TOTAL			264.92	1.2
18	001	FUR ROOF SKIN CASING	19.51	1.2
18	002	1 PASS ROOF SKINCASG	0.15	1.2
18	010	PR PARTS ATTACH-CASG	0.30	1.2
18	701	Furnace Roof Skin Casing BOI Item	0.11	1.2
PG 18 TOTAL			20.07	1.2
19	306	Eco Supports For Line & Links DD Item	0.10	1.2
19	307	Eco Feed Pipe Suspnn DD Item	0.10	1.2
19	506	Eco Supports For Line & Links Shop Item	0.10	1.2
19	507	Eco Feed Pipe Suspnn Shop Item	0.10	1.2
19	701	ECO INLET HDR	35.00	1.2
19	702	ECO OUTLET HDR	22.00	1.2
19	753	ECO JUNCTION HDR	10.00	1.2
19	763	ECO JUNCTION HDR	10.00	1.2
19	783	ECO JUNCTION HDR	10.00	1.2
19	793	ECO JUNCTION HDR	10.00	1.2
19	802	ECO LWR HANGER TUBES	110.00	1.2
19	814	ECO UPPER ASSY - LEFT	275.00	1.2
19	824	ECO LWR ASSY -LEFT	280.00	1.2
19	850	ECO INLET LINKS	75.00	1.2
19	851	LINKS FROM ECO OUT. HDR TO ECO MIX LINE	85.00	1.2
19	853	LINKS FROM ECO MIX LINE TO FURN I/T HDRS	50.00	1.2
19	903	ECO.MISCL COMP	120.00	1.2
19	904	ECO HDR SUPT AB ROOF	82.00	1.2
19	905	ECO HDR SUPT BL ROOF	40.00	1.2
19	906	ECO LINE&LINK SUPORT	27.45	1.2
19	907	ECO,FEEDPIPE SUPPORT	15.00	1.2
19	914	ECO UPPER ASSY - RIGHT	275.00	1.2
19	924	ECO LWR ASSY-RIGHT	280.00	1.2
19	991	Welding Electrodes-Part-1	0.03	1.2
19	992	Welding Electrodes	0.10	1.2
PG 19 TOTAL			1811.98	1.2
21	600	S.B. PPG & FITTINGS	20.62	1.2
21	601	S.B PIPING SUPPORTS	0.90	1.2
21	602	Sb Piping - DD Items	1.63	1.2
21	603	Sb Piping - BOI Items	0.01	1.2
21	604	SB Piping Supports - OS items	5.62	1.2
21	605	SB Piping Supports - DD Items	0.01	1.2
21	606	SB Piping Supports - BOI Items	0.00	1.2
21	700	BULKED BPS COMP	0.26	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
21	800	SB VALVES (BHEL)	3.20	1.2
21	825	SB VALVES (SUBDELY)	0.30	1.2
21	825	SB VALVES (SUBDELY)	0.25	1.2
21	850	SB SAFETY VALVE BHEL	0.05	1.2
21	987	COMMG SPARES SB SV	0.00	1.2
21	988	COMMG SPARES-SD	0.00	1.2
21	992	WELDING ELECTRODES	0.06	1.2
PG 21 TOTAL			32.90	1.2
24	350	BLR FILLING PIPING	1.36	1.2
24	351	H&S BLR FILLING PPG	0.02	1.2
24	352	Boiler Fill Piping - DD Items	0.15	1.2
24	353	H&S For Boiler Fill Piping - OS Items	0.43	1.2
24	354	BOI Items for Blr Trim Piping	0.00	1.2
24	700	BULKED BPS COMP	0.22	1.2
24	800	BOILER TRIM PIPING	44.33	1.2
24	801	SUPPORTS-TRIM PIPING	0.40	1.2
24	803	Boiler Trim Piping - DD Items	0.36	1.2
24	804	Supports - Blr Trim Piping - OS Items	21.21	1.2
24	805	LINK TO BOILER RECIRCU SYSTEM	26.70	1.2
24	806	MIXING VESSEL	6.31	1.2
24	807	RECIRCU PUMP SUCTION LINE	23.58	1.2
24	808	RECIRCU PUMP DISCHARGE LINE	7.91	1.2
24	809	BOILR RECIR LINK FROM BF LINE	10.37	1.2
24	810	H and S FOR STARTUP SYSTEM	21.27	1.2
24	811	Fur Link to Flash tank HWL1&2	74.47	1.2
24	815	SPRAY WATER SYSTEM	34.83	1.2
24	817	H&S For Start-Up System - OS Items	11.95	1.2
24	818	H&S For Start-Up System - DD Items	0.13	1.2
24	820	EXHAUS PIPE SAFETY VLV	50.30	1.2
24	822	De-Superheater Pipes - OS Items	7.05	1.2
24	823	De-Superheater Pipes - DD Items	2.04	1.2
24	824	Exhaust Pipe For Sv - OS Items	11.21	1.2
24	825	SILENCER SUPPORTS	0.11	1.2
24	826	Silencer Supp - OS Items	57.00	1.2
24	827	Exhaust Pipe For Sv - DD Items	1.08	1.2
24	828	Exhaust Pipe For Sv - BOI Items	0.02	1.2
24	835	STARTUP VENT DIFFUSER SILEN SUP	0.50	1.2
24	836	Start-Up Vent, Diffuser, Sil Supp-OS	4.06	1.2
24	837	Start-Up Vent, Diffuser, Sil Supp-DD	0.01	1.2
24	840	SAMPLE COOLER AND SUPPORTS	0.63	1.2
24	841	Sample Cooler & Supports - OS Items	0.14	1.2
24	842	Sample Cooler and Suprts-DD items	0.01	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
24	855	RECIRCULATING PUMB COMP	19.53	1.2
24	860	VALVES (BHEL)	74.53	1.2
24	860	VALVES (BHEL)	4.00	1.2
24	865	CTL VALVES FOR SPRAY PIPING SD	6.57	1.2
24	865	CTL VALVES FOR SPRAY PIPING SD	0.20	1.2
24	867	CTL VAL FOR STARTUP RECIRCU SYS	27.70	1.2
24	867	CTL VAL FOR STARTUP RECIRCU SYS	1.50	1.2
24	880	SAFETY VALVES	10.18	1.2
24	880	SAFETY VALVES	0.80	1.2
24	881	SAFETY VALVES AND ERV(BHEL) SD	0.43	1.2
24	885	SILENCERS(BHEL)	74.07	1.2
24	950	SPECIAL TOOLS	0.16	1.2
24	955	LAP TOOL SV&ERV	0.07	1.2
24	960	LAP TOOL-CON VAL(BHEL)	0.03	1.2
24	987	BHEL-SV/ERV COMG SPARES	0.01	1.2
24	988	COMMING SPARES/SD	0.02	1.2
24	989	BHEL VALVE COMG SPAR	0.02	1.2
24	992	WELDING ELECTRODES-TRIM PPG	1.19	1.2
24	993	CONSUME & EREC MATLS	1.96	1.2
24	994	NAME PLATES	0.34	1.2
PG 24 TOTAL			643.44	1.2
31	010	COMPS WELDED TO PR	0.95	1.2
31	104	FUR REAR ARCH SKIN	2.30	1.2
PG 31 TOTAL			3.25	1.2
32	700	BULKED DD COMPONENT	28.50	1.2
32	810	EQUIPMENT OUTER CASING	248.50	1.2
PG 32 TOTAL			277.00	1.2
42	988	O&G SYS COMMING SPARE	0.01	1.2
PG 42 TOTAL			0.01	1.2
52	0	SPECIAL TOOLS/CONTRA	0.83	1.2
52	10	LARG AH-ROTOR ASSY	1037.00	1.2
52	11	LARG AH-ROTOR POST	48.20	1.2
52	12	LARG AH-ROTORPINRACK	6.95	1.2
52	13	LARG AH-ROTORSEALS	15.69	1.2
52	30	LARG AH-ROTORHOUSING	61.70	1.2
52	41	HOT END CONN PLATE	115.02	1.2
52	42	COLD END CONN PLATE	208.70	1.2
52	54	LARG AH-AXIAL SEAL	1.23	1.2
52	55	LARG AH-BY PASS SEAL	1.57	1.2
52	101	LARG AH-AUX ROTDRIVE	14.05	1.2
52	102	COMP AIR LINE PIPING	10.46	1.2
52	211	LARG AH-AIRSEAL PIPE	0.89	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
52	220	LARG AH-GENS DETAILS	3.01	1.2
52	261	LARG AH-GUIDE BEARNG	7.99	1.2
52	262	LARG AH-SUPRT BEARNG	18.76	1.2
52	271	OIL PIPING GUIDE BRG	0.53	1.2
52	272	OIL PIPING SUPRT BRG	0.54	1.2
52	274	LUB OIL CIRCULATION UNIT	1.11	1.2
52	275	LARGE AIR HEATER-LUBRICANTS	1.35	1.2
52	301	WASH MANIFLD GAS INL	2.27	1.2
52	302	WASH MANIFLD GAS OUT	2.27	1.2
52	339	LARGE AH-RETRACT CLNG DEV (HE)	1.50	1.2
52	340	LARG AH-CLEANINGEQPT	1.90	1.2
52	988	LARG AH COMMISSIONING SPARE	0.45	1.2
PG 52 TOTAL			1563.97	1.2
80	370	HP DRAIN FLASH TANK VENT TO ATMOSPHERE	47.00	1.2
PG 80 TOTAL			47.00	1.2
81	36	CW STORAGE TANK 16-25 CUM	5.50	1.2
81	41	IMPURE CONDENSATE TANK	4.00	1.2
81	60	SPECIAL TANKS AND VESSELS	45.00	1.2
PG 81 TOTAL			54.50	1.2
PRESSURE PARTS TOTAL			11862.09	
20	051	LONG RETRACT SB M11E	67.95	1.3
20	054	WALL BOX NPR LRSB MI	1.30	1.3
20	201	WALL DESLAGGER RW5E	13.56	1.3
20	204	WALL BOX NPR-RW5E	2.19	1.3
20	511	DA HEAD VALVE ASSY	0.11	1.3
20	794	WALL BOX NPR FOR TP	0.06	1.3
20	962	TR PROBE DUP PT&AC	2.03	1.3
20	988	SB COMMG SPARES	0.01	1.3
20	998	SPL TOOLS FOR SB	0.01	1.3
PG 20 TOTAL			87.20	1.3
28	220	DOORS	13.00	1.3
28	700	BPS FASTENERS	4.50	1.3
PG 28 TOTAL			17.50	1.3
30	105	FUR BOTTOM ENCL FRAM	49.00	1.3
30	211	FUR REAR ARCH ENCL	5.20	1.3
30	215	MAIN BOILER ENCL	31.50	1.3
30	219	VERT ROOF ENCL	87.00	1.3
30	223	GAS DIST BAFFLES	0.50	1.3
30	224	Antivibration Baffles	11.95	1.3
30	233	IST PASS DECK SPRT	34.00	1.3
30	234	2ND PASS DECK SPRT	33.00	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
30	235	ENCL SUPPORT STEEL	44.00	1.3
PG 30 TOTAL			296.15	1.3
41	350	ACOIL GUN ASSY	1.00	1.3
41	390	OIL GUN VICE&RACK	1.20	1.3
41	500	HEA IGNITOR	1.00	1.3
41	710	Oil Gun Assembly - DD items	0.01	1.3
41	988	O&G BURN COMMG SPARE	0.01	1.3
PG 41 TOTAL			3.21	1.3
42	001	PNEUMATIC FITTINGS	0.19	1.3
42	002	STEAM BLOW MATERIALS	2.25	1.3
42	005	INSTRUMENT FITTINGS	0.30	1.3
42	010	LFO PUMP SET	7.70	1.3
42	020	Hfo Pump Set	12.10	1.3
42	030	Hfo Heater Set	33.20	1.3
42	046	DO PUMP-MOTOR ASSY	0.45	1.3
42	065	DRAIN OIL TANK	5.57	1.3
42	070	BURNER STN SKID ASLY	5.60	1.3
42	120	PIPING,PH FUEL OIL	5.70	1.3
42	128	Piping,Pump House Steam - lbr	1.20	1.3
42	150	Piping, Operating Floor Hfo & Tracer	3.70	1.3
42	152	PIPING,OP.FLR LFO	1.16	1.3
42	154	PIPING,OP.FLR DO	0.53	1.3
42	157	PIPING,OP.FLR AIR	0.01	1.3
42	158	Piping,Opr'G Floor Steam-lbr	4.10	1.3
42	200	SUB.DEL FO SYSTEM	3.50	1.3
42	300	BHEL VALVE F.O. SYS	2.70	1.3
42	358	Bhel Valve,Opr'G Floor Stm-lbr	0.67	1.3
42	700	BULKED BPS COMPONENT	0.55	1.3
42	710	Fuel Oil System - DD Items	2.10	1.3
42	858	Fuel Oil System - Shop items	18.70	1.3
42	992	IMPORTED ELECTRODES	0.03	1.3
PG 42 TOTAL			112.01	1.3
43	004	ASSY SCNR&GUN AIR SY	5.00	1.3
43	005	ASSY MILL AIR SYSTEM	20.00	1.3
43	104	M/C SCNR&GUN AIR SYS	16.00	1.3
43	105	M/C MILL AIR SYSTEM	68.00	1.3
43	200	SUBDEL,IGNR,SCNR AIR	6.00	1.3
43	710	Seal Air & Scanner Air System - DD items	0.50	1.3
PG 43 TOTAL			115.50	1.3
45	200	Windbox - Sub Delivery	4.00	1.3
45	710	Wind Box & SOFA Assembly - DD items	0.20	1.3
45	801	WINDBOX AND SOFA TUBE ATTACH	32.00	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
45	802	WINDBOX ASSEMBLY - 32" WIDTH	175.00	1.3
45	804	WINDBOX - SOFA ASSEMBLY	47.50	1.3
45	805	WINDBOX SUPPT AIR CYL MOUNTG	30.00	1.3
45	858	Wind Box & SOFA Assy - Shop items	37.50	1.3
PG 45 TOTAL			326.20	1.3
47	200	Fuel Piping - Sub-delivery	17.50	1.3
47	261	Fuel Pipe Supports	30.00	1.3
47	263	Fuel Pipe Coupling , Collar, Gate Misc lte	17.50	1.3
47	269	St Pipes & Shop Bends For Rest Of Mills	372.00	1.3
47	710	Pulverised Fuel Piping - DD items	3.00	1.3
47	858	Fuel Piping - Shop items	30.00	1.3
PG 47 TOTAL			470.00	1.3
48	012	DUCT - -FDFAN TO A.H	170.00	1.3
48	014	EXP.JT - -FDFAN TO A.H	10.00	1.3
48	015	SUPPORT-FDFAN TO A.H	16.50	1.3
48	112	DUCT - -PAFAN-PRI-AH	150.00	1.3
48	114	EXP.JT - -PAFAN-PRI-AH	6.50	1.3
48	115	SUPPORT-PAFAN-PRI-AH	8.80	1.3
48	141	SEAL AIR HAG&ID GATE-PARTIAL	5.00	1.3
48	142	DUCT - -COLDAIRBUS	100.00	1.3
48	144	EXP.JT - -COLDAIRBUS	6.60	1.3
48	145	SUPPORT-COLDAIRBUS	1.50	1.3
48	200	INS TAPPINGS ON DUCT-PARTIAL	1.50	1.3
48	202	DUCT - AH-WIND BOX	180.00	1.3
48	204	EXPJT - AH-WIND BOX	42.00	1.3
48	205	SUPORT AH-WIND BOX	30.00	1.3
48	206	CLH/VLH -Hot Air	15.00	1.3
48	207	FLOWMTR-SEC AIRFLOW	20.00	1.3
48	208	DUCT-SEC.AIR TO WB	130.00	1.3
48	212	DUCT - WIND BOX CONN	100.00	1.3
48	214	EXPJT - WIND BOX CONN	10.00	1.3
48	222	SQ DUCT AH-HOT AIR BUS	120.00	1.3
48	224	EXPN PCS AH-HOT AIR BUS	16.00	1.3
48	225	SUPPORT AH-HOT AIR BUS	2.00	1.3
48	232	DUCT - HOT AIR BUS	77.00	1.3
48	234	EXPJT - HOT AIR BUS	2.50	1.3
48	235	SUPORT HOT AIR BUS	1.50	1.3
48	262	Rect Duct Aihtr Toprinnozzle And Seca	100.00	1.3
48	264	Expn Piece Aihtr Toprinnozzle and Seca	20.00	1.3
48	265	Supports Aihtr Toprinnozzle And Seca	7.00	1.3
48	372	DUCT - ECO HOPPER TO AH	100.00	1.3
48	382	DUCT - ECO-HOPPER	180.00	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
48	384	EXPNJT - ECO-HOPPER	35.00	1.3
48	385	SUPPORT - ECO-HOPPER	40.00	1.3
48	386	DUCT - ECO TO ECO HOPPER	160.00	1.3
48	395	CLH/VLH-FLUE GAS-PARTIAL	4.85	1.3
48	432	DUCT - AH-BLROUTFL	180.00	1.3
48	434	EXPJT - AH-BLROUTFL	7.00	1.3
48	435	SUPORT AH-BLROUTFL	8.50	1.3
48	662	CIRCULAR DUCT HOT BUS MILLS	105.00	1.3
48	664	EXPN PCS HOT BUS MILLS	15.00	1.3
48	665	SUPPORTS HOT BUS MILLS	1.50	1.3
48	667	FLOW METER	20.00	1.3
48	700	BULKED BPS COMPONENT-PARTIAL	3.50	1.3
48	911	Slide Brg PI & Pac Bellow-Blr	1.40	1.3
48	915	Man Hole Doors (450X450)-PARTIAL	4.50	1.3
48	993	ERECTON-MATERIALS-PARTIAL	10.00	1.3
PG 48 TOTAL			2225.65	1.3
50	510	STEAM COIL A P H	9.85	1.3
PG 50 TOTAL			9.85	1.3
57	10	GATE-FD FAN OUTLET	26.30	1.3
57	33	DAMPER-SA SCAPH INLET	16.00	1.3
57	63	DAMPER-SA SCAPH OUTLET	16.00	1.3
57	83	DAMPER-SA SCAPH BYPASS	16.00	1.3
57	110	GATE-PA FAN OUTLET	23.50	1.3
57	141	SEAL AIR HAG AND ID FAN OUTGAT	30.05	1.3
57	143	DAMPER-COLD AIR TO MILL	7.66	1.3
57	160	GATE-COLD AIR TO MILLS	26.86	1.3
57	173	DAMPER-PA APH INLET	9.60	1.3
57	203	DAMPER-SA APH OUTLET	30.50	1.3
57	209	MTG BKT FOR CL DAMPER AIR CYL	4.37	1.3
57	223	DAMPER-PA APH OUTLET	12.00	1.3
57	270	GATE-HOT AIR TO MILLS	32.57	1.3
57	273	DAMPER-HOT AIR TO MILL	11.43	1.3
57	577	ELECT ACTUATOR FOR GATE,DAMPER-PARTIAL	23.75	1.3
57	578	ELECTRICAL ITEMS FOR GATE,DAMP-PARTIAL	0.03	1.3
57	623	DAMPER-SCR BYPASS	62.90	1.3
PG 57 TOTAL			349.51	1.3
97	297	MTM CLAMPS & PADS	0.38	1.3
PG 97 TOTAL			0.38	1.3
99	300	PUMP HANDLING EQUIPT	4.00	1.3
99	400	SCAPH,RAPH HANDLG EQ	3.50	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
99	501	QUICK ERECT SCAFFOLD	185.00	1.3
99	502	Pre.Parts Handling Equipments	12.00	1.3
99	514	FURN CRADL-4WALC	6.00	1.3
99	600	FO SYSTEM HANDLG EQU	1.00	1.3
PG 99 TOTAL			211.50	1.3
NON PRESSURE PARTS TOTAL			4224.66	
55	11	FD FAN FOUNDATION MATL	1.50	1.4
55	17	FD FAN C&I ITEMS	0.05	1.4
55	21	AXL IDFAN FDN MATL	3.00	1.4
55	24	ID SEALING/COOLING FANS	3.00	1.4
55	27	ID FAN C&I ITEMS	0.06	1.4
55	31	PA FAN FOUNDATION MATL	2.20	1.4
55	37	PA FAN C&I ITEMS	0.06	1.4
55	91	FISRT FILL LUBRICANTS	4.00	1.4
55	216	AXIAL FD FAN ROTOR	5.50	1.4
55	227	AXIAL ID FAN ROTOR	22.00	1.4
55	334	AXIAL PA FAN ROTOR	5.00	1.4
55	516	AXIAL FD FAN STATOR	30.00	1.4
55	527	AXIAL ID FAN STATOR	90.00	1.4
55	634	AXIAL PA FAN STATOR	18.00	1.4
55	810	AXIAL FDFAN COUPLING	0.80	1.4
55	820	AXIAL IDFAN COUPLING	3.50	1.4
55	830	AXL PAFAN COUPLING	1.00	1.4
55	910	AXIAL FD FAN LUBE OIL SYSTEM	2.80	1.4
55	911	AXIAL FDFAN SILENCER	70.00	1.4
55	920	AXIAL ID FAN LUBE OIL SYSTEM	3.50	1.4
55	930	AXIAL PA FAN LUBE OIL SYSTEM	4.80	1.4
55	931	PA FAN SILENCER	46.00	1.4
PG 55 TOTAL			316.77	1.4
56	77	SEAL AIR FAN C&I ITEMS	0.01	1.4
56	161	RADIAL PENT HOUSE VENTILN FAN	1.20	1.4
56	173	RADIAL SEAL AIR FAN ROTOR	1.70	1.4
56	373	RADIAL SEAL AIR FAN BEARINGS	0.21	1.4
56	473	RADIAL SEAL AIR FAN STATOR	7.00	1.4
56	670	RADIAL SEAL AIR FAN MOTOR	2.20	1.4
56	870	SEAL AIR FAN COUPLING(RADIAL)	0.06	1.4
PG 56 TOTAL			12.38	1.4
61	10	JOURNAL ASSEMBLY(3nos),JOURNAL HEAD ASSY	193.20	1.4
61	110	PLANETARY GEAR BOX ,BOWL & BOWL HUB ASSY	242.20	1.4
61	210	MILL SIDE ASSEMBLY	138.81	1.4

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
61	310	SEPARATOR BODY ASSEMBLY WITH TRUNNION SHAFTS & JOURNAL OPENING COVER,SEPARATOR TOP ASSEMBLY	240.73	1.4
61	310	DYNAMIC CLASSIFIER COMPLETE	82.60	1.4
61	410	MDV ASSEMBLY -4nos (KNIFE GATVE VALVES)	13.86	1.4
61	710	MILL MOTOR COUPLING ASSEMBLY	3.01	1.4
61	810	LUB OIL(GEAR BOX)	13.58	1.4
61	910	FOUNDATION FASTNERS AND MOUNTING PL	66.30	1.4
PG 61 TOTAL			994.29	1.4
65	200	Coal Feeder- Sub-Delivey	1.10	1.4
65	710	Coal Feeder - DD items	0.25	1.4
65	736	36GRAVIMETRIC FEEDER	57.00	1.4
PG 65 TOTAL			58.35	1.4
67	200	Coal Feeding System- Sub dely.	1.50	1.4
67	204	RAW COAL GATES	3.60	1.4
67	272	BUNKER OUTLET GATE -36" MOTOR	7.50	1.4
67	276	FEEDER INLET GATE- 36" CHAIN	6.70	1.4
67	283	FEEDER OUTLET ISOLATION GATE	9.00	1.4
67	710	Coal Feeding System - DD items	0.60	1.4
67	801	DOWN SPOUT	15.55	1.4
67	802	BUNKER EMPTYINGCHUTE	20.00	1.4
67	803	FEED PIPE TO MILL	17.00	1.4
PG 67 TOTAL			81.45	1.4
XX	XX	Mill Motors	60.40	1.4
XX	XX	FD Fan Motor	24.00	1.4
XX	XX	ID Fan Motor	60.00	1.4
XX	XX	PA Fan Motor	29.00	1.4
PG XX TOTAL			173.40	1.4
ROTATING MACHINES TOTAL			1636.64	
61	XX	MILL HDLG COMPONENTS	55.71	1.5
PG 61 TOTAL			55.71	1.5
99	099	MISC CHAIN PULLY BLO	0.20	1.5
99	100	FAN HANDLING EQUIPT	23.00	1.5
PG 99 TOTAL			23.20	1.5
HANDLING EQUIPMENT TOTAL			78.91	
GRAND TOTAL (BOILER & AUX - UNIT 1)			34815.96	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.9.2.3. AUXILIARY BOILER

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
35	010	Foundation Materials-Boiler	4.40	1.1
35	110	Main Columns Left & right	17.90	1.1
35	410	Column Frames-Front Frame	12.60	1.1
35	510	Column Bracings-Front Bracing	13.40	1.1
35	610	Boiler Roof Structure	3.50	1.1
35	611	Boiler Roof Sheetting	1.00	1.1
35	810	Temporary Structure For Drum Erection	4.00	1.1
PG 35 TOTAL			56.80	1.1
36	310	Main Floor I Mbl	8.00	1.1
36	811	Floor grill sand guard plates-Lower	9.00	1.1
36	820	Stairs And Ladders	1.20	1.1
36	850	Handrails And Hand Rail Post	4.00	1.1
PG 36 TOTAL			22.20	1.1
STRUCTURALS TOTAL			79.00	
04	114	Upper Drum + Intl Id 49-60	18.00	1.2
04	144	Upper Drum Sspn Id 49-60	0.45	1.2
04	210	Lower Drum + Intl Id Upto 36	8.80	1.2
PG 04 TOTAL			27.25	1.2
06	609	Corner Ww Pnl	2.35	1.2
06	614	D'Pnl Ww Pnl	6.50	1.2
06	616	Baffle Ww Pnl	3.70	1.2
06	657	Side Boiler Ww Pnl	4.15	1.2
PG 06 TOTAL			16.7	1.2
07	200	Furnace Tubes	0.55	1.2
07	211	Boiler Bank Tubes	16.50	1.2
07	214	Boiler Side Wall Shield Tubes	1.70	1.2
07	601	Pressure Seals	2.80	1.2
07	989	Tools For Tube Expansion	0.07	1.2
07	992	Welding Electrodes	0.00	1.2
07	993	Consumables & Erection Materials	0.28	1.2
PG 07 TOTAL			21.902	1.2
09	001	Seal Boxes For Furnace Opening	0.30	1.2
09	002	Seal Boxes For Instrument Inserts	0.15	1.2
09	003	Material For Instrument Inserts	0.30	1.2
PG 09 TOTAL			0.75	1.2
10	170	Vertical Sh Inlet Hdr	0.55	1.2
10	270	Vertical Sh Outlet Header	0.55	1.2
PG 10 TOTAL			1.1	1.2
11	170	Sh Vertical Coil Element	2.00	1.2
PG 11 TOTAL			2	1.2
12	850	Sh Connecting Pipe	1.85	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
12	900	Sh Desuperheater	0.70	1.2
12	901	Sh Hngr,Suprts,Guides & Ties	0.35	1.2
12	992	Welding Electrodes	0.01	1.2
12	993	Consumables & Erection Materials	0.28	1.2
PG 12 TOTAL			3.185	1.2
18	001	Furnace Roof Skin Casing	0.50	1.2
PG 18 TOTAL			0.5	1.2
19	850	Eco Inlet Links	0.14	1.2
19	992	Welding Electrodes	0.00	1.2
PG 19 TOTAL			0.141	1.2
21	600	Soot Blower Piping And Fittings	0.27	1.2
21	602	Soot Blower Piping & Fittings - Dd	0.06	1.2
21	603	Soot Blower Piping & Fittings - Boi	0.00	1.2
21	604	Soot Blower Piping Supports - Os Items	0.63	1.2
21	700	Bulked Bps Components For Sb Piping	0.01	1.2
21	800	Soot Blower Valves (Bhel)	0.13	1.2
21	992	Imported Electrodes	0.00	1.2
PG 21 TOTAL			1.094	1.2
24	350	Boiler Filling Piping	0.09	1.2
24	351	Hangers And Supports Of Blr Filling Pipe	0.00	1.2
24	352	Boiler Fill Piping - Dd	0.01	1.2
24	353	Hangers & Supports For Boiler Fill Pipin	0.16	1.2
24	600	Boiler Trim Piping And Fittings	0.96	1.2
24	601	Boiler Trim Piping Supports	0.15	1.2
24	603	Boiler Trim Piping - Dd Items	0.02	1.2
24	604	Supports - Boiler Trim Piping - Os	0.53	1.2
24	620	Safety Valve Esc Pipe&Drain - Pack Blr	0.87	1.2
24	624	Exhaust Pipe For Safety Valve - Os Items	0.40	1.2
24	625	Silencer Support-Safety Valves	1.00	1.2
24	627	Exhaust Pipe For Safety Valve - Dd Items	0.05	1.2
24	628	Exhaust Pipe For Safety Valve - Boi Item	0.00	1.2
24	635	Slncr&Suprt-Starting Vent - Pack Blr	0.25	1.2
24	640	Sample Cooler And Supports	0.28	1.2
24	641	Sample Cooler & Supports - Os Items	0.10	1.2
24	642	Sample Cooler & Supports - Dd Items	0.00	1.2
24	660	Valves (Bhel) Pack Blr	0.77	1.2
24	665	Valves & Fittings (Sd) Pack Blr	0.07	1.2
24	680	Erv And Safety Valves(Bhel)	0.18	1.2
24	685	Safety Valve/Erv Silencers(Bhel)	1.10	1.2
24	700	Bulked Bps Components For Trim Pipes	0.06	1.2
24	955	Lapping Tools For Sv&Erv	0.01	1.2
24	960	Lapping Tools For Conventional Val(Bhel)	0.01	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
24	992	Imported Electrodes-Trim Piping	0.01	1.2
24	993	Consumables & Erection Materials	0.00	1.2
24	994	Name Plates	0.06	1.2
PG 24 TOTAL			7.108	1.2
31	010	Skin Casing Comps Welded To Pressure P	0.40	1.2
31	301	Miscellaneous Casing	1.65	1.2
PG 31 TOTAL			2.05	1.2
42	152	Piping,Opr'G Floor Lfo	0.50	1.2
42	200	Subdelivery Fuel Oil System	0.20	1.2
42	300	Bhel Valve F.O. System	0.10	1.2
42	700	Bps Fasteners	0.05	1.2
PG 42 TOTAL			0.85	1.2
80	300	MS FROM SUPERHEATER TO BOILER STOP VALVE	2.00	1.2
80	345	AUX STEAM TO DEAERATING HEATER	3.50	1.2
80	366	IBD TANK VENT TO ATMOSPHERE	0.85	1.2
80	417	BOILER FEED DISCHARGE PIPING	0.75	1.2
80	418	ERECTION MATERIALS FOR INSTRUMENTS	0.16	1.2
80	420	BOILER FEED PUMP SUCTION	0.70	1.2
80	421	BOILER FEED PUMP RECIRCULATION	0.25	1.2
80	446	DEAERATING HEATER OVER FLOW AND DRAIN	0.55	1.2
80	450	CBD AND EMERGENCY DRUM DRAIN	0.35	1.2
80	451	BOILER INTEGRAL PIPING DRAINS	0.40	1.2
80	453	LP PIPING DRAINS - SG SCOPE	0.25	1.2
80	460	SG AUX COOLING WATER UNIT SYSTEM	0.83	1.2
80	473	DEMINERALISED WATER SYSTEM	0.68	1.2
80	600	HIGH PRESSURE DOSING PIPING	0.15	1.2
80	601	LOW PRESSURE DOSING PIPING	0.10	1.2
80	612	SERVICE AIR FOR INDIVIDUAL UNITS	0.35	1.2
80	616	INSTRUMENT AIR FOR INDIVIDUAL UNIT	0.47	1.2
80	650	FUEL OIL SUPPLY AND RETURN PIPING	2.10	1.2
80	901	SUB DELIVERY VALVES FOR LIGHT UP	0.80	1.2
80	920	H AND S FOR HYDRO TEST	2.30	1.2
80	921	H AND S FOR LIGHT UP STEAM LINE	3.10	1.2
80	922	H AND S FOR LIGHT UP - NON STEAM LINES	1.20	1.2
80	936	VLH AND CLH for SG PPG -HERP	1.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
80	992	WELDING ELECTRODES-1	0.03	1.2
PG 80 TOTAL			22.855	1.2
81	005	INTERMITTENT BLOW DOWN EXPANDER-D1500 MM	2.40	1.2
81	026	TRAY TYPE DEAERATOR BELOW 100 cuM/HR	23.00	1.2
81	034	PLATFORM & STAIRS FOR FEED TANK & DEARTR	2.80	1.2
PG 81 TOTAL			28.2	1.2
PRESSURE PARTS TOTAL			135.69	
20	301	Rotary Soot Blower Elec Optd-D5e	0.27	1.3
20	304	Wall Box Non Pressurised For Rb	0.08	1.3
20	621	Blowing Element For Rb	0.04	1.3
20	998	Special Tools For Soot Blowers	0.01	1.3
PG 20 TOTAL			0.4	1.3
28	220	Doors	1.80	1.3
PG 28 TOTAL			1.8	1.3
30	215	Main Boiler enclosure	0.60	1.3
PG 30 TOTAL			0.6	1.3
41	200	Sv-Burner Assy With Oil Gun	2.50	1.3
41	500	High Energy Arc Ignitor	0.10	1.3
PG 41 TOTAL			2.6	1.3
42	001	Pneumatic Fittings	0.01	1.3
42	002	Steam Blow Materials	0.20	1.3
42	005	Instrument Fittings	0.05	1.3
42	010	Lfo Pump Set	2.00	1.3
PG 42 TOTAL			2.255	1.3
48	082	Duct-Sa Scaph Bypass	5.82	1.3
48	084	Expjt-Sa Scaph Bypass	0.23	1.3
48	200	Instrument Tappings On Ducting	0.19	1.3
48	207	Flowmeters For Secondary Air Flow	1.14	1.3
48	332	Sqduct,Boiler-Chimney	5.31	1.3
48	334	Support,Boiler-Chimney	0.53	1.3
48	335	Supportsetcfluegas Ducts System	0.57	1.3
48	700	Bulked Bps Components	0.04	1.3
48	911	Slide Brg Plate & Pacific Bellow-Boiler	0.05	1.3
48	915	Man Hole Doors (450x450)	0.23	1.3
48	993	Erection Materials	0.65	1.3
PG 48 TOTAL			14.755	1.3
57	13	DAMPER-FD FAN OUTLET	2.30	1.3
57	577	ELECT ACTUATOR FOR GATE,DAMPER	0.20	1.3
PG 57 TOTAL			2.5	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
81	127	LOW PRESSURE DOSING SYSTEM	0.10	1.3
81	128	HIGH PRESSURE DOSING SYSTEM	1.00	1.3
PG 81 TOTAL			1.1	1.3
87	10	CHIMNEY FDN MATERIAL	2.00	1.3
87	100	CHIMNEY SHELL	23.42	1.3
87	150	CHIMNEY STRAKES	1.80	1.3
87	200	PAINTER TROLLEY	0.58	1.3
87	300	PLATFORMS & LADDERS	3.30	1.3
87	930	AVIATION LAMPS	0.50	1.3
PG 87 TOTAL			31.6	1.3
NON PRESSURE PARTS TOTAL			57.61	
56	0	TOOLS & FIXTURE/CONT	0.30	1.4
56	11	FD FAN FOUNDATION MATL	0.50	1.4
56	114	RADIAL FD FAN ROTOR	2.00	1.4
56	314	RADIAL FD FAN BEARINGS	0.85	1.4
56	414	RADIAL FD FAN STATOR	7.00	1.4
56	810	RADL FDFAN COUPLING	0.06	1.4
56	911	FD FAN SILENCER	1.60	1.4
PG 56 TOTAL			12.31	1.4
81	104	BOILER FEED PUMP	3.50	1.4
PG 81 TOTAL			3.5	1.4
ROTATING MACHINES TOTAL			15.81	
GRAND TOTAL (AUXILIARY BOILER)			288.11	

1.9.2.4. INSULATION UNIT – 1

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
33	210	MAIN BLR CAST REF GR	155.00	1.8
33	230	MAIN BLR POUR INSUL	65.00	1.8
33	201	Main Blr Formed Refractory Is8	7.90	1.8
33	212	Main Blr Castable Refractory Gr C	25.00	1.8
CASTABLE & POURABLE TOTAL			252.90	
33	221	DUCT MINERAL WOOL	616.00	1.9
79	67	MIN WOOL FOR ESP INSULATION	265.00	1.9
33	021	BLR PP MINRL WOOL	697.50	1.9
33	924	MISC EQPTS PCK MATLS	0.28	1.9
55	919	AXIAL FD FAN INSULATION WOOL	18.40	1.9
55	939	AXIAL PA FAN INSULATION WOOL	12.00	1.9
81	325	MINERAL WOOL MATTRESS (Part)	2.25	1.9
33	021	Blr Pr Parts Mineral Wool	6.50	1.9
81	341	MINERAL WOOL MATTRESS	1.80	1.9

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
87	950	CHIMNEY INSULATION	6.60	1.9
MINERAL WOOL SUBTOTAL			1626.33	
32	010	FICOM BLR PP INSUL	4.90	1.10
32	210	FIX COMP-DUCT INSULN	89.00	1.10
33	970	MISC EQPTS EXP METAL	11.50	1.10
37	810	BLR OUTER CASING	53.80	1.10
81	318	FIX COM FOR MISCELLANEOUS PPG INSULATION (Part)	0.18	1.10
79	68	FIXING COMP. FOR ESP INSULATIN	62.00	1.10
32	010	Fixing Comp For Blr Pr Parts Insul	3.00	1.10
37	010	Blr Outer Casing Components	0.55	1.10
37	810	Blr Outer Casing	1.05	1.10
87	960	CHIMN INS FIX COMP	1.80	1.10
81	325	FIX COM FOR MISCELLANEOUS PPG INSULATION	0.55	1.10
FIXING/IRON COMPONENTS SUBTOTAL			228.33	
33	975	MISC EQPTS SEAL COMP	0.50	1.11
37	010	BLR OUTER CSG COMPS	48.00	1.11
81	341	SEALING COMPOUND FOR INSL (Part)	0.03	1.11
81	350	ALUMINIUM CLADDING FOR INSULATION (Part)	1.50	1.11
79	6	INSULATOR HOUSING AS	55.00	1.11
89	615	INSULATION CLADDING SH FOR ESP	76.00	1.11
81	350	SEALING COMPOUND FOR INSL	0.03	1.11
81	411	ALUMINIUM CLADDING FOR INSULATION	1.30	1.11
ALUMINIUM SHEETS/HOUSING SUBTOTAL			182.36	
INSULATION SUBTOTAL			2289.91	

1.9.2.5. ESP UNIT 1:

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
79	1	ROLL/SLIDE SUPPORTS	25.00	1.6
79	5	ESP-SUB-DELIVERY COMPONENTS	0.60	1.6
79	8	GAS DIST. ASSY	77.00	1.6
79	9	GD-RAPPING MECHANISM	16.00	1.6
79	10	GD_DRIVE ARRANGEMENT	1.00	1.6
79	11	GAS SCREEN-EP	7.00	1.6
79	13	EMIT SYST SUSPENSION	18.00	1.6
79	14	SUPPORT INSULATORS	12.00	1.6

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
79	15	EMITTING ELECTRODES	30.00	1.6
79	16	EMIT ELECT RAPP MECH	42.00	1.6
79	17	DRIVE ARGT. FOR EMIT. SYS	37.00	1.6
79	19	COL ELEC SUSPENSION	136.00	1.6
79	20	COLLECTING ELECTRODE	1365.00	1.6
79	21	EMIT SYS FRAME-TOP	142.00	1.6
79	22	EMIT SYS FRAME BOTOM	161.00	1.6
79	23	INSPECTION DOORS	14.00	1.6
79	24	SHOCK BARS	109.00	1.6
79	25	COLL ELECT RAPP MECH	90.00	1.6
79	26	COLL ELEC RAPP DRIVE	7.20	1.6
79	28	ESP ROOF BEAM	191.00	1.6
79	31	GEARED MOTORS FOR RAPPING MECH	23.00	1.6
79	32	EMIT SYS FRAME-MIDLE	224.00	1.6
79	42	OUTER ROOF-EP	280.00	1.6
79	43	HOPPER RIDGES	78.00	1.6
79	44	HOPPER UPPER PART	315.00	1.6
79	45	HOP MLD&LOWER PART	520.00	1.6
79	46	INSULATOR SUPP PANEL	119.00	1.6
79	47	ROOF PANEL ASSY	168.00	1.6
79	48	CASING STRUCTURE	390.00	1.6
79	49	CASING SHELL/PANEL	572.00	1.6
79	50	INLET-OUTLET FUNNEL	197.00	1.6
79	55	PENT HOUSE FOR E P	155.00	1.6
79	57	SPLITTER&GUIDE VANES	30.00	1.6
79	61	EP PERF TEST EQUIPT	7.00	1.6
79	63	ASH LEVEL INDICATOR	1.80	1.6
79	65	APP PLATFORM-HOPPER	140.00	1.6
79	66	WATER WASHING SYSTEM	6.00	1.6
79	72	INTERLOCKS-EP	1.60	1.6
79	73	ELECTRICALLY OPERTD HOIST& ACCE	7.00	1.6
79	74	OPACITY MONITOR & ACCESSORIES	0.50	1.6
79	80	FOUNDATION MATLS FOR ESP	28.00	1.6
79	81	SUPPOTING STRUCTURES FOR ESP	625.00	1.6
79	89	GUIDE PLATE/VANE EP INLET DUCT	15.00	1.6
79	90	HEATING ELEMENTS	4.00	1.6
79	996	TOOLS & TACKLES	0.30	1.6
89	610	EP GALLERIES&STAIRS	65.00	1.6

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
89	611	ESP ROOF HANDRAILS	9.00	1.6
89	612	FLOOR GRILL AND STEP TREAD	46.00	1.6
89	613	FLOOR GRILL AND MOBILE LADDER	56.00	1.6
89	614	PENT HOUSE ROOFING SHEETS	40.00	1.6
XX	XX	HVR TRANSFORMERS RECTIFIER	160.00	1.6
ESP Total			6764.00	
39	012	FOUNDATION MATERIALS	34.82	1.7
39	101	COLUMNS FRAMES BEFOR	138.90	1.7
39	102	COLUMNS FRAMES BEFOR	345.41	1.7
39	141	COLS FRAMES NEAR ID	128.84	1.7
39	142	COLS FRAMES NEAR ID	316.06	1.7
39	150	COL FRAMES BETN I.D.	149.19	1.7
39	299	Platforms - Before ESP	140.88	1.7
39	300	PLATFORMS - AFTER ESP	94.52	1.7
39	700	HSFG FASTENERS FOR P	0.63	1.7
39	810	FLOOR GRILL	33.88	1.7
39	820	STAIRS	18.41	1.7
39	850	HAND RAIL AND HAND R	35.99	1.7
39	993	CONSUMABLES AND EREC	10.27	1.7
48	018	MISC. DUCT&SPRT MATL	50.00	1.7
48	019	AIRDUCT SUP FDN MATL	3.20	1.7
48	141	SEAL AIR HAG&ID GATE-PARTIAL	5.00	1.7
48	200	INS TAPPINGS ON DUCT-PARTIAL	1.50	1.7
48	395	CLH/VLH-FLUE GAS-PARTIAL	4.85	1.7
48	462	DUCT - BLROUTFL-EP	400.00	1.7
48	464	EXPJT - BLROUTFL-EP	45.60	1.7
48	465	SUPORT BLR OUTFL-EP	35.50	1.7
48	482	DUCT - ESP TO ID FAN	400.00	1.7
48	484	EXPNJ - ESP TO ID FAN	25.00	1.7
48	485	SUPPORT - ESP TO ID FAN	30.00	1.7
48	492	DUCT - IDFAN-CHIMNY	360.00	1.7
48	494	EXPNJ - IDFAN-CHIMNY	11.20	1.7
48	495	SUPORT IDFAN-CHIMNEY	25.00	1.7
48	700	BULKED BPS COMPONENT-PARTIAL	3.50	1.7
48	912	Slide Brg PI-Id Sys	1.50	1.7
48	915	Man Hole Doors (450X450)-PARTIAL	4.50	1.7
48	993	ERECTON-MATERIALS-PARTIAL	10.00	1.7
57	430	FLUE GAS AH OUT GATE	67.00	1.7
57	443	DAMPER APH TO CHIMNEY - GAS	41.30	1.7
57	460	GATE-ESP INLET	55.50	1.7

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
57	466	PLATFORMS AND LADDERS	72.00	1.7
57	470	GATE-ESP OUTLET	55.50	1.7
57	480	GATE-ID FAN INLET	68.00	1.7
57	490	GATE-ID FAN OUTLET	62.80	1.7
57	491	BLOWER WITH MOTOR	18.40	1.7
57	497	KNIFE GATE VALVE	16.55	1.7
57	577	ELECT ACTUATOR FOR GATE,DAMPER-PARTIAL	23.75	1.7
57	578	ELECTRICAL ITEMS FOR GATE,DAMP- PARTIAL	0.03	1.7
57	988	DUCTS COMMISSIONING SPARES	0.03	1.7
ESP - NON PRESSURE PARTS SUBTOTAL			3345.01	
GRAND TOTAL (ESP & AUX - UNIT 1)			10109.01	

1.9.2.6. BOILER & AUX - UNIT 2

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
34	100	BUNKER BAY COLUMNS	663.00	1.1
34	200	BUNKER SUPPORT BEAMS	520.00	1.1
34	300	BUNKER BAY HORIZONTAL BRACINGS	22.50	1.1
34	390	Misc Structures	171.30	1.1
34	400	Bunker Bay Horz.Beams	394.76	1.1
34	500	Bunker Bay Vertical Bracings	242.04	1.1
34	810	FLOOR GRILLS	6.90	1.1
34	820	STAIRS	4.70	1.1
34	850	HAND RAILS	10.80	1.1
PG 34 TOTAL			2036.00	1.1
35	010	FOUNDATION MATERIALS	33.83	1.1
35	111	Main Columns Left 1st Pass	319.16	1.1
35	112	Main Columns Left 2nd Pass	452.40	1.1
35	121	Main Columns Right 1st Pass	307.50	1.1
35	122	Main Columns Right 2nd Pass	452.39	1.1
35	130	Main Columns Middle	349.48	1.1
35	140	Auxiliary Columns-Left Side	791.75	1.1
35	150	Auxiliary Columns-Rightside	650.97	1.1
35	190	GIRDER PIN CONNECTIO	20.55	1.1
35	211	CEILING STRUCTUREMAI	398.99	1.1
35	212	CEILING STRUCTUREMAI	475.70	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
35	213	CEIL STRUCT -CROSS W	129.65	1.1
35	214	CEIL STRUCT -CROSS W	84.23	1.1
35	221	CEILING STRUCTURE RO	49.62	1.1
35	222	CEILING STRUCTURE RO	45.68	1.1
35	231	CEILING STRUCTURE HO	66.04	1.1
35	232	CEILING STRUCTURE HO	54.05	1.1
35	311	HORIZONTAL BRACING I	28.69	1.1
35	312	HORIZ BRACING II PAS	26.05	1.1
35	321	HORIZ BRACING I PASS	22.93	1.1
35	322	HORIZ BRACING II PAS	36.02	1.1
35	331	HORIZ BRACING I PASS	34.35	1.1
35	332	HORIZ BRACING II PAS	23.97	1.1
35	341	HORIZ BRACING I PASS	62.23	1.1
35	342	HORIZ BRACING II PAS	45.48	1.1
35	351	HORIZ BRACING I PASS	28.28	1.1
35	352	HORIZ BRACING II PAS	23.61	1.1
35	361	HORIZ BRACING I PASS	35.06	1.1
35	362	HORIZ BRACING II PAS	38.96	1.1
35	381	Landing & Connecting Platforms Tier-1	67.36	1.1
35	382	Landing & Connecting Platforms Tier-2	31.73	1.1
35	383	Landing & Connecting Platforms Tier-3	107.72	1.1
35	384	Landing & Connecting Platforms Tier-4	26.33	1.1
35	385	Landing & Connecting Platforms Tier-5	27.09	1.1
35	386	Landing & Connecting Platforms Tier-6	51.96	1.1
35	387	Landing & Connecting Platforms Tier-7	42.13	1.1
35	390	MISC STRUCTURES	32.46	1.1
35	441	Horil Beams First Pass-Tier-1	113.62	1.1
35	442	Horil Beams First Pass-Tier-2	70.20	1.1
35	443	Horil Beams First Pass-Tier-3	108.25	1.1
35	444	Horil Beams First Pass-Tier-4	60.71	1.1
35	445	Horil Beams First Pass-Tier-5	68.33	1.1
35	446	Horil Beams First Pass-Tier-6	87.48	1.1
35	447	Horil Beams First Pass-Tier-7	46.83	1.1
35	451	Hor Beam-Second Pass- Tier-1	86.42	1.1
35	452	Hor Beam-Second Pass- Tier-2	70.70	1.1
35	453	Hor Beam-Second Pass- Tier-3	109.92	1.1
35	454	Hor Beam-Second Pass- Tier-4	46.44	1.1
35	455	Hor Beam-Second Pass- Tier-5	68.49	1.1
35	456	Hor Beam-Second Pass- Tier-6	66.91	1.1
35	457	Hor Beam-Second Pass- Tier-7	55.45	1.1
35	511	Front Bracing-Tier-1	50.08	1.1
35	512	Front Bracing-Tier-2	12.99	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
35	513	Front Bracing-Tier-3	24.58	1.1
35	514	Front Bracing-Tier-4	21.90	1.1
35	515	Front Bracing-Tier-5	17.43	1.1
35	516	Front Bracing-Tier-6	26.05	1.1
35	517	Front Bracing-Tier-7	13.58	1.1
35	521	Side Bracing-Tier-1	67.03	1.1
35	522	Side Bracing-Tier-2	45.60	1.1
35	523	Side Bracing-Tier-3	82.03	1.1
35	524	Side Bracing-Tier-4	45.32	1.1
35	525	Side Bracing-Tier-5	37.63	1.1
35	526	Side Bracing-Tier-6	43.67	1.1
35	527	Side Bracing-Tier-7	32.14	1.1
35	531	Rear Bracing-Tier-1	134.56	1.1
35	532	Rear Bracing-Tier-2	34.61	1.1
35	533	Rear Bracing-Tier-3	40.56	1.1
35	534	Rear Bracing-Tier-4	31.29	1.1
35	535	Rear Bracing-Tier-5	26.86	1.1
35	536	Rear Bracing-Tier-6	33.42	1.1
35	537	Rear Bracing-Tier-7	24.27	1.1
35	700	HSFG FASTENERS	72.00	1.1
35	701	HSFG FASTENERS	5.37	1.1
35	811	FLOOR GRILLS AND GUARD PLATE	151.12	1.1
35	812	Edge Strip And Guard Plate	15.45	1.1
35	821	STAIRS - LOWER	8.67	1.1
35	822	STAIRS - MIDDLE	9.32	1.1
35	823	STAIRS - UPPER	11.55	1.1
35	851	HAND RAILS AND POSTS	31.68	1.1
35	993	CONSUMABLES AND ERECTI	10.34	1.1
35	995	CHUTE PIPE AND LADDE	34.06	1.1
PG 35 TOTAL			7729.09	1.1
36	110	COLUMNS NEAR AIR PRE	1222.64	1.1
36	130	Middle Columns In Boiler	559.43	1.1
36	150	BEAMS AND BRACINGS NEA	736.77	1.1
36	311	MAIN FLOOR I MBL 1ST	23.59	1.1
36	312	MAIN FLOOR I MBL 2ND	35.92	1.1
36	313	NON-MBL FLOOR BETWEEN	79.08	1.1
36	314	NON-MBL FLOOR BETWEEN	87.22	1.1
36	315	NON-MBL FLOOR BETWEEN	74.19	1.1
36	316	NON-MBL FLOOR BETWEEN	149.56	1.1
36	321	MAIN FLOOR II MBL 1ST	31.51	1.1
36	322	MAIN FLOOR II MBL 2ND	23.91	1.1
36	323	NON-MBL FLOOR BETWEEN	38.32	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
36	324	NON-MBL FLOOR BETWEE	114.67	1.1
36	325	NON-MBL FLOOR BETWEE	61.72	1.1
36	326	NON-MBL FLOOR BETWEE	31.79	1.1
36	331	MAIN FLOOR III MBL 1	59.42	1.1
36	332	MAIN FLOOR III MBL 2	54.33	1.1
36	333	NON-MBL FLOOR BETWEE	87.47	1.1
36	334	NON-MBL FLOOR BETWEE	91.39	1.1
36	335	NON-MBL FLOOR BETWEE	115.82	1.1
36	336	NON-MBL FLOOR BETWEE	22.87	1.1
36	337	NON-MBL FLOOR BETWEE	52.79	1.1
36	338	NON-MBL FLOOR BETWEE	53.51	1.1
36	341	MAIN FLOOR IV MBL 1ST	25.34	1.1
36	342	MAIN FLOOR IV MBL 2ND	17.02	1.1
36	343	NON-MBL FLOOR BETWEE	46.70	1.1
36	344	NON-MBL FLOOR BETWEE	45.76	1.1
36	345	NON-MBL FLOOR BETWEE	58.18	1.1
36	346	NON-MBL FLOOR BETWEE	25.53	1.1
36	351	MAIN FLOOR V MBL 1ST	35.19	1.1
36	352	MAIN FLOOR V MBL II ND	20.96	1.1
36	353	NON-MBL FLOOR BETWEE	70.78	1.1
36	354	NON-MBL FLOOR BETWEE	56.71	1.1
36	355	NON-MBL FLOOR BETWEE	85.83	1.1
36	356	NON-MBL FLOOR BETWEE	38.04	1.1
36	361	MAIN FLOOR VI MBL 1ST	61.42	1.1
36	362	MAIN FLOOR VI MBL 2ND	42.47	1.1
36	363	NON_MBL FLOOR ABOVE	39.72	1.1
36	364	NON MBL FLOOR ABOVE MBL VI	38.29	1.1
36	365	NON MBL FLOOR ABOVE MBL VI	20.52	1.1
36	366	NON MBL FLOOR ABOVE MBL VI	46.16	1.1
36	391	MISCELLANEOUS PLATFO	148.86	1.1
36	392	MISCELLANEOUS PLATFO	100.45	1.1
36	393	APH, SCAPH, HANDLING	30.39	1.1
36	394	MISCELLANEOUS PLATFO	0.27	1.1
36	395	MISCELLANEOUS PLATFO	178.21	1.1
36	610	BOILER ROOF STRUCTUR	213.51	1.1
36	611	BOILER ROOF SHEETING	51.67	1.1
36	613	RAIN WATER PIPES and	24.81	1.1
36	620	BOILER SIDE CLADDING	84.83	1.1
36	621	BOILER SIDE CLADDING	25.00	1.1
36	700	Hsfg Bolts	2.80	1.1
36	740	POSTS AND HANGERS	5.79	1.1
36	811	FLOORGRILLSANDGUARDP	177.65	1.1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
36	812	FLOORGRILLSANDGUARDP	119.73	1.1
36	813	FLOORGRILLSANDGUARDP	85.40	1.1
36	814	FLOORGRILLSANDGUARDP	32.72	1.1
36	820	STAIRS AND LADDERS	31.17	1.1
36	851	HANDRAILS AND POSTS	73.54	1.1
36	852	HANDRAILS AND POSTS	31.51	1.1
36	853	HANDRAILS AND POSTS	26.23	1.1
PG 36 TOTAL			6027.05	1.1
38	210	INTER CONN PLATFORMS	31.05	1.1
38	299	MILL HANDLING MONORA	175.26	1.1
38	310	CONN PLATFORMS TO MI	40.95	1.1
38	381	ECO HANDLING STRUCTU	50.25	1.1
38	410	MILL MAINTANANCE PLA	117.36	1.1
38	510	LIFT BEAMS AND BRACI	74.73	1.1
38	610	ELEVATOR CLADDING ST	91.26	1.1
38	611	ELEVATOR CLADDING SH	59.41	1.1
38	710	LIFT MACHINE ROOM DE	74.24	1.1
38	810	FLOORGRILLS AND GUAR	166.71	1.1
38	820	STAIRS AND LADDERS	59.16	1.1
38	850	HAND RAILS AND HAND	49.77	1.1
PG 38 TOTAL			990.14	1.1
39	301	STRUC AND PLATFORM F	1.86	1.1
39	302	STRUC FOR MOTOR HOOD	9.24	1.1
39	304	FAN HANDLING STRUCTU	32.15	1.1
39	305	FAN HANDLING STRUCTU	6.53	1.1
39	306	FAN HANDLING STRUCTU	82.42	1.1
39	700	HSFG FASTENERS FOR P	0.63	1.1
39	810	FLOOR GRILL	33.88	1.1
39	820	STAIRS	18.41	1.1
39	850	HAND RAIL AND HAND R	35.99	1.1
39	993	CONSUMABLES AND EREC	10.27	1.1
PG 39 TOTAL			231.38	1.1
STRUCTURALS TOTAL			17013.66	
04	147	Suprts for Collectr & Separatr Vessel	22.00	1.2
04	321	VERTICAL SEPARATOR	26.00	1.2
04	323	STORAGE TANK	43.50	1.2
04	347	Seperator/Collecting Vessel Supp DD	0.30	1.2
04	547	Seperator/Collecting Vessel Supp Shop	2.20	1.2
PG 04 TOTAL			94.00	1.2
05	137	EVAPORATOR INLET HDR - FRNT	15.50	1.2
05	147	FUR LWR REAR INLET HDR	15.50	1.2
05	155	FUR LWR SIDE INLET HDRS	13.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
05	227	FUR UPPER REAR OUTLET HDR	12.00	1.2
05	231	FUR UPPER FRNT OUTLET HDR	9.00	1.2
05	251	FUR UPPER SIDE OUTLET HDRS	16.00	1.2
05	327	FUR INTERMEDIATE REAR HDR	11.00	1.2
05	330	FUR INTERMEDIATE FRNT HDR	11.00	1.2
05	350	FUR INTERMEDIATE SIDE HDRS	20.00	1.2
PG 05 TOTAL			123.00	1.2
06	400	FUR BURNER PANELS	41.00	1.2
06	401	Burner Panel- OS	0.20	1.2
06	431	Front Upper Ww Panel Attachment	0.20	1.2
06	434	Front Intermediate WW Panel -OS	15.00	1.2
06	437	Front WW Lower Panel-OS	40.00	1.2
06	441	Rear Upper WW Panel -OS	0.05	1.2
06	444	Rear Intermediate WW Panel -OS	40.00	1.2
06	447	Rear Lower WW Panel -OS	35.00	1.2
06	451	Side Upper Ww Panel Attachment	0.20	1.2
06	453	Side Intermediate WW Panel -OS	60.00	1.2
06	455	Side Lower WW Panel -OS	9.54	1.2
06	500	FUR SOFA PANELS	13.00	1.2
06	501	Sofa Panels -OS	0.21	1.2
06	515	H&S For Start-Up System - Boi Items	13.00	1.2
06	731	FUR VERTICAL WALL PANELS - FRNT	55.00	1.2
06	732	FRONT WW PNL + ATT	55.00	1.2
06	734	FUR UPPER FRNT SPIRAL PANEL	80.00	1.2
06	735	FUR FRNT SPIRAL TO VERTICAL TRANS. PANEL	7.00	1.2
06	737	FUR LWR FRNT SPRL PNL WITH I/T TERM TUBE	45.00	1.2
06	741	FUR REAR ARCH PANELS	50.00	1.2
06	744	FUR UPPER REAR SPIRAL PANEL	80.00	1.2
06	745	FUR REAR SPIRAL TO vert TRANSITION PANEL	7.50	1.2
06	747	FUR LWR RR SPRL PNL WITH I/T TERM TUBES	55.00	1.2
06	751	FUR VERTICAL WALL PANELS - SIDE	70.00	1.2
06	752	FUR LWR VERTICAL WALL PANELS - SIDE	100.00	1.2
06	753	FUR UPPER SIDE SPIRAL PANELS	122.50	1.2
06	755	FUR LWR SIDE SPIRAL PANELS	45.00	1.2
06	759	FUR SIDE SPIRAL TO VERT TRANSITION PANEL	12.00	1.2
PG 06 TOTAL			1051.40	1.2
07	102	LINKS FROM SEPARATOR TO	27.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
		STORAGE TANK		
07	110	DOWNCOMER TO CONNECTING SPHERE	7.50	1.2
07	125	Connecting Sphere	3.00	1.2
07	223	FUR SCREEN AND HANGER ASSEMBLY	70.00	1.2
07	231	FUR SPIRAL WALL OUTLET TERM TUBES	2.30	1.2
07	232	FUR VERTICAL WALL INLET TERM TUBES	10.00	1.2
07	302	Ww Front Header Suspns DD Item	0.01	1.2
07	309	Furnace Wall Supports Front-DD	1.00	1.2
07	315	FUR SIDE RISERS	37.00	1.2
07	316	FUR REAR RISERS	22.39	1.2
07	317	FURN STORAGE TANK VENT LINK	5.00	1.2
07	318	FUR FRNT RISERS	12.00	1.2
07	331	Riser Tube Support DD Item	0.03	1.2
07	361	Furnace Wall Support Rear DD Item	1.30	1.2
07	362	Furnace Wall Support Side L&R DD Item	0.60	1.2
07	393	Consumables & Erection Materials-DD	0.07	1.2
07	402	WW FRT HDR SUSPN	3.00	1.2
07	403	WW SIDE HDR SUSPN	1.30	1.2
07	405	WW SCR.HDR SUSPN.	25.00	1.2
07	409	Furnace wall Supports front	28.00	1.2
07	423	Furnace Screen Tubes Attachment	1.00	1.2
07	431	RISER TUBE SUPPORT	4.00	1.2
07	460	Furnace Spiral Wall supports Misc items	19.00	1.2
07	461	Furnace wall Supports rear	15.00	1.2
07	462	Furnace wall Supports Sides L & R	22.00	1.2
07	502	Ww Front Header Suspns Shop Item	1.15	1.2
07	503	Ww Side Header Suspension Shop Item	1.00	1.2
07	505	Ww Screen Header Suspns Shop Item	21.00	1.2
07	509	MISC PR.PART COMPNTS	0.67	1.2
07	531	Riser Tube Support Shop Item	1.50	1.2
07	560	Furnace Spiral Wall Support Shop Item	1.00	1.2
07	561	Furnace Wall Support Rear Shop Item	0.30	1.2
07	991	Welding Electrodes-Part-1	0.12	1.2
07	992	Welding Electrodes	0.23	1.2
07	993	EREC MATLS, CONSUMES	1.00	1.2
PG 07 TOTAL			345.47	1.2
08	001	FURN UPR BKSTYS-F&R	74.00	1.2
08	003	FURN UPR BKSTYS-SIDE	140.00	1.2
08	006	FURN INT BKSTYS	400.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
08	007	FURN LWR BKSTYS	55.00	1.2
08	111	FURN REAR ARCH BKSTYS	40.00	1.2
08	380	FURN BOT SUPRTS	170.00	1.2
08	382	H&S For Start-Up System - Boi Items	190.00	1.2
08	501	FURN B P BKSTYS-F&R	200.00	1.2
08	503	FURN B P BKSTYS-SIDE	230.00	1.2
08	901	FURN KEY BKSTYS-UPR	14.00	1.2
08	907	H&S For Start-Up System - Boi Items	1.10	1.2
08	910	EX.MOVT MEAS COMP	1.25	1.2
08	911	Bulk Bps Items-Upper	0.15	1.2
08	912	Bulk Bps Items-Inter	1.30	1.2
08	913	Bulk Bps Items-Lower	2.00	1.2
PG 08 TOTAL			1518.80	1.2
09	003	MATL FOR INST TAPPG	1.00	1.2
09	004	SEAL BOX FURN OPENG	15.60	1.2
09	005	SEAL BOX INST OPENG	3.40	1.2
09	303	Material For Instrument Insert Dd Item	0.10	1.2
09	304	Seal Boxes For Furnace Openings-DD	0.10	1.2
09	503	Material For Instrument Insert Shop Item	0.70	1.2
PG 09 TOTAL			20.90	1.2
10	135	FUR ARCH SUPPPORT INLET HDR	13.50	1.2
10	174	FINISH SH INLET HDR	25.00	1.2
10	178	SH PLATEN INLET HDR	25.00	1.2
10	182	BP LWR REAR HDR	16.00	1.2
10	183	BP UPPER SIDE INLET HDR	20.00	1.2
10	184	BP EXTENDED SIDE INLET HDR	12.00	1.2
10	185	BP LWR FRNT HDR	20.00	1.2
10	191	SH FUR ROOF INLET HDR	15.00	1.2
10	195	SH DIVN PANEL IN HDR	16.00	1.2
10	235	FUR ARCH SUPPPORT OUTLET HDR	14.00	1.2
10	274	FINISH SH OUTLET HDR	45.00	1.2
10	278	SH PLATEN OUTLET HDR	20.00	1.2
10	283	BP LWR SIDE HDRS	24.00	1.2
10	284	BP EXT FLOOR OUTLET HDR WITH TERM TUBES	10.00	1.2
10	285	BP FRNT OUTLET HDR	25.00	1.2
10	291	SH FUR ROOF OUTLET HDR	30.00	1.2
10	295	SH DIVN PANEL OUTHDR	2.00	1.2
PG 10 TOTAL			332.50	1.2
11	074	FINISH SH FRNT ASSY WITH I/T TERM & COT	421.00	1.2
11	078	SH PLATEN ASSY WITH TERM TUBES -	215.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
		LEFT		
11	095	SH DIVN PANEL LEFT	50.00	1.2
11	374	FINISH SH REAR ASSY WITH O/T TERM & COT	350.00	1.2
11	378	SH PLATEN ASSY WITH TERM TUBES - RIGHT	70.00	1.2
11	395	SH DIVN PANEL RIGHT	50.00	1.2
11	406	SH Frnt Upper Pnl Attachment	0.50	1.2
11	416	SH Rear Uppr Pnl Attachment	0.10	1.2
11	467	SH Sc Side Pnl Upper Left Attachment	0.01	1.2
11	469	SH Sw Panels Lower Front (L&R)-OS	0.05	1.2
11	474	SH Vertical Spaced Coil Attachment	0.38	1.2
11	487	BP LTRH Hanger Tube Atchment	0.37	1.2
11	491	SH Radient Roof Tubes (Left)-OS	0.05	1.2
11	494	SH Extended Bottom Panels-OS	0.01	1.2
11	606	BP FRNT WALL PANELS	70.00	1.2
11	684	BP EXTENDED SIDE FIN WELDED PANEL	28.00	1.2
11	694	BP EXTENDED SIDE FLOOR FIN WELDED PANEL	20.00	1.2
11	716	BP UPPER REAR PANEL	54.00	1.2
11	718	BP LWR REAR PANEL	55.00	1.2
11	767	BP UPPER SIDE PANEL-LEFT	55.00	1.2
11	768	BP INTER SIDE PANEL - LEFT	31.25	1.2
11	769	BP LWR SIDE PANEL - LEFT	38.75	1.2
11	787	BP REAR ROOF PANELS	50.00	1.2
11	791	SH FUR ROOF FIN WELDED PANEL	40.00	1.2
11	967	BP UPPER SIDE PANEL-RIGHT	50.60	1.2
11	968	BP INTER SIDE PANEL - RIGHT	28.75	1.2
11	969	BP LWR SIDE PANEL - RIGHT	35.60	1.2
11	991	SH FUR ROOF TUBES	40.00	1.2
PG 11 TOTAL			1754.42	1.2
12	178	LINK TO SH DESUPERHEATER	40.00	1.2
12	179	LINK TO FINISH SH INLET HDR	22.00	1.2
12	181	FUR ARCH SUPPORT LINKS	25.00	1.2
12	184	BP EXTENDED SIDE CONNECTION LINK	20.00	1.2
12	187	SH BYPASS PIPES	15.00	1.2
12	306	SH Spprt For Lines And Links DD Item	0.10	1.2
12	314	Suspns of SH R.Roof Headers DD Item	0.02	1.2
12	317	Suspns of R.Roof Headers DD Item	0.07	1.2
12	324	Suspension of SH Rear Wall DD Items	1.05	1.2
12	327	Suspension of SH Rear Wall DD Items	0.50	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
12	328	Suspension of SH Rear Wall DD Items	2.25	1.2
12	344	Suspn of Vert. Spaced Assy DD Item	0.03	1.2
12	348	Suspn of Vert. Spaced Assy DD Item	0.30	1.2
12	354	Suspn of Vert. Spaced Assy DD Item	0.04	1.2
12	368	RH Vert Platen Frnt Coil Left DD Item	25.00	1.2
12	393	SH Misc Components DD Item	0.21	1.2
12	395	SH DIVN PNL IN TUBE	15.00	1.2
12	403	SH Sc Spacer Tube Attachment	0.20	1.2
12	405	SH Hanger Tube Attachment	0.25	1.2
12	495	SH DIVN PNL OUT TUBE	19.50	1.2
12	514	Suspn of SH R.Roof Hdrs Shop Item	3.50	1.2
12	517	Suspn of R.Roof Headers Shop Item	0.95	1.2
12	524	Suspension of SH Rear Wall Shop Item	5.00	1.2
12	528	Suspension of SH Rear Wall Shop Item	0.15	1.2
12	544	Suspn of Vert. Spaced Assy Shop Item	2.00	1.2
12	548	Suspn of Vert. Spaced Assy Shop Item	1.45	1.2
12	554	Suspn of Vert. Spaced Assy Shop Item	3.50	1.2
12	568	RH Vert Platen Frnt Coil Left Shop Item	0.15	1.2
12	800	SH DESUP-STAGE II	8.00	1.2
12	803	SH STEAM COOLED SPACER TUBES	3.25	1.2
12	805	BP FRNT WALL SCREEN TUBES	45.00	1.2
12	850	SH CONNECTING PIPE	20.00	1.2
12	852	LINKS TO SH PLATEN INLET HDR	30.00	1.2
12	900	SH DESUPERHEATER	6.00	1.2
12	903	SH MISCL COMPONENTS	5.00	1.2
12	906	SH LINK SUPPORTS	2.70	1.2
12	907	RAD&RR ROOF SUPPORTS	4.00	1.2
12	914	EXPN-SH RAD ROOF HDR	5.50	1.2
12	917	SUSPN OF RADINT ROOF	17.50	1.2
12	924	SUSPN-SH BAKPASS HDR	22.00	1.2
12	927	SUSPN OF REAR ROOF	16.00	1.2
12	928	SUSPN - SH REAR WALL	40.00	1.2
12	944	SUSPN-SH PLATEN HDRS	4.00	1.2
12	948	SUSP-VERT SPACD ASSY	100.00	1.2
12	954	SUSP-VERT SPACD HDRS	3.50	1.2
12	968	SUSPN OF PLATEN ASSY	5.20	1.2
12	991	Welding Electrodes-Part-1	0.50	1.2
12	993	EREC MATLS, CONSUMES	6.15	1.2
12	994	PORT IN FOR THK MSMT	0.05	1.2
PG 12 TOTAL			547.56	1.2
15	136	LTRH INLET HDR	10.00	1.2
15	178	FINISH RH INLET HDR	12.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
15	236	LTRH OUTLET HDR	11.00	1.2
15	278	FINISH RH OUTLET HDR	30.00	1.2
PG 15 TOTAL			63.00	1.2
16	079	RH VERPLN FR COIL LT	229.00	1.2
16	201	LTRH UPPER ASSEMBLY	188.00	1.2
16	202	LTRH INTERMEDIATE ASSEMBLY	442.00	1.2
16	203	LTRH LWR ASSEMBLY WITH INLET TERM TUBES	190.00	1.2
16	270	LTRH PENDANT ASSY WITH O/T TERM TUBES	216.00	1.2
16	379	RH VERPLN FR COIL RT	27.00	1.2
PG 16 TOTAL			1292.00	1.2
17	174	LINK TO RH DESUPERHEATER	75.00	1.2
17	304	RH Sprrts For Lines And Links DD Item	0.03	1.2
17	306	RH Suprt For Lines And Links DD Item	0.02	1.2
17	319	RH Frnt Suspension DD Item	0.04	1.2
17	474	RH Cross Over Links-OS	0.50	1.2
17	476	RH V.S. Centre Cross Over Tube Attchmt	0.50	1.2
17	504	RH Suprts For Lines And Links Shop Item	3.50	1.2
17	506	RH Suprt For Lines And Links Shop Item	0.20	1.2
17	519	RH Frnt Suspension Shop Item	4.00	1.2
17	900	RH DESUPERHEATER	8.00	1.2
17	903	RH MISCL COMPONENTS	100.00	1.2
17	904	RH HDR SUPRT AB ROOF	15.00	1.2
17	906	RH SUPRT LINES & LIN	6.00	1.2
17	919	RH FRONT SUSPENSION	50.00	1.2
17	991	Welding Electrodes-Part-1	1.00	1.2
17	992	Welding Electrodes	1.13	1.2
PG 17 TOTAL			264.92	1.2
18	001	FUR ROOF SKIN CASING	19.51	1.2
18	002	1 PASS ROOF SKINCASG	0.15	1.2
18	010	PR PARTS ATTACH-CASG	0.30	1.2
18	701	Furnace Roof Skin Casing BOI Item	0.11	1.2
PG 18 TOTAL			20.07	1.2
19	306	Eco Supports For Line & Links DD Item	0.10	1.2
19	307	Eco Feed Pipe Suspn DD Item	0.10	1.2
19	506	Eco Supports For Line & Links Shop Item	0.10	1.2
19	507	Eco Feed Pipe Suspn Shop Item	0.10	1.2
19	701	ECO INLET HDR	35.00	1.2
19	702	ECO OUTLET HDR	22.00	1.2
19	753	ECO JUNCTION HDR	10.00	1.2
19	763	ECO JUNCTION HDR	10.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
19	783	ECO JUNCTION HDR	10.00	1.2
19	793	ECO JUNCTION HDR	10.00	1.2
19	802	ECO LWR HANGER TUBES	110.00	1.2
19	814	ECO UPPER ASSY - LEFT	275.00	1.2
19	824	ECO LWR ASSY -LEFT	280.00	1.2
19	850	ECO INLET LINKS	75.00	1.2
19	851	LINKS FROM ECO OUT. HDR TO ECO MIX LINE	85.00	1.2
19	853	LINKS FROM ECO MIX LINE TO FURN I/T HDRS	50.00	1.2
19	903	ECO.MISCL COMP	120.00	1.2
19	904	ECO HDR SUPT AB ROOF	82.00	1.2
19	905	ECO HDR SUPT BL ROOF	40.00	1.2
19	906	ECO LINE&LINK SUPORT	27.45	1.2
19	907	ECO,FEEDPIPE SUPPORT	15.00	1.2
19	914	ECO UPPER ASSY - RIGHT	275.00	1.2
19	924	ECO LWR ASSY-RIGHT	280.00	1.2
19	991	Welding Electrodes-Part-1	0.03	1.2
19	992	Welding Electrodes	0.10	1.2
PG 19 TOTAL			1811.98	1.2
21	600	S.B. PPG & FITTINGS	20.62	1.2
21	601	S.B PIPING SUPPORTS	0.90	1.2
21	602	Sb Piping - DD Items	1.63	1.2
21	603	Sb Piping - BOI Items	0.01	1.2
21	604	SB Piping Supports - OS items	5.62	1.2
21	605	SB Piping Supports - DD Items	0.01	1.2
21	606	SB Piping Supports - BOI Items	0.00	1.2
21	700	BULKED BPS COMP	0.26	1.2
21	800	SB VALVES (BHEL)	3.20	1.2
21	825	SB VALVES (SUBDELY)	0.30	1.2
21	850	SB SAFETY VALVE BHEL	0.05	1.2
21	992	WELDING ELECTRODES	0.06	1.2
21	987	COMMG SPARES SB SV	0.00	1.2
21	988	COMMG SPARES-SD	0.00	1.2
21	825	SB VALVES (SUBDELY)	0.00	1.2
PG 21 TOTAL			32.65	1.2
24	350	BLR FILLING PIPING	1.36	1.2
24	351	H&S BLR FILLING PPG	0.02	1.2
24	352	Boiler Fill Piping - DD Items	0.15	1.2
24	353	H&S For Boiler Fill Piping - OS Items	0.43	1.2
24	354	BOI Items for Blr Trim Piping	0.00	1.2
24	700	BULKED BPS COMP	0.22	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
24	800	BOILER TRIM PIPING	44.33	1.2
24	801	SUPPORTS-TRIM PIPING	0.40	1.2
24	803	Boiler Trim Piping - DD Items	0.36	1.2
24	804	Supports - Blr Trim Piping - OS Items	21.21	1.2
24	805	LINK TO BOILER RECIRCU SYSTEM	26.70	1.2
24	806	MIXING VESSEL	6.31	1.2
24	807	RECIRCU PUMP SUCTION LINE	23.58	1.2
24	808	RECIRCU PUMP DISCHARGE LINE	7.91	1.2
24	809	BOILR RECIR LINK FROM BF LINE	10.37	1.2
24	810	H and S FOR STARTUP SYSTEM	21.27	1.2
24	811	Fur Link to Flash tank HWL1&2	74.47	1.2
24	815	SPRAY WATER SYSTEM	34.83	1.2
24	817	H&S For Start-Up System - OS Items	11.95	1.2
24	818	H&S For Start-Up System - DD Items	0.13	1.2
24	820	EXHAUS PIPE SAFETY VLV	50.30	1.2
24	822	De-Superheater Pipes - OS Items	7.05	1.2
24	823	De-Superheater Pipes - DD Items	2.04	1.2
24	824	Exhaust Pipe For Sv - OS Items	11.21	1.2
24	825	SILENCER SUPPORTS	0.11	1.2
24	826	Silencer Supp - OS Items	57.00	1.2
24	827	Exhaust Pipe For Sv - DD Items	1.08	1.2
24	828	Exhaust Pipe For Sv - BOI Items	0.02	1.2
24	835	STARTUP VENT DIFFUSER SILEN SUP	0.50	1.2
24	836	Start-Up Vent, Diffuser, Sil Supp-OS	4.06	1.2
24	837	Start-Up Vent, Diffuser, Sil Supp-DD	0.01	1.2
24	840	SAMPLE COOLER AND SUPPORTS	0.63	1.2
24	841	Sample Cooler & Supports - OS Items	0.14	1.2
24	842	Sample Cooler and Suprts-DD items	0.01	1.2
24	855	RECIRCULATING PUMB COMP	19.53	1.2
24	860	VALVES (BHEL)	74.53	1.2
24	865	CTL VALVES FOR SPRAY PIPING SD	6.57	1.2
24	867	CTL VAL FOR STARTUP RECIRCU SYS	27.70	1.2
24	880	SAFETY VALVES	10.18	1.2
24	881	SAFETY VALVES AND ERV(BHEL) SD	0.43	1.2
24	885	SILENCERS(BHEL)	74.07	1.2
24	950	SPECIAL TOOLS	0.16	1.2
24	955	LAP TOOL SV&ERV	0.07	1.2
24	960	LAP TOOL-CON VAL(BHEL)	0.03	1.2
24	992	WELDING ELECTRODES-TRIM PPG	1.19	1.2
24	993	CONSUME & EREC MATLS	1.96	1.2
24	994	NAME PLATES	0.34	1.2
24	987	BHEL-SV/ERV COMG SPARES	0.01	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
24	988	COMMG SPARES/SD	0.02	1.2
24	989	BHEL VALVE COMG SPAR	0.02	1.2
24	860	VALVES (BHEL)	0.00	1.2
24	865	CTL VALVES FOR SPRAY PIPING SD	0.00	1.2
24	867	CTL VAL FOR STARTUP RECIRCU SYS	0.00	1.2
24	880	SAFETY VALVES	0.00	1.2
PG 24 TOTAL			636.94	1.2
31	010	COMPS WELDED TO PR	0.95	1.2
31	104	FUR REAR ARCH SKIN	2.30	1.2
PG 31 TOTAL			3.25	1.2
32	700	BULKED DD COMPONENT	28.50	1.2
32	810	EQUIPMENT OUTER CASING	248.50	1.2
PG 32 TOTAL			277.00	1.2
42	988	O&G SYS COMMG SPARE	0.01	1.2
PG 42 TOTAL			0.01	1.2
52	0	SPECIAL TOOLS/CONTRA	0.83	1.2
52	10	LARG AH-ROTOR ASSY	1037.00	1.2
52	11	LARG AH-ROTOR POST	48.20	1.2
52	12	LARG AH-ROTORPINRACK	6.95	1.2
52	13	LARG AH-ROTORSEALS	15.69	1.2
52	30	LARG AH-ROTORHOUSING	61.70	1.2
52	41	HOT END CONN PLATE	115.02	1.2
52	42	COLD END CONN PLATE	208.70	1.2
52	54	LARG AH-AXIAL SEAL	1.23	1.2
52	55	LARG AH-BY PASS SEAL	1.57	1.2
52	101	LARG AH-AUX ROTDRIVE	14.05	1.2
52	102	COMP AIR LINE PIPING	10.46	1.2
52	211	LARG AH-AIRSEAL PIPE	0.89	1.2
52	220	LARG AH-GENS DETAILS	3.01	1.2
52	261	LARG AH-GUIDE BEARNG	7.99	1.2
52	262	LARG AH-SUPRT BEARNG	18.76	1.2
52	271	OIL PIPING GUIDE BRG	0.53	1.2
52	272	OIL PIPING SUPRT BRG	0.54	1.2
52	274	LUB OIL CIRCULATION UNIT	1.11	1.2
52	275	LARGE AIR HEATER-LUBRICANTS	1.35	1.2
52	301	WASH MANIFLD GAS INL	2.27	1.2
52	302	WASH MANIFLD GAS OUT	2.27	1.2
52	339	LARGE AH-RETRACT CLNG DEV (HE)	1.50	1.2
52	340	LARG AH-CLEANINGEQPT	1.90	1.2
52	988	LARG AH COMMISSIONING SPARE	0.45	1.2
PG 52 TOTAL			1563.97	1.2
80	370	HP DRAIN FLASH TANK VENT TO	47.00	1.2

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
		ATMOSPHERE		
PG 80 TOTAL			47.00	1.2
81	36	CW STORAGE TANK 16-25 CUM	5.50	1.2
81	41	IMPURE CONDENSATE TANK	4.00	1.2
81	60	SPECIAL TANKS AND VESSELS	45.00	1.2
PG 81 TOTAL			54.50	1.2
PRESSURE PARTS TOTAL			11855.34	
20	051	LONG RETRACT SB M11E	67.95	1.3
20	054	WALL BOX NPR LRSB MI	1.30	1.3
20	201	WALL DESLAGGER RW5E	13.56	1.3
20	204	WALL BOX NPR-RW5E	2.19	1.3
20	511	DA HEAD VALVE ASSY	0.11	1.3
20	794	WALL BOX NPR FOR TP	0.06	1.3
20	962	TR PROBE DUP PT&AC	2.03	1.3
20	998	SPL TOOLS FOR SB	0.01	1.3
20	988	SB COMMG SPARES	0.01	1.3
PG 20 TOTAL			87.20	1.3
28	220	DOORS	13.00	1.3
28	700	BPS FASTENERS	4.50	1.3
PG 28 TOTAL			17.50	1.3
30	105	FUR BOTTOM ENCL FRAM	49.00	1.3
30	211	FUR REAR ARCH ENCL	5.20	1.3
30	215	MAIN BOILER ENCL	31.50	1.3
30	219	VERT ROOF ENCL	87.00	1.3
30	223	GAS DIST BAFFLES	0.50	1.3
30	224	Antivibration Baffles	11.95	1.3
30	233	1ST PASS DECK SPRT	34.00	1.3
30	234	2ND PASS DECK SPRT	33.00	1.3
30	235	ENCL SUPPORT STEEL	44.00	1.3
PG 30 TOTAL			296.15	1.3
41	350	ACOIL GUN ASSY	1.00	1.3
41	390	OIL GUN VICE&RACK	1.20	1.3
41	500	HEA IGNITOR	1.00	1.3
41	710	Oil Gun Assembly - DD items	0.01	1.3
41	988	O&G BURN COMMG SPARE	0.01	1.3
PG 41 TOTAL			3.21	1.3
42	001	PNEUMATIC FITTINGS	0.19	1.3
42	002	STEAM BLOW MATERIALS	0.00	1.3
42	005	INSTRUMENT FITTINGS	0.20	1.3
42	10	LFO PUMP SET	0.00	1.3
42	20	Hfo Pump Set	0.00	1.3
42	30	Hfo Heater Set	0.00	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
42	046	DO PUMP-MOTOR ASSY	0.15	1.3
42	065	DRAIN OIL TANK	2.80	1.3
42	070	BURNER STN SKID ASLY	5.60	1.3
42	120	PIPING,PH FUEL OIL	0.00	1.3
42	128	Piping,Pump House Steam - lbr	0.00	1.3
42	150	Piping, Operating Floor Hfo & Tracer	3.70	1.3
42	152	PIPING,OP.FLR LFO	1.16	1.3
42	154	PIPING,OP.FLR DO	0.53	1.3
42	157	PIPING,OP.FLR AIR	0.01	1.3
42	158	Piping,Opr'G Floor Steam-lbr	4.10	1.3
42	200	SUB.DEL FO SYSTEM	2.70	1.3
42	300	BHEL VALVE F.O. SYS	2.40	1.3
42	358	Bhel Valve,Opr'G Floor Stm-lbr	0.67	1.3
42	700	BULKED BPS COMPONENT	0.25	1.3
42	710	Fuel Oil System - DD Items	1.50	1.3
42	858	Fuel Oil System - Shop items	10.50	1.3
42	992	IMPORTED ELECTRODES	0.03	1.3
PG 42 TOTAL			36.49	1.3
43	004	ASSY SCNR&GUN AIR SY	5.00	1.3
43	005	ASSY MILL AIR SYSTEM	20.00	1.3
43	104	M/C SCNR&GUN AIR SYS	16.00	1.3
43	105	M/C MILL AIR SYSTEM	68.00	1.3
43	200	SUBDEL,IGNR,SCNR AIR	6.00	1.3
43	710	Seal Air & Scanner Air System - DD items	0.50	1.3
PG 43 TOTAL			115.50	1.3
45	200	Windbox - Sub Delivery	4.00	1.3
45	710	Wind Box & SOFA Assembly - DD items	0.20	1.3
45	801	WINDBOX AND SOFA TUBE ATTACH	32.00	1.3
45	802	WINDBOX ASSEMBLY - 32" WIDTH	175.00	1.3
45	804	WINDBOX - SOFA ASSEMBLY	47.50	1.3
45	805	WINDBOX SUPPT AIR CYL MOUNTG	30.00	1.3
45	858	Wind Box & SOFA Assy - Shop items	37.50	1.3
PG 45 TOTAL			326.20	1.3
47	200	Fuel Piping - Sub-delivery	17.50	1.3
47	261	Fuel Pipe Supports	30.00	1.3
47	263	Fuel Pipe Coupling , Collar,Gate Misc lte	17.50	1.3
47	269	St Pipes & Shop Bends For Rest Of Mills	372.00	1.3
47	710	Pulverised Fuel Piping - DD items	3.00	1.3
47	858	Fuel Piping - Shop items	30.00	1.3
PG 47 TOTAL			470.00	1.3
48	012	DUCT - -FDFAN TO A.H	170.00	1.3
48	014	EXP.JT - -FDFAN TO A.H	10.00	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
48	015	SUPPORT-FDFAN TO A.H	16.50	1.3
48	112	DUCT - -PAFAN-PRI-AH	150.00	1.3
48	114	EXP.JT - -PAFAN-PRI-AH	6.50	1.3
48	115	SUPPORT-PAFAN-PRI-AH	8.80	1.3
48	141	SEAL AIR HAG&ID GATE-PARTIAL	5.00	1.3
48	142	DUCT - -COLDAIRBUS	100.00	1.3
48	144	EXP.JT - -COLDAIRBUS	6.60	1.3
48	145	SUPPORT-COLDAIRBUS	1.50	1.3
48	200	INS TAPPINGS ON DUCT-PARTIAL	1.50	1.3
48	202	DUCT - AH-WIND BOX	180.00	1.3
48	204	EXPJT - AH-WIND BOX	42.00	1.3
48	205	SUPPORT AH-WIND BOX	30.00	1.3
48	206	CLH/VLH -Hot Air	15.00	1.3
48	207	FLOWMTR-SEC AIRFLOW	20.00	1.3
48	208	DUCT-SEC.AIR TO WB	130.00	1.3
48	212	DUCT - WIND BOX CONN	100.00	1.3
48	214	EXPJT - WIND BOX CONN	10.00	1.3
48	222	SQ DUCT AH-HOT AIR BUS	120.00	1.3
48	224	EXPN PCS AH-HOT AIR BUS	16.00	1.3
48	225	SUPPORT AH-HOT AIR BUS	2.00	1.3
48	232	DUCT - HOT AIR BUS	77.00	1.3
48	234	EXPJT - HOT AIR BUS	2.50	1.3
48	235	SUPPORT HOT AIR BUS	1.50	1.3
48	262	Rect Duct Aihtr Toprinnozzle And Seca	100.00	1.3
48	264	Expn Piece Aihtr Toprinnozzle and Seca	20.00	1.3
48	265	Supports Aihtr Toprinnozzle And Seca	7.00	1.3
48	372	DUCT - ECO HOPPER TO AH	100.00	1.3
48	382	DUCT - ECO-HOPPER	180.00	1.3
48	384	EXPNJT - ECO-HOPPER	35.00	1.3
48	385	SUPPORT - ECO-HOPPER	40.00	1.3
48	386	DUCT - ECO TO ECO HOPPER	160.00	1.3
48	395	CLH/VLH-FLUE GAS-PARTIAL	4.85	1.3
48	432	DUCT - AH-BLROUTFL	180.00	1.3
48	434	EXPJT - AH-BLROUTFL	7.00	1.3
48	435	SUPPORT AH-BLROUTFL	8.50	1.3
48	662	CIRCULAR DUCT HOT BUS MILLS	105.00	1.3
48	664	EXPN PCS HOT BUS MILLS	15.00	1.3
48	665	SUPPORTS HOT BUS MILLS	1.50	1.3
48	667	FLOW METER	20.00	1.3
48	700	BULKED BPS COMPONENT-PARTIAL	3.50	1.3
48	911	Slide Brg Pl & Pac Bellow-Blr	1.40	1.3
48	915	Man Hole Doors (450X450)-PARTIAL	4.50	1.3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
48	993	ERECTON-MATERIALS-PARTIAL	10.00	1.3
PG 48 TOTAL			2225.65	1.3
50	510	STEAM COIL A P H	9.85	1.3
PG 50 TOTAL			9.85	1.3
57	10	GATE-FD FAN OUTLET	26.30	1.3
57	33	DAMPER-SA SCAPH INLET	16.00	1.3
57	63	DAMPER-SA SCAPH OUTLET	16.00	1.3
57	83	DAMPER-SA SCAPH BYPASS	16.00	1.3
57	110	GATE-PA FAN OUTLET	23.50	1.3
57	141	SEAL AIR HAG AND ID FAN OUTGAT	30.05	1.3
57	143	DAMPER-COLD AIR TO MILL	7.66	1.3
57	160	GATE-COLD AIR TO MILLS	26.86	1.3
57	173	DAMPER-PA APH INLET	9.60	1.3
57	203	DAMPER-SA APH OUTLET	30.50	1.3
57	209	MTG BKT FOR CL DAMPER AIR CYL	4.37	1.3
57	223	DAMPER-PA APH OUTLET	12.00	1.3
57	270	GATE-HOT AIR TO MILLS	32.57	1.3
57	273	DAMPER-HOT AIR TO MILL	11.43	1.3
57	577	ELECT ACTUATOR FOR GATE, DAMPER- PARTIAL	23.75	1.3
57	578	ELECTRICAL ITEMS FOR GATE,DAMP- PARTIAL	0.03	1.3
57	623	DAMPER-SCR BYPASS	62.90	1.3
PG 57 TOTAL			349.51	1.3
97	297	MTM CLAMPS & PADS	0.38	1.3
PG 97 TOTAL			0.38	1.3
99	300	PUMP HANDLING EQUIPT	4.00	1.3
99	400	SCAPH,RAPH HANDLG EQ	3.50	1.3
99	501	QUICK ERECT SCAFFOLD	0.00	1.3
99	502	Pre.Parts Handling Equipmens	12.00	1.3
99	514	FURN CRADL-4WALC	0.00	1.3
99	600	FO SYSTEM HANDLG EQU	0.00	1.3
PG 99 TOTAL			19.50	1.3
NON PRESSURE PARTS TOTAL			3957.14	
55	11	FD FAN FOUNDATION MATL	1.50	1.4
55	17	FD FAN C&I ITEMS	0.05	1.4
55	21	AXL IDFAN FDN MATL	3.00	1.4
55	24	ID SEALING/COOLING FANS	3.00	1.4
55	27	ID FAN C&I ITEMS	0.06	1.4
55	31	PA FAN FOUNDATION MATL	2.20	1.4
55	37	PA FAN C&I ITEMS	0.06	1.4
55	91	FISRT FILL LUBRICANTS	4.00	1.4

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
55	216	AXIAL FD FAN ROTOR	5.50	1.4
55	227	AXIAL ID FAN ROTOR	22.00	1.4
55	334	AXIAL PA FAN ROTOR	5.00	1.4
55	516	AXIAL FD FAN STATOR	30.00	1.4
55	527	AXIAL ID FAN STATOR	90.00	1.4
55	634	AXIAL PA FAN STATOR	18.00	1.4
55	810	AXIAL FDFAN COUPLING	0.80	1.4
55	820	AXIAL IDFAN COUPLING	3.50	1.4
55	830	AXL PAFAN COUPLING	1.00	1.4
55	910	AXIAL FD FAN LUBE OIL SYSTEM	2.80	1.4
55	911	AXIAL FDFAN SILENCER	70.00	1.4
55	920	AXIAL ID FAN LUBE OIL SYSTEM	3.50	1.4
55	930	AXIAL PA FAN LUBE OIL SYSTEM	4.80	1.4
55	931	PA FAN SILENCER	46.00	1.4
PG 55 TOTAL			316.77	1.4
56	77	SEAL AIR FAN C&I ITEMS	0.01	1.4
56	161	RADIAL PENT HOUSE VENTILN FAN	1.20	1.4
56	173	RADIAL SEAL AIR FAN ROTOR	1.70	1.4
56	373	RADIAL SEAL AIR FAN BEARINGS	0.21	1.4
56	473	RADIAL SEAL AIR FAN STATOR	7.00	1.4
56	670	RADIAL SEAL AIR FAN MOTOR	2.20	1.4
56	870	SEAL AIR FAN COUPLING(RADIAL)	0.06	1.4
PG 56 TOTAL			12.38	1.4
61	10	JOURNAL ASSEMBLY(3nos),JOURNAL HEAD ASSY	193.20	1.4
61	110	PLANETARY GEAR BOX ,BOWL & BOWL HUB ASSY	242.20	1.4
61	210	MILL SIDE ASSEMBLY	138.81	1.4
61	310	SEPARATOR BODY ASSEMBLY WITH TRUNNION SHAFTS & JOURNAL OPENING COVER,SEPARATOR TOP ASSEMBLY	240.73	1.4
61	410	MDV ASSEMBLY -4nos (KNIFE GATVE VALVES)	13.86	1.4
61	310	DYNAMIC CLASSIFIER COMPLETE	82.60	1.4
61	710	MILL MOTOR COUPLING ASSEMBLY	3.01	1.4
61	810	LUB OIL(GEAR BOX)	13.58	1.4
61	910	FOUNDATION FASTNERS AND MOUNTING PL	66.30	1.4
PG 61 TOTAL			994.29	1.4
65	200	Coal Feeder- Sub-Delivey	1.10	1.4
65	710	Coal Feeder - DD items	0.25	1.4
65	736	36GRAVIMETRIC FEEDER	57.00	1.4

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
PG 65 TOTAL			58.35	1.4
67	200	Coal Feeding System- Sub dely.	1.50	1.4
67	204	RAW COAL GATES	3.60	1.4
67	272	BUNKER OUTLET GATE -36" MOTOR	7.50	1.4
67	276	FEEDER INLET GATE- 36" CHAIN	6.70	1.4
67	283	FEEDER OUTLET ISOLATION GATE	9.00	1.4
67	710	Coal Feeding System - DD items	0.60	1.4
67	801	DOWN SPOUT	15.55	1.4
67	802	BUNKER EMPTYINGCHUTE	20.00	1.4
67	803	FEED PIPE TO MILL	17.00	1.4
PG 67 TOTAL			81.45	1.4
XX	XX	Mill Motors	60.40	1.4
XX	XX	FD Fan Motor	24.00	1.4
XX	XX	ID Fan Motor	60.00	1.4
XX	XX	PA Fan Motor	29.00	1.4
PG XX TOTAL			173.40	1.4
ROTATING MACHINES TOTAL			1636.64	
61	XX	MILL HDLG COMPONENTS	55.71	1.5
99	099	MISC CHAIN PULLY BLO	0.20	1.5
99	100	FAN HANDLING EQUIPT	23.00	1.5
HANDLING EQUIPMENTS TOTAL			78.91	
GRAND TOTAL (BOILER & AUX - UNIT 2)			34541.69	

1.9.2.7. INSULATION UNIT-2

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
33	210	MAIN BLR CAST REF GR	155.00	1.8
33	230	MAIN BLR POUR INSUL	65.00	1.8
CASTABLE & POURABLE TOTAL			220.00	
33	021	BLR PP MINRL WOOL	697.50	1.9
33	924	MISC EQPTS PCK MATLS	0.28	1.9
55	919	AXIAL FD FAN INSULATION WOOL	18.40	1.9
55	939	AXIAL PA FAN INSULATION WOOL	12.00	1.9
81	325	MINERAL WOOL MATTRESS (Part)	2.25	1.9
33	221	DUCT MINERAL WOOL	616.00	1.9
79	67	MIN WOOL FOR ESP INSULATION	265.00	1.9
MINERAL WOOL SUBTOTAL			1611.43	
32	210	FIX COMP-DUCT INSULN	89.00	1.11
81	318	FIX COM FOR MISCELLANEOUS PPG INSULATION (Part)	0.18	1.11
33	970	MISC EQPTS EXP METAL	11.50	1.11

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
37	810	BLR OUTER CASING	53.80	1.11
32	010	FICOM BLR PP INSUL	4.90	1.11
79	68	FIXING COMP. FOR ESP INSULATIN	62.00	1.11
FIXING/IRON COMPONENTS SUBTOTAL			221.38	
33	975	MISC EQPTS SEAL COMP	0.50	1.12
37	010	BLR OUTER CSG COMPS	48.00	1.12
81	341	SEALING COMPOUND FOR INSL (Part)	0.03	1.12
81	350	ALUMINIUM CLADDING FOR INSULATION (Part)	1.50	1.12
79	6	INSULATOR HOUSING AS	55.00	1.12
89	615	INSULATION CLADDING SH FOR ESP	76.00	1.12
ALUMINIUM SHEETS/HOUSING SUBTOTAL			181.03	1.12
GRAND TOTAL (INSULATION)			2233.83	

1.9.2.8. ESP UNIT-2

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
79	1	ROLL/SLIDE SUPPORTS	25.00	1.6
79	5	ESP-SUB-DELIVERY COMPONENTS	0.60	1.6
79	8	GAS DIST. ASSY	77.00	1.6
79	9	GD-RAPPING MECHANISM	16.00	1.6
79	10	GD_DRIVE ARRANGEMENT	1.00	1.6
79	11	GAS SCREEN-EP	7.00	1.6
79	13	EMIT SYST SUSPENSION	18.00	1.6
79	14	SUPPORT INSULATORS	12.00	1.6
79	15	EMITTING ELECTRODES	30.00	1.6
79	16	EMIT ELECT RAPP MECH	42.00	1.6
79	17	DRIVE ARGT. FOR EMIT. SYS	37.00	1.6
79	19	COL ELEC SUSPENSION	136.00	1.6
79	20	COLLECTING ELECTRODE	1365.00	1.6
79	21	EMIT SYS FRAME-TOP	142.00	1.6
79	22	EMIT SYS FRAME BOTOM	161.00	1.6
79	23	INSPECTION DOORS	14.00	1.6
79	24	SHOCK BARS	109.00	1.6
79	25	COLL ELECT RAPP MECH	90.00	1.6
79	26	COLL ELEC RAPP DRIVE	7.20	1.6
79	28	ESP ROOF BEAM	191.00	1.6
79	31	GEARED MOTORS FOR RAPPING MECH	23.00	1.6

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
79	32	EMIT SYS FRAME-MIDLE	224.00	1.6
79	42	OUTER ROOF-EP	280.00	1.6
79	43	HOPPER RIDGES	78.00	1.6
79	44	HOPPER UPPER PART	315.00	1.6
79	45	HOP MLD&LOWER PART	520.00	1.6
79	46	INSULATOR SUPP PANEL	119.00	1.6
79	47	ROOF PANEL ASSY	168.00	1.6
79	48	CASING STRUCTURE	390.00	1.6
79	49	CASING SHELL/PANEL	572.00	1.6
79	50	INLET-OUTLET FUNNEL	197.00	1.6
79	55	PENT HOUSE FOR E P	155.00	1.6
79	57	SPLITTER&GUIDE VANES	30.00	1.6
79	61	EP PERF TEST EQUIPT	7.00	1.6
79	63	ASH LEVEL INDICATOR	1.80	1.6
79	65	APP PLATFORM-HOPPER	140.00	1.6
79	66	WATER WASHING SYSTEM	6.00	1.6
79	72	INTERLOCKS-EP	1.60	1.6
79	73	ELECTRICALLY OPERTD HOIST&ACCE	7.00	1.6
79	74	OPACITY MONITOR & ACCESSORIES	0.50	1.6
79	80	FOUNDATION MATLS FOR ESP	28.00	1.6
79	81	SUPPOTING STRUCTURES FOR ESP	625.00	1.6
79	89	GUIDE PLATE/VANE EP INLET DUCT	15.00	1.6
79	90	HEATING ELEMENTS	4.00	1.6
79	996	TOOLS & TACKLES	0.30	1.6
89	610	EP GALLERIES&STAIRS	65.00	1.6
89	611	ESP ROOF HANDRAILS	9.00	1.6
89	612	FLOOR GRILL AND STEP TREAD	46.00	1.6
89	613	FLOOR GRILL AND MOBILE LADDER	56.00	1.6
89	614	PENT HOUSE ROOFING SHEETS	40.00	1.6
XX	XX	HVR TRASNFORMERS RECTIFIER	160.00	1.6
ESP Total			6764.00	
39	012	FOUNDATION MATERIALS	34.82	1.7
39	101	COLUMNS FRAMES BEFOR	138.90	1.7
39	102	COLUMNS FRAMES BEFOR	345.41	1.7
39	141	COLS FRAMES NEAR ID	128.84	1.7
39	142	COLS FRAMES NEAR ID	316.06	1.7
39	150	COL FRAMES BETN I.D.	149.19	1.7
39	299	Platforms - Before ESP	140.88	1.7
39	300	PLATFORMS - AFTER ESP	94.52	1.7

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PG	MA	DESCRIPTION	ESTIMATE WT (MT)	Rate Schedule Id.
39	700	HSFG FASTENERS FOR P	0.63	1.7
39	810	FLOOR GRILL	33.88	1.7
39	820	STAIRS	18.41	1.7
39	850	HAND RAIL AND HAND R	35.99	1.7
39	993	CONSUMABLES AND EREC	10.27	1.7
48	018	MISC. DUCT&SPRT MATL	50.00	1.7
48	019	AIRDUCT SUP FDN MATL	3.20	1.7
48	141	SEAL AIR HAG&ID GATE-PARTIAL	5.00	1.7
48	200	INS TAPPINGS ON DUCT-PARTIAL	1.50	1.7
48	395	CLH/VLH-FLUE GAS-PARTIAL	4.85	1.7
48	462	DUCT - BLROUTFL-EP	400.00	1.7
48	464	EXPJT - BLROUTFL-EP	45.60	1.7
48	465	SUPPORT BLR OUTFL-EP	35.50	1.7
48	482	DUCT - ESP TO ID FAN	400.00	1.7
48	484	EXPNJT - ESP TO ID FAN	25.00	1.7
48	485	SUPPORT - ESP TO ID FAN	30.00	1.7
48	492	DUCT - IDFAN-CHIMNY	360.00	1.7
48	494	EXPNJT - IDFAN-CHIMNY	11.20	1.7
48	495	SUPPORT IDFAN-CHIMNEY	25.00	1.7
48	700	BULKED BPS COMPONENT-PARTIAL	3.50	1.7
48	912	Slide Brg PI-Id Sys	1.50	1.7
48	915	Man Hole Doors (450X450)-PARTIAL	4.50	1.7
48	993	ERECTON-MATERIALS-PARTIAL	10.00	1.7
57	430	FLUE GAS AH OUT GATE	67.00	1.7
57	443	DAMPER APH TO CHIMNEY - GAS	41.30	1.7
57	460	GATE-ESP INLET	55.50	1.7
57	466	PLATFORMS AND LADDERS	72.00	1.7
57	470	GATE-ESP OUTLET	55.50	1.7
57	480	GATE-ID FAN INLET	68.00	1.7
57	490	GATE-ID FAN OUTLET	62.80	1.7
57	491	BLOWER WITH MOTOR	18.40	1.7
57	497	KNIFE GATE VALVE	16.55	1.7
57	577	ELECT ACTUATOR FOR GATE,DAMPER-PARTIAL	23.75	1.7
57	578	ELECTRICAL ITEMS FOR GATE,DAMP- PARTIAL	0.03	1.7
57	988	DUCTS COMMISSIONING SPARES	0.03	1.7
ESP - NON PRESSURE PARTS SUBTOTAL			3345.01	
GRAND TOTAL (ESP & AUX - UNIT 2)			10109.01	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER -X GENERAL

(Applicable for Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.10.1 Contractors are requested to furnish the following documents at PSSR-HQ, Chennai immediately after release of Letter of Intent (L.O.I)

- i) Security Deposit and Additional Security Deposit
- ii) Un Qualified Acceptance for Detailed L.O.I. / work order
- iii) Rs 100 /- Stamp Paper for Preparation of Contract agreement.

1.10.2 Contractors are requested to furnish the Proof of Documents for the following at PSSR-Site

- i) Provident Fund (PF) Registration Number.
- ii) Labour License Number.
- iii) Workmen Insurance Policy Number.

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

1.10.3.1 BOCW Act & BOCW Welfare Cess Act

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

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

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

1.10.3.1.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal

TECHNICAL CONDITIONS OF CONTRACT (TCC)

protective equipments, canteen, rest-room, drinking water, Toilets, ambulance, first aid centre etc

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

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

1.10.3.1.6 Non-compliance to provisions of the BOCW Act and BOCW welfare Cess Act is not acceptable. BHEL reserves the right to withhold any sum it deems fit. Only upon total compliance to the BOCW Act and also discharge of total payment of Cess under the BOCW Cess act by the contractor, BHEL shall consider refund of the amounts.

1.10.3.2 **Provident Fund**

1.10.3.2.1 The contractor is required to extend the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of this letter of intent. In case, you are exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of your failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to us by the customer or paid to statutory authorities by us, such amount will be recovered from payments due to you.

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

1.10.3.3 **Other Statutory Requirements**

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

1.10.3.3.2 The contractor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

- 1.10.3.3.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case, of “Non-compliance of Sec 21 or non-payment of wages” to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
- 1.10.3.3.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (If applicable) to BHEL along with the Final Bill.
- 1.10.3.3.5 In case of any dispute pending before the appropriate authority under I D act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.
- 1.10.3.3.6 In case of any dispute prolonged / pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

1.10.3.4 **Deployment of Skilled / Semi-Skilled Tradesmen**

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

1.10.3.5 **Compensation in cases of death / permanent incapacitation of person**

BHEL shall recover the amount of compensation paid to victim(s) by BHEL towards loss of life/ permanent disability due to an accident which is attributable to the negligence of contractor, agency or firm or any of its employee as detailed below:

1.10.3.5.1 Victim: Any person who suffers permanent disablement or dies in an accident as defined below.

1.10.3.5.2 Accident: Any death or permanent disability resulting solely and directly from any unintended and unforeseen injurious occurrence caused during the manufacturing / operation and works incidental thereto at BHEL factories / offices and precincts thereof, project execution, erection and commissioning, services, repairs and maintenance, trouble shooting, serving, overhaul, renovation and retrofitting, trial operation, performance guarantee testing undertaken by the company or during any works / during working at BHEL Units / Offices / townships and premises / Project Sites.

1.10.3.5.3 Compensation in respect of each of the victims:

(i) In the event of death or **permanent disability** resulting from **Loss of both limbs**: Rs 10,00,000/- (Rs Ten Lakhs)

(ii) In the event of **other permanent disability**: Rs 7,00,000/- (Rs Seven Lakhs)

1.10.3.5.4 Permanent Disablement: A disablement that is classified as a permanent total disablement under the proviso to Section 2 (I) of the Employee's Compensation Act, 1923."

1.10.4 **GENERAL**

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.4.2 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
- 1.10.4.3 Contractor shall erect all items / materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials / work fronts etc., will decide the sequence of erection / commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection / commissioning adopted in erection / commissioning of similar job or for any reasons whatsoever.
- 1.10.4.4 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.
- 1.10.4.5 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials.
- 1.10.4.6 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum kW demand.
- 1.10.4.7 Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and erection program have to be planned in such a way that the milestones are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.
- 1.10.4.8 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works or as bed for pre-assembly works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.
- 1.10.4.9 All the works such as cleaning, leveling, aligning, trial assembly, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting-up etc., as may be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.

- 1.10.4.10 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor should ensure successful and timely operation of equipment installed. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.
- 1.10.4.11 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess draws at the rate prescribed by manufacturing units.
- 1.10.4.12 No member of the already erected structure, platform, pipes, grills, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 1.10.4.13 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
- 1.10.4.14 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – 2015 Standards.
- 1.10.4.15 For other agencies, such as Boiler, ESP, Turbine, Electrical, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope, Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.
- 1.10.4.16 The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.
- 1.10.4.17 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.4.18 If applicable, all boiler, piping layout drawings received from BHEL for pipeline erection to be submitted to Boiler Inspector for approval. After approval of the above drawing, Erection of pipe line to be started. Inspection fee and registration fee as mentioned in Chapter VIII of Special Conditions of contract (Volume-IB in Volume-I Book-II) shall be paid by BHEL.
- 1.10.4.19 Contractor should obtain the formal statutory clearance from Chief Inspector of Boilers to carry out erection & Welding of piping under IBR purview. Arrangement for the visit of Boiler inspector for field inspection, hydraulic test etc., is in the scope of contractor, and necessary drawing / details only will be given by BHEL.
- 1.10.4.20 Contractor shall arrange the necessary clearance from statutory authorities like IBR, Electrical Inspectorate, etc. as required for installation of the plant and equipment and render all assistance, service required in this regard.
- 1.10.4.21 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost. Inspection fee, if any shall be paid by BHEL
- 1.10.4.22 Contractor shall submit a copy of license to undertake construction / repair of Boilers & Piping issued by Boiler inspectorate before commencement of Pressure Parts / Piping Erection.
- 1.10.4.23 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.10.4.24 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.
- 1.10.4.25 Upon completion of daily work, the contractor shall remove from the vicinity of work all scrap packing materials, rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer.
- 1.10.4.26 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
- 1.10.4.27 On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instructions of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

recovered from the contractor. The decision of BHEL Engineer in this regard is final.

1.10.4.28 UTILITY POINTS

1.10.4.28.1 Number of utility points (Service / plant air, service / plant water, service / washing steam, inert gas (N₂) etc., shall be indicated in the P & I diagram. Contractor to locate the utility points as advised by site engineer and shall route the piping to these points as per site conditions, and shall submit as built layout with 'BILL OF MATERIAL' to BHEL for approval.

1.10.4.28.2 The utility points shall be located at convenient point to handle and to be terminated with brass / bronze valve with suitable connection for hose pipe.

1.10.4.29 DOCUMENTATION

1.10.4.29.1 Contractor shall be supplied with two extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copy with Red ink all the changes / deviations / alterations etc. carried out at site due to various reasons, with site engineer's endorsement. Marked up drawings shall be submitted to BHEL for approval.

1.10.4.29.2 After successful completion, testing and commissioning of installation work, as built drawings / documents if any, in line with the actual work carried out as per site routing drawing shall be submitted by the contractor as agreed for the project.

1.10.4.29.3 The contractor shall maintain a record in the form as prescribed by BHEL for all operations carried out on each weld and maintain a record indicating the number of welds, the name of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejections if any, percentage of rejection, etc. and submit copies of the same to the BHEL Engineer as required.

1.10.4.29.4 Other documents as specified in of Chapter – XI of Technical Conditions of Contract (VOLUME-IA PART- II)

1.10.4.30 PLATFORMS, CROSSOVERS & CANOPIES

Platforms, ladders, crossovers and canopies shall also be provided at places where it has not been shown in drawings but if felt necessary by site engineer. Canopies shall be provided for all outdoor pumps and motors. Platforms, ladders, crossovers and canopies shall have to be fabricated from raw materials supplied by BHEL and erected by contractor as per instruction of BHEL and shall be paid as per accepted tonnage rate for "structures" i.e, Rate schedule Id. No 1.1. The work shall be executed

TECHNICAL CONDITIONS OF CONTRACT (TCC)

under the usual conditions existing in major power plant construction, without affecting power plant construction and in conjunction with other numerous operations and contracting agencies at site. The bidder and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.10.4.31 **Site Inspection:**

1.10.4.31.1 The contractor shall maintain at site a joint protocol for recording actual measurement of work carried out at site, inspection and witnessing of various tests conducted by the contractor.

1.10.4.31.2 The Owner or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the Owner or his authorized agents without any extra cost to the Owner or his authorized agents. No cost whatsoever such duplication of inspection of work be entertained.

1.10.4.31.3 BHEL / Owner will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by Owner / BHEL.

1.10.4.31.4 Field Quality Assurance Formats: -

It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and Owner as token of their acceptance. Payment to the contractor will be linked with the submission of these FQA log sheets.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - XI

PROGRESS OF WORK

(Applicable for Package A and Package B)

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.11.1 Refer forms F -14 to F-18 of volume I D (Forms & Procedure) of volume -I book-II. Plan and review will be done as per the formats. Please note that Form F-14 and F-15 are revised and published in this booklet (Volume I Book I)
- 1.11.2 Contractor is required to draw mutually agreed monthly construction / erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
- 1.11.3 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.
- 1.11.4 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer. The periodicity of the reports will be decided by BHEL Engineer at site.
- 1.11.5 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.11.6 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 1.11.7 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details:-
 - a. Progress photographs in colour.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- b. Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
 - c. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan
 - d. Category- wise man hours engaged during the previous month under the categories like fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operators, security, helpers etc. Data shall be split up under the work areas like Boiler (pressure parts, structures), Auxiliary boiler, Rotating machines, Bunker etc.
 - e. Consumables report giving consumption of all types of gases and electrodes during the previous month.
 - f. Availability report of cranes / T & Ps
 - g. Safety implementation report in the format
 - h. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.
- 1.11.8 During the course of construction, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians etc. employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
- 1.11.9 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding construction progress, labour availability, equipment deployment, testing, etc.
- 1.11.10 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.
- 1.11.11 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER -XII FOUNDATIONS AND GROUTING (Applicable for Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.12.1 Foundation for the equipments to be erected shall be provided by BHEL / clients of BHEL. The dimensions of the foundations and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipments / plants shall be carried out by the contractor.
- 1.12.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., dewatering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form / shuttering work are within the scope this work.
- 1.12.3 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates / shims, as may be required for the erection of the equipment / plants will have to be carried out by the contractor without extra cost
- 1.12.4 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments / equipments based on the foundations including shear lug provisions / openings.
- 1.12.5 Foundation pockets are to be cleaned thoroughly before placing the supports / columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
- 1.12.6 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also

TECHNICAL CONDITIONS OF CONTRACT (TCC)

be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.

- 1.12.7 Total grouting of the columns / equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column / equipments is in the scope of the contractor. All the grouting should be carried out by non-shrink cement like conbextra GPI / Conbextra GP II / Shrinkkomp or its equivalent etc. This special non-shrink cement shall be arranged by the contractor at his cost. The quoted rate shall be inclusive of the same.
- 1.12.8 The contractor shall arrange for grouting of foundation bolt holes of equipment and final grouting of equipment as per the drawings / specification as advised by the Engineer or BHEL after preparing the foundation surface for grouting. The contractor has to arrange, a representative from the supplier of special cement for witnessing the grouting and other works at their cost including any miscellaneous expenditure for this activity. BHEL will not pay any service and incidental charges for arranging the supplier representative. The contractor to take note of this aspect and quote accordingly.
- 1.12.9 All equipment bases and structural steel bases and foundations pockets shall be grouted and finished as per these specifications after surface preparation unless otherwise recommended by the equipment manufacturers. The surface preparation includes soda washing of the foundations to remove oil, grease etc. to ensure proper grouting.
- 1.12.10 The certificates of the grout are to be submitted to BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc. to be arranged by the contractor including the fine aggregates.
- 1.12.11 All the materials required for grouting including special cements as approved by BHEL and other materials like Portland cement, sand chips, gravel etc., are to be arranged by the contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.
- 1.12.12 Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates / sheets at site by the contractor to meet site requirement. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.
- 1.12.13 **PROCEDURE FOR GROUTING:**
Contractor has to carry out the grouting as per the work instructions for grouting available at site or the grouting is to be carried out as per the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

supplier's recommendation / IS standard. Copy of those recommendations is to be submitted to BHEL for records.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER -XIII

MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

(Applicable for Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.13.1 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment, placement on respective foundation / location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks/ slings/ tools and tackles / labour including operators, fuel, lubricants etc. for loading & unloading of materials will be in the scope of contractor.
- 1.13.2 Some of the materials may be unloaded near to erection site, as per space availability & site condition. All other materials have to be transported from storage yard to construction area by the contractor at his own cost.
- 1.13.3 Temporary Approach road will be laid by BHEL from the storage yard up to the Erection Area. Further rectification of approach road shall be shared among the contractors utilizing the road.
- 1.13.4 The Storage yard is located at a distance of approximately 1 km from Erection Area. Transportation of materials from storage Yard to Erection Area shall be under the scope of this contract. No separate payment will be made for this transportation.
- 1.13.5 Transportation of steel materials from storage yard to fabrication area and transportation of the fabricated structures from the fabrication area to the erection site should be done within the quoted rate.
- 1.13.6 Some consignments like ODC consignments may be unloaded near to erection site as per space availability. Unloading to be done by the contractor within the quoted rates.
- 1.13.7 Loading at storage yard and transporting to site, unloading at site / pre assembly area or at working area, is in the scope of work. Required cranes for loading & unloading of materials, trailer shall be in the scope of contractor. The contractor shall provide any fixtures, concrete blocks & wooden sleepers, sandbags which are required for temporary supporting of the components at site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.13.8 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.
- 1.13.9 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.
- 1.13.10 Sometimes it may become necessary for the contractor to handle certain unrequired components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
- 1.13.11 Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
- 1.13.12 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.
- 1.13.13 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.
- 1.13.14 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.
- 1.13.15 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting of the components at site
- 1.13.16 Contractor has to draw the material either from BHEL store yard or fabrication yard and transport to his working place.

VOLUME-IA PART-I CHAPTER XIV

FABRICATION AND ERECTION

(Applicable for Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.14.1 Applicable for both Package A & Package B

- 1.14.1.1 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision / clarification of BHEL engineer will have to be followed.
- 1.14.1.2 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection /location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage/loss of such equipment at site.
- 1.14.1.3 Sometimes it may become necessary for the contractor to handle certain unrequired components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
- 1.14.1.4 Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
- 1.14.1.5 All pipe and tube ends shall be covered with plastic caps or shall be closed with wooden plugs as the case may be.
- 1.14.1.6 Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
- 1.14.1.7 In case of any class of work for which there is no such specifications as laid down in the contract such as blue matching, welding of stainless steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.
- 1.14.1.8 The contractor is strictly prohibited in using any of the Boiler components like angles, channels, hand-rails for any temporary supporting or scaffolding work. In case of such misuse, a sum as determined by BHEL shall be recovered from contractor's bills. Also the contractor will be responsible for the safe custody and proper accounting of all materials in connection with

TECHNICAL CONDITIONS OF CONTRACT (TCC)

the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess draws at the rate prescribed by manufacturing units.

- 1.14.1.9 Any fixtures, scaffolding materials, approach ladders, concrete block supports, steel structures required for temporary supporting, pre assembly, checking, welding, lifting & handling during pre-assembly and erection shall be arranged by the contractor at his cost.
- 1.14.1.10 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. Any damage so to permanent members / pipes to be made good by the contractor at his cost.
- 1.14.1.11 In the case of structural members / ducts in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length / prepare the edges to suit the matching profiles, weld / bolt connects the joints at no extra cost. Normally, the machine profile will be cut out for the structural members but the contractor will have to carry out suitable alteration / adjustments at site, without any extra payment in case it becomes necessary.
- 1.14.1.12 Fine fittings and other small bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.
- 1.14.1.13 All welded joints should be painted with anti-corrosive paint, once NDE works are over.
- 1.14.1.14 All welded joints shall be subjected to acceptance by BHEL Engineer.
- 1.14.1.15 Work such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc. are covered in the scope of work.
- 1.14.1.16 All piping items including pipes, valves, flanges, fittings etc. shall be supplied as commercially available. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.
- 1.14.1.17 Pipes above 2" diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. For pipes below 2" diameter, shall be sponge cleaned with air flushing.
- 1.14.1.18 In case of piping connected to equipment, matching of flanges for achieving the parallelism and alignment at equipment end by suitably

TECHNICAL CONDITIONS OF CONTRACT (TCC)

resorting to heat correction or other method as instructed by BHEL Engineer is within scope of work.

- 1.14.1.19 Wherever elbows of 45 deg. or any other angle are required, the same shall be cut from 90 deg. elbow supplied and used. No extra cost shall be paid.
- 1.14.1.20 Erection of flow switches, filters, flow meters, other metering elements, flow orifices, flow indicators, control valves supplied either by BHEL or customer forming part of the system is in the scope of work. This will include collecting from BHEL / Customer stores, transportation to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.
- 1.14.1.21 Contractor shall also weld small length of piping with root valve to the pressure, flow and level tapping points on piping or flow nozzles/orifices/metering elements fixed on piping as per the instructions of BHEL Engineer.
- 1.14.1.22 Welding of all thermowells, draft, pressure and temperature instrumentation points and all other instrumentation points on piping and auxiliaries and welding of thermocouple pads for permanent system as well as for performance guarantee test is in the scope of work.
- 1.14.1.23 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor at no extra cost. Other supports namely Hangers, U-clamps etc., shall be supplied by BHEL duly bent and threaded. Assembly and necessary cutting work etc., shall be carried out at site by contractor within the quoted rate.
- 1.14.1.24 Wherever hanger and support materials are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the system on temporary supports to ensure the progress of work. The required structural steel materials will be issued on free of charges by BHEL, either from scrap/spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports.
- 1.14.1.25 No separate payment will be made for the edge preparation of pipes, Standard fittings such as bends, Tees etc.,
- 1.14.1.26 Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive is within the quoted / accepted rate.
- 1.14.1.27 All the equipments /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like

TECHNICAL CONDITIONS OF CONTRACT (TCC)

coolers, oil tanks, Rubber expansion joints and other components as per instruction of BHEL Engineer during erection within the quoted rate.

- 1.14.1.28 Contractor shall cut / open works if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. This contingency shall be included within the quoted value. During commissioning, opening of valves, changing of gaskets, attending to leakages, minor modification, rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower with T & Ps in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning, the same has to be rectified by the contractor at his cost.
- 1.14.1.29 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from all locations and taking them away from the erection areas to various locations as indicated by BHEL Engineer. The house keeping must be a routine and continuous activity.
- 1.14.1.30 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 1.14.1.31 Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be removed / attended as per BHEL engineer.
- 1.14.1.32 Proper care to be taken during the erection & welding of pipes, ducts, pressure parts etc. such that entry of any foreign materials viz. bits of welding electrodes, gloves, helmets, etc. into the system is avoided. The damage to any equipment due to the entry of such foreign material in the system will be rectified by BHEL and the cost involved will be recovered from the contractor's RA bills.
- 1.14.1.33 Field Quality Assurance Formats: -
It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and customer as token of their acceptance. Payment to the contractor will be linked with the submission of these FQA log sheets

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.14.2 FABRICATION & ERECTION OF BUNKER

- 1.14.2.1 Fabrication, erection, alignment, welding, NDT, bolting, grouting and painting as applicable for fabricated structures (Supplied by units/fabricated at site) of bunkers should be done by the vendor within the quoted rates.
- 1.14.2.2 Wherever the design & supply together is covered in the scope of bidder necessary approvals from BHEL / Customer shall be taken by bidder for the design, inspection procedure and vendor. List of items for which such approvals required will be frozen during the execution of the contract.
- 1.14.2.3 Contractor shall procure and supply the items as per the price bid wherever supply is in the scope of the contractor, from the vendors approved by BHEL / Customer meeting the specification, drawings and instructions of the BHEL Engineer.
- 1.14.2.4 Total no. of bunkers per Boiler is seven. Bunkers are to be fabricated from the structural steel, which will be supplied by BHEL free of cost. Only basic structural drawing will be provided to the contractor by BHEL. Contractor shall prepare detailed engineering structural and fabrication drawings and get approval from BHEL before fabrication and erection of the same respectively. The cost of preparation of the drawings shall be within the quoted rates of the contract.
- 1.14.2.5 Contractor shall provide the temporary structures like scaffolding, access ladders, working platforms etc. and removal of the same after completion of Bunker erection.

1.14.3 ERECTION OF BOILER & ITS AUXILIARIES AND ROTATING MACHINES

- 1.14.3.1 Brief list of System / sub-system to be erected by the contractor & approximate weight of individual PGMA's and number of welding joints mentioned in this Tender Specification are meant for giving general idea to the tenderer only about magnitude of the work involved. This should not be taken for billing or any other claims. All weights for such purposes will have to be taken from design documents only (shipping list). This section also gives general idea about various components to be erected with expected accuracy level. However, the contractor shall get the correct details from the engineer to avoid mistakes and rework.
- 1.14.3.2 Preparation of preassembly bed is very much essential for preassembly of MBLs, columns, ceiling girders, panels, coils etc. on consolidated ground and to avoid sagging and shrinking the temporary supports are to be provided. The preassembled component should have minimum three supports to avoid sagging.
- 1.14.3.3 The column and girder pieces are to be measured individually to check for camber, sweep etc. The level markings on the columns to be checked

TECHNICAL CONDITIONS OF CONTRACT (TCC)

before erection. The verticality stickers are to be fixed over individual column pieces on both the flanges (90° apart in two places). Arranging these stickers shall be done by the contractor.

- 1.14.3.4 Tier by tier erection method is to be followed. Columns are to be tied up with horizontal and diagonal bracing in each tier before proceeding to next level. Log sheets are to be maintained in line with log sheets which are available with BHEL. After grouting the first tier columns, second tier erection is to be taken up. Adequate curing of the grout is to be ensured. Verticality of the columns is to be ensured either by plumb bob or theodolite. The tolerance shall be as indicated in BHEL's erection drawings. Care should be taken while erecting the vertical and diagonal bracings to maintain the work points as per drawing. Necessary lubricant for the girder pin assembly should be applied as per drawing within the quoted rates.
- 1.14.3.5 The following measuring and test equipments with proper calibration certificates are to be made available by the contractor before taking up the structural and other pressure parts erection. Steel tapes minimum 5m, 30m in sufficient numbers, torque wrench 650-1000 ft. pounds, bolt tension calibrator, torque wrench with calibration, temperature recorder, two theodolites with one second accuracy etc. Periodic calibration of the measuring instruments is to be done once in six months and certificate for the same to be submitted to BHEL for records.
- 1.14.3.6 Detailed procedure available with BHEL site office should be collected before taking up the job by the contractor for preassembly of ceiling girders. No. of ceiling girders is six. Each ceiling girder will be supplied in maximum three pieces and welding & NDT are to be carried out including 100% radiography and the required UT for the welded joints in ceiling girders. The heaviest assembled ceiling girder will be around 150 MT and maximum elevation of ceiling girder is 91.50 m and top of silencer is 103 m maximum.
- 1.14.3.7 Camber, sweep and twist are to be checked. The tolerances for individual piece camber and sweep, individual length, level of girder assembly, flatness of the web, out of squareness of assembly, overall length of the assembly etc. to be ensured before taking up the job. Major deviation if any observed should be intimated to BHEL for getting the resolution before proceeding further.
- 1.14.3.8 Suitable crane to be used for handling / lifting the ceiling girder will be provided by BHEL. Levelled area will be provided by BHEL for erection. However, backfilling and consolidation, if required, shall be carried out by the contractor, at no extra cost. Necessary plates / sleepers required for marching and operation shall be provided by the contractor within quoted rates. Positioning of the crane is to be decided in consultation with BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.3.9 The erection of the welded beams, rolled beams, boiler roof frame assembly etc. to be taken up along with ceiling girders immediately as the crane moves from first girder to the last. The silencers of various safety valves also to be erected in the respective bays. The completion of the roof sheeting should follow to create a comfortable working space in the boiler cavity giving protection to all work men from rains and sun. It is expected that the contractor will complete the same before separator/pressure parts erection. The materials for boiler roofing and side cladding etc. will be supplied by BHEL and contractor has to erect the same at the quoted / accepted tonnage rate.
- 1.14.3.10 The tightening procedures for HSFG bolts are to be obtained from BHEL at site before taking up the work. Normally it is done by turn of nut method. Torque wrenches also can be used. The bolted joints will be checked jointly by BHEL / Customer engineers for required tightness and retightening is to be done as per requirement. The tightened bolts will be marked with colour paints. Facility for random checking by torque wrench will have to be done. The required calibrated torque wrench will be provided by the contractor.
- 1.14.3.11 Some platform materials in PG 36 and PG 38, approach ladders, suspension materials etc. will be supplied in running meters. The contractor has to fabricate these materials wherever they are supplied in running meters to the required size / shape, to be welded and erect them within the quoted rates.
- 1.14.3.12 It shall be the responsibility of the contractor to provide ladders on column for initial works till such time stairways are completed. For this the ladder should not be welded on the column and should be fabricated clamping type ladders. No temporary welding on any structural members is permitted except under special circumstances with the approval of BHEL. The necessary materials for the ladders are to be arranged by bidder within quoted rate. Any ladder supplied by the manufacturing unit for this purpose will be issued to contractor free of cost and the same is to be returned once the platforms are completed.
- 1.14.3.13 Scrap disposing chutes are to be provided by the contractor within the quoted rate at different areas like along the boiler main column, bunker structure and duct supporting structures. Material for the scrap chute will be provided by BHEL.
- 1.14.3.14 All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to specifically list out all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- a) Scaffolding and rigging operations
 - b) Machine / flame / electric cutting, grinding, welding, radiography and stress relieving.
 - c) Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, cleaning, checking, levelling, blue matching, aligning and assembly.
 - d) Machining, surface grinding, drilling, doweling, shaping.
 - e) Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication.
 - f) The contractor should get the formal approval from the Boiler inspectorate to take up the boiler erection work (mainly pressure parts, piping etc.) Necessary assistance will be extended by BHEL for the same.
- 1.14.3.15 Normally, high pressure valves will have prepared edges for welding. But if it becomes necessary, the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like "T" pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning. Edge preparation becomes the part of erection work. However, payment for new edge preparation reconditioning beyond reasonable limits will be considered as per man day rates.
- 1.14.3.16 Certain adjustments in length of steel /pipe/tube members may be necessary while erecting high pressure pipelines of boiler and piping (pre-fabricated lines) and the contractor should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures at no extra cost, wherever indicated. Depending upon the type of deviation BHEL will consider the reimbursement at man hour rates. If the drawing provides for erection allowance, then it becomes part of the work and no compensation is payable. The prepared edges in pressure parts shall be applied with weldable primer as preservation and supply of the primer is in contractor scope.
- 1.14.3.17 Ducts / expansion pieces are dispatched to site in loose walls / plates and these are to be assembled at site before erection. (Walls with stiffeners in welded condition will be provided).
- 1.14.3.18 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over. Daily welding reports in

TECHNICAL CONDITIONS OF CONTRACT (TCC)

the format suggested by BHEL should be submitted by next morning without fail.

- 1.14.3.19 All the dampers, valves, lifting equipments, power cylinders, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The bearings of dampers shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning, if there are problems in the operation they have to be attended by the contractor during the tenure of the contract.
- 1.14.3.20 Spring suspensions / constant load hangers have to be pre-assembled and adjusted for the required loading and erected as per instructions, of BHEL Engineer. Any adjustments, removal of temporary arrestors / lockers etc., have to be carried out as and when required at no extra cost to BHEL.
- 1.14.3.21 The contractor shall carry out necessary preservative painting, periodic application of preservations on pressure parts and other equipments during erection / after erection until completion of work. Necessary preservatives / paints, thinner are to be arranged by the contractor at his cost. Contractor shall provide necessary crew with all items like wire brushes, paint brushes, emery paper, cotton waste, scaffolding materials etc., at his cost.
- 1.14.3.22 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
- 1.14.3.23 The contractor shall fabricate piping, install lube oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system, carry out the hydraulic test of oil coolers. etc.
- 1.14.3.24 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing to obtain a reliable and complete pipe installation as per instructions of BHEL Engineer. Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost. (Any machining or threading is involved will only be done by BHEL).
- 1.14.3.25 Normally the high pressure valves will have prepared edges for welding. But if it becomes necessary the contractor shall prepare new edges or

TECHNICAL CONDITIONS OF CONTRACT (TCC)

recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like "T" pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning. Edge preparation becomes the part of erection work. However, payment for new edge preparation reconditioning beyond reasonable limits will be considered as per man day rates. All the valves, after chemical cleaning, have to be checked, cleaned or over hauled in full or part before erection if called for as part of scope.

- 1.14.3.26 Adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of all piping including high pressure piping to suit the layout shall be considered part of work and the contractor is required to carry out such work free of cost, as per instructions of BHEL, which shall include specific heat treatment procedures etc.,
- 1.14.3.27 Suspension for piping, pressure parts, ducting etc., will be supplied in running lengths which shall be cut to suitable sizes and adjusted as required within the quoted cost.
- 1.14.3.28 Fabricated pipes are sent in standard length and will be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to NB 65 mm will have to be fabricated at site adopting specified heat treatment procedures, wherever required at no extra cost.
- 1.14.3.29 In the case of structural members / ducts in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length / prepare the edges to suit the matching profiles, weld / bolt connects the joints at no extra cost. Normally, the machine profile will be cut out for the structural members but the contractor will have to carry out suitable alteration / adjustments at site, without any extra payment in case it becomes necessary.
- 1.14.3.30 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurements and performance testing to be provided on boiler / its auxiliaries or pipelines covered with in scope of this tender, will also be the responsibility of the contractor and the same will be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if,
 - (a) Product group (PG) under which these items are released are not covered in the scope of this tender.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- (b) Items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package. Payment will be regulated as per the agreed terms and conditions.
- 1.14.3.31 The contractor shall fabricate piping, install lube oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system, carry out the pressure test of oil coolers. etc.,
- 1.14.3.32 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Sponge ball test shall be carried out for all tubes before erecting the same. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.
- 1.14.3.33 All attachment welding including those for insulation and refractory work coming on the pressure parts shall have to be done by the contractor. The hooks are suitable for stud welding machines. Contractor's quoted rate shall include all these contingencies. Attachment welding on pressure parts shall be done by qualified and certified welders only. Welding of Insulation hooks at site shall be welded on the fins by manual welding / stud welding machines.
- 1.14.3.34 It is the responsibility of the contractor to do the alignment, checking, etc., if necessary, repeatedly to satisfy BHEL Engineer / customer Engineers with all the necessary tools and tackles manpower, etc., without any extra cost. The alignment will be complete only when jointly certified so, by the BHEL Engineer & customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 1.14.3.35 Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before and after installation.
- 1.14.3.36 Fine fittings, boiler trim piping, oil system and other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small bore piping in boiler and oil system shall be done as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.
- 1.14.3.37 Additional platforms for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be assembled and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for erection. The steel materials required

TECHNICAL CONDITIONS OF CONTRACT (TCC)

for these works shall be supplied by BHEL free of cost and the contractor will have to install them to suit the requirement. Works of major nature not covered under this clause.

- 1.14.3.38 Complete penetration of water wall (Panel to panel) tube to tube and fins welding shall be achieved either by single side or double side welding. The decision of BHEL Engineer is final.

NOTE: The water wall / spiral wall panels will be supplied with fin cut to a length of 300 mm on ends for alignment and welding of tube to tube of panels at site.

The bidder may require to cut fins further to a maximum length of 1000 mm or alignment and welding of tube to tube in water wall/spiral wall panels and welding of fins on both sides after completion of panel to panel welding within the quoted rate. No extra payment will be made for the above works.

- 1.14.3.39 Work such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc. are covered in the scope of work.
- 1.14.3.40 Certain extra lengths of various tubes/pipes and fabricated ducts are provided as erection allowance and the same have to be cut/adjusted to suit the site conditions and layouts or certain small lengths may have to be added for adjustments to suit the site conditions. For any mismatch while matching the joints in tubes, the cutting, adjusting, re welding, addition spool pieces should be done by the contractor to match site conditions without any extra payment.
- 1.14.3.41 Assistance for calibrating / testing the power cylinders / valves, gauges, instruments, etc. and setting to actuators coming under various groups shall be provided by contractor within the quoted rates.
- 1.14.3.42 Hanger rods are shown in the pressure parts arrangement drawing for boiler. Any cutting / welding and required heat treatment and necessary NDT of such hanger rods will be done by the contractor. The hangers for pressure parts will be tested for even distribution of load with the help of torque wrench.
- 1.14.3.43 Skin casing sheet for covering the boiler roof panels, and other areas will be supplied as fabricated items. Any cutting and re-fabrication to suit the site conditions shall be carried out within the quoted rates.
- 1.14.3.44 For all the site routed piping under PG-21, 24 & 42 as built drawings are to be submitted by the contractor immediately after erection. The Number of site welds indicated for PG21, 24 the under the heading "Quantum of HP joints" is approximate. It is to be noted that piping for fine fittings, trim piping, oil system (PG 42) soot blower system shall be supplied mostly in

TECHNICAL CONDITIONS OF CONTRACT (TCC)

running meters which will be erected and all joints are to be welded as per the drawings/site routing within the quoted rates by the bidder.

- 1.14.3.45 Hydraulic test of SCAPH has to be carried out on the ground before lifting it to the position.
- 1.14.3.46 Seal box to be painted with bituminous paint of IS158 by the bidder. The required paint shall be supplied by the bidder within the quoted rate.
- 1.14.3.47 Before lifting the heavy components like header, panels, burner assemblies, down comer pipes etc. soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc. The capacity, number of sheave pulleys, size of the rope, guide pulley locations are to be decided at site with respect to the capacity and positioning of the winch. The end caps provided at shop for various stubs are to be removed during final fit up only.
 1. While Lifting the headers lifting lugs or shell portion of the headers only to be used. The temporary supports to be removed prior to hydraulic test. While erecting the temporary supports, care should be taken so that they do not affect the erection of permanent supports. Tack welding of suspension rods with bearing plates to be done after final adjustment. Details for welding of bearing plates can be referred in the drawings/check list.
 2. Precautions to be used while erecting the collector channel supports. Equal loading of the hangers is to be ensured. Ring headers are erected before erection of water wall bottom hopper panels. Headers are to be arrested before welding to panels/headers/tubes/coils as the case may be. Sequence of welding to be followed while welding higher size joints.
 3. Each water wall tube is provided with an orifice assembly in the bottom ring header. Orifice adopter is welded inside the header and welded at shop. After chemical cleaning operations, the orifice assemblies are to be erected at site as per directive of engineer and drawings.
 4. Erection of various components is taken up from top to bottom. Planning has to be done every month in consultation with the engineer. Pre assembly of seal boxes for the peep hole openings, pressure tapping, soot blowers etc. can be done on the ground before erection, if feasible. The burner blocks are to be erected in convenient position before closing the furnace with panels. For panel to panel erection and welding panels erection attachments are supplied by units. Furnace alignment with respect to boiler / furnace axis is very

TECHNICAL CONDITIONS OF CONTRACT (TCC)

vital and important. The alignment is to be achieved. Details to be checked with engineer.

5. The gaps between coils and steam cooled /WW panels /between coils etc. to be maintained in line with drawing. Please check up the permissible tolerance before taking up the work.
6. Preassembly of end bars with crown plates including stress relieving for coil assemblies.
7. Pump case / volute is welded with suction manifold in line with procedures available with site office.
8. The required accuracy level to be ensured before welding as per drawing. Necessary radiography/NDT along with heat treatment to be done.
9. CC pump motor installation is taken up only after completion of system pipe work supports. When mounted the pump should accommodate movement in the pipe without imposing excessive loads on the casing and branches. Sufficient clearance should be available beneath the motor to facilitate removal during maintenance. It is to be assembled as per the directions available with engineer.
10. Ensure completion of the maintenance hoists meant for CC pumps immediately else the area may be used by other agencies for laying the cables for various equipments coming in that area, inadvertently and they have to be removed later. Heat exchanger installation is also to be completed and necessary cooling water lines, thermocouples, pressure gauges etc. to be completed. The power cable connection made to the pumps should ensure free down ward expansion of the boiler at the level.
11. Down comer pipes erection can be done by carrying out preassembling the pipes whatever feasible as per availability. The suction manifold received in loose pieces and to be pre-assembled in the floor nearby. After welding the suction manifold, it is to be positioned, aligned and then only the down comers from the steam separator/ drum are to be connected. Erection of suction spool pieces, and hand operated valves for the system to be erected. The CC pump volute without impeller is fitted to the bottom of the suction spool. Bottom flange of the volute is carefully levelled and aligned before welding the suction spool. After completion of welding in all respects cutting and trimming of erection attachment to be done. CC pumps volute is to be blanked for carrying out hydro test. After hydro test, the blanks are removed and pump erection taken up. The

TECHNICAL CONDITIONS OF CONTRACT (TCC)

tightening of the bolts to be done with torque wrench as per the instructions of the supplier.

12. Before taking up the erection of coils, pre erection checks to be carried out like width and length of the coil, availability of flexible connectors, damages on the coils, permanent bows if any, sponge test for the coil and completion of ground inspection by inspector of boilers as deemed.
13. Erection of LTRH / Economizer coils as applicable can be done by preassembling the upper and lower coils. Pre erection checks like width, length etc., and sponge test of coils for thoroughness to be done before erection. Required hanger tubes erection to be completed before LTRH / Economizer coils erection. **The preassembly of cassette baffles of LTRH and Eco coils can be carried out before their erection.**
14. Check for the gaps between SH steam cooled front wall and Eco/SH horizontal assemblies, gap between SH steam cooled rear wall and SH horizontal assemblies/ eco assemblies, spacing between rear WW arch and pendant assemblies and finish SH coils. Detailed drawings are to be referred during execution. The items indicated are suggestive only.
15. Check for the inner space between eco coils, LTRH, RH and SH coils as per drawing
16. Ensure proper completion of steam cooled spacers. Check for clearances for soot blower lance tubes. Radiant roof skin casing sheets are to be welded after application of castable refractory.
17. Before erecting the valves and other mountings, check for the tag for correct rating with valve schedule. Ensure correct flow direction. Ensure easy accessibility for operation and maintenance of valves.
18. While erecting the safety valves, check for the set pressure and type. The lever arrangement, blow down ring approach for floating should be ensured. Drip pan drains with proper slope to be given to safe location. Check the exhaust pipe arrangement for expansion and proper guides to be given. Ensure anchor points for the above pipes.
19. Ensure removal of drains plugs provided in the silencers, the gap between exhaust pipe and roof is sealed properly.
20. DWLGs to be erected as per drawing. Joint protocol to be made for its correct erection with supports.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

21. Other tapping points meant for monitoring the level should be erected and protocol is to be made. Maximum use of the pads and lugs welded on the steam separator/drum to be used for giving supports.
22. Sample coolers are to be erected preferably in clean area. All the lines should be air blown before termination on both ends. Sockets are to be used for sampling lines.
23. All the drain lines should have sufficient slope towards drain. Provide expansion loops in all the vents and drains as per the drawings. Electromatic relief valve controller is supported separately in column so that the vibration from boiler is not transmitted. Provide pre compression springs where required to take care of the load. All the motor operated valve stems should be vertical preferably. All the valve packing with asbestos base to be lubricated once in 6 months till handing over. Necessary gland packing will be supplied by BHEL.
24. Prior to erection of any pressure part like headers, pipes, tubes, panels etc. inspection to be done for any foreign materials and damages and they are to be removed/ attended as per BHEL engineer.
25. Transport binders on all coils are to be removed.
26. Gas distribution baffles and vibration snubbers, mechanical spacer bars etc. are to be erected as per drawings.
27. Buckstays are preassembled and raised to their respective elevations and hung prior to erection of furnace walls. Before fixing them to furnace walls, ensure completion of panel to panel welding and voids in the buck stay region. The necessary scalloped bars / plates / pads are to be welded after leveling. Ensure completion of vertical buckstays including support hangers, links. The erection of leveler channels with guides to be completed.
28. All the furnace guides to be erected as per drawing keeping gap of about 3 mm for free boiler expansion.
29. The necessary connection to the wind box is to be completed in all respects as per drawing. If any drain holes are envisaged, the same to be provided. No pipe line supports should be taken from the buck stays without getting the approval from engineer.
30. Sagging of roof tubes results in condensate stagnation during shut down. Hence ensure that radiant roof and back pass roof tubes are erected without sag.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

31. Total boiler is to be examined in all levels for free expansion. All the arrestors are to be removed. Expansion indicators are to be erected in various levels as per drawing / instruction of engineer.

32. Some of the few important locations for voids filling: -

- Around penetration for pendent surfaces and radiant Roof/SH screen tubes/second pass roof tubes
- Between loose front WW tubes above front upper panels and below radiant roof
- Gap between radiant roof tubes at the junction of front wall
- Extreme rear arch tubes and side WW / extended WW panels
- Extreme SH screen tubes and SH extended steam cooled walls
- Gaps between tubes / nipples in the steam cooled rear, side and front wall and respective headers.
- Extreme tubes of front and side WW lower panels.
- Side WW / extended side WW and extreme tubes of radiant roof.
- Extended side steam cooled wall and extreme tubes of SH screen tubes.
- Steam cooled side wall and extreme tubes of second pass roof.
- Between tubes in upper corner tubes.
- Between tubes in lower transition tubes.
- Gap between tubes / nipples of side WW lower header at the ash hopper throat region
- Voids due to lifting slots in fusion/fin welded panels
- Voids due to erection slots in fusion/fin welded panels
- Fusion / fin welded panel fin slits at the panel tube-tube butt joint locations
- **The above list is suggestive only. Voids are to be closed suitably to retain refractory in position and to achieve the gas tightness**

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.14.3.48 Erection of Boiler structures and points to be taken care of for achieving verticality of Boiler columns.

- The column pieces are pre-assembled and site match marks to be provided.
- Pre assembly checks to detect and deviations in the columns like length, camber sweep, twist etc.
- Checking of foundations for its levels distance, diagonal, distance etc.
- Proper tightening of the foundation bolts.
- Erection of columns tier by tier and box by box. Grouting to be done immediately after first tier erection.
- Ensuring the availability of guy ropes, etc. during column erection and removal of guy ropes after ensuring the verticality of columns.
- Using calibrated theodolite for verticality measurement of columns.
- Tightening of HSFG bolts to be done by turn of nut method only after ensuring the verticality of the columns.
- Measuring adjacent diagonals of the ceiling girders after its erection.
- Ensuring the verticality of the columns before and after the steam separator erection.

1.14.3.49 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.

1.14.3.50 The fans shall be checked for blade clearance and other vital tolerances. The Flow control devices in fans like Inlet Guide Vanes (IGV) / Damper units shall be serviced. Necessary assistance for balancing of equipment during trial run shall be provided by the contractor.

1.14.3.51 Vital clearance of mill should be checked at site and adjusted if required.

1.14.3.52 The HT motor bearings shall be blue matched at site and checked for bearing clearance. Scrapping of bearing housing, if required shall be carried out by the contractor. No extra claim for blue matching of any two surfaces will be entertained. The HT motors will be checked for air gap and adjustment of stator / rotor to magnetic center shall be carried out as part of erection.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.3.53 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of the above electrical hoist. Required loads will be provided by BHEL free of cost.
- 1.14.3.54 The civil foundations for passenger cum goods lifts (temporary lift) shall be provided by BHEL. The contractor has to erect the passenger cum goods lifts, as per instruction of BHEL Engineer, including transport of materials from BHEL Stores. Grouting including supply of grout materials shall be in the scope of the contractor. The dismantling of the erected lifts, Transport / Handing over to BHEL Stores is also covered in this scope of work. The contractor has to arrange operators, technicians for round the clock operation and maintenance is to be carried out by the contractor at his cost. The operation and maintenance shall be carried out till the end of contract period, or the date, on which the lifts are dismantled as per the directives of BHEL, whichever is earlier.
- 1.14.3.55 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 1.14.3.56 The contractor shall remove from the vicinity of work all scrap / debris periodically and return to stores / deposit in places, as specified by BHEL Engineer. In the event of his failure to do so, the same will be arranged / removed by BHEL and the expenses incurred with overhead will be recovered from the contractors.
- 1.14.3.57 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from all locations and taking them away from the erection areas to various locations as indicated by BHEL Engineer. The house keeping must be a routine and continuous activity. If the contractor does not do this job satisfactory, BHEL will arrange for the same and the expenses incurred with overhead will be recovered from the contractors. Periodical payments to the contractor for the work done will be considered only if the housekeeping is certified as satisfactory by the customer.
- 1.14.3.58 Scrap disposing chutes are to be erected by the contractor with in the quoted rate at different areas like Boiler main column, duct supporting structures. Materials for the scrap chute will be provided by BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.3.59 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges, re-prepare the edges to suit site conditions, which shall be done by the contractor at no extra cost.
- 1.14.3.60 Temporary lugs / structures meant for transportation is to be removed by the contractor as and when instructed by BHEL Engineer.
- 1.14.3.61 The enclosed welding schedule in VOLUME- IA PART II Chapter 2 is for information and the applicable welding schedules will be issued during erection of work at site.

1.14.4 **ERECTION OF ESP AND ITS AUXILIARIES**

- 1.14.4.1 The contractor should erect and assemble the components as per the drawings issued and the number of components supplied to him will be on the basis of shipping list / completion schedules. Complete pre assembling of components are in the scope of the contractor.
- 1.14.4.2 All the dampers, valves, lifting equipments, power cylinders etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The bearings of dampers shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning the equipments, if there are problems in the operation they have to be attended by the contractor during the tenure of the contract.
- 1.14.4.3 Ducts / expansion pieces are dispatched to site in loose walls / plates and these are to be assembled at site before erection.
- 1.14.4.4 Any other systems / Components which are integral to ESP & auxiliaries, supplied by BHEL manufacturing units are also to be erected and commissioned by the contractor within the quoted / accepted tonnage rate / lump sum value.
- 1.14.4.5 The Erection & Alignment of HV rectifier transformer is in the scope of contractor. However, dry out, testing and commissioning is not in the scope of this contract. HVR Transformer to be erected and handed over for commissioning in good condition. Refilling of oil, if required for HVR transformer, is included in the scope of the bidder till completion of HVR Transformer commissioning
- 1.14.4.6 Erection & dismantling of air blowers and connecting pipes & ducts, providing blanks/ dummies at the required locations and conducting gas-tightness test is in the scope contract and shall be carried out within the quoted rate.
- 1.14.4.7 Certain extra lengths of various tubes/pipes are provided as erection allowance and the same have to be cut/ adjusted to suit the site conditions and layouts or certain small lengths may have to be added for adjustments

TECHNICAL CONDITIONS OF CONTRACT (TCC)

to suit the site conditions. For any mismatch while matching the joints in tubes, the cutting, adjusting, re welding, addition spool pieces should be done by the contractor to match site conditions without any extra payment.

- 1.14.4.8 Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost. (Any machining or threading is involved will only be done by BHEL).
- 1.14.4.9 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.
- 1.14.4.10 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians are to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of the above electrical hoist. Required loads will be provided by BHEL free of cost.
- 1.14.4.11 Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be removed / attended as per BHEL engineer
- 1.14.4.12 For skid mounted equipment, the checking and re-alignment required at site is in the scope of work.
- 1.14.4.13 All the shafts of rotating equipment shall have to be properly aligned to those of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment.
- 1.14.4.14 Wherever equipments are supplied in pre-fabricated assembled packages, there may be necessity to make minor changes, including strengthening by additional welds. This shall be treated as part of the contractor's scope.
- 1.14.4.15 All the bearings, Gearboxes etc., of the equipment and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing/gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and

TECHNICAL CONDITIONS OF CONTRACT (TCC)

shall arrange for re- greasing/lubricating them with recommended lubricants and assembling back.

- 1.14.4.16 All the motors/pumps shall be stripped opened, thoroughly serviced with proper care and re-assembled properly before erection by the contractor. During servicing, pre-commissioning & commissioning, if any deficiency is observed the same should be taken up with BHEL Engineer at site and rectified at site without any delay.
- 1.14.4.17 All site-fabricated pipes will be issued in running metres as straight. These are to be cut and edge prepared at site to required length to suit layout as given in the erection drawing. All the attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing. Necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor. Fittings like bends, tees, elbow, MITRE bends, reducers, flanges etc., will be supplied as loose items.
- 1.14.4.18 ESP collecting Electrodes may require straightening and repair for minor transport damages before erection as per erection manual by the contractor with in the quoted price.
- 1.14.4.19 Additional platforms of permanent nature for approaching different equipments, as per site requirement which may not be indicated in drawings shall be fabricated and installed by the contractor. However, the contractor will be paid (as per Rate Schedule 1.1) for this work on accepted tonnage rate for erection. The material required for platform will be supplied by BHEL free of cost.
- 1.14.4.20 It shall be the responsibility of the contractor to provide ladders on column for initial works till such time stairways are completed. For this the ladder should not be welded on the column and should be pre-fabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL.
- 1.14.4.21 Any fixtures, concrete block supports, steel structures required for temporary supporting for pre-assembly or checking and welding for lifting and handling during pre-assembly and erection shall be arranged by the contractor.
- 1.14.4.22 The scope of equipments to be erected under this contract is detailed in Tender Specification. The schedule of weights given wherein is approximate and is meant only to give a general idea to the tenderer about the magnitude of the work involved.
- 1.14.4.23 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge

TECHNICAL CONDITIONS OF CONTRACT (TCC)

preparation, fabrication of tubes and pipes as per general engineering practices at site, cutting, grinding, straightening, chamfering, filing, chipping, and rectification of foundation upto 30 mm, drilling, reaming, scrapping, shaping, fitting up etc. as may be applicable in such erection works are to be treated as incidental to erection and necessary to complete the work satisfactorily shall be carried out by the contractor as part of the work and at his quoted rates.

- 1.14.4.24 Fixing, welding of necessary instrumentation tapping points for regular measurements as well as performance testing, to be provided on auxiliaries covered within the scope of this specification will also be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer. The fixing / welding of all the above items will be contractor's responsibility even if the
- i) Product groups under which these items are supplied are not specifically indicated in the Tender Specification.
 - ii) Items are supplied by an agency other than BHEL.
- 1.14.4.25 Suspension for pipes will be supplied in running lengths which shall be cut to size and adjusted as required. All joints connecting ducts, expansion pieces shall be seal welded on inside and as well outside. Also it may sometime become necessary to remove any of the erected members to facilitate erection of bigger / pre-assembled equipment. In such as the removal and re-erection of such members, which are essential will have to be carried out by the contractor without any extra payment.
- 1.14.4.26 In the case of structural members / ducts, in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length/prepared the edges to suit the matching profile weld/bolt connect the joints at no extra cost.
- 1.14.4.27 Normally, the matching profile will be cut out for the structural members but the contractor will have to carry out suitable alterations / adjustments at site, without any extra payment, in case it becomes necessary.
- 1.14.4.28 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 1.14.4.29 Contractor shall carryout necessary touch up painting periodic application of preservation on all components and other equipment during erection / after erection until completion of work. Contractor shall provide necessary crew with all items like wire brushes, paint brushes, emery paper, cotton waste, scaffolding materials etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.4.30 Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
- 1.14.4.31 It is the responsibility of the contractor to do the alignment, checking, etc. if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 1.14.4.32 Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.
- 1.14.4.33 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from various locations as indicated by BHEL Engineer. The housekeeping must be a routine and continuous activity in the various work fronts. If the contractor does not do this job satisfactorily, BHEL will arrange for the same at the cost of the contractor. Periodical payments to the contractor for the work done will be considered only if the housekeeping is certified as satisfactory by the customer.
- 1.14.4.34 It is the responsibility of the contractor to engage his workmen in shifts or on overtime basis for achieving the desired progress and target set by BHEL. The contractors quoted rate shall include all these contingencies.
- 1.14.4.35 All the gates, dampers, valves, lifting equipments, etc. shall be serviced and lubricated to the satisfaction of BHEL Engineer before erecting the same and also during pre-commissioning. The bearings shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning the equipments, if there are problems in the operation they have to be attended to by the contractor during the tenure of the contract. Welding or joining of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rate.
- 1.14.4.36 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing to obtain a reliable and complete installation as per instructions of BHEL Engineer. Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost. (Any machining or threading is involved will only be done by BHEL).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.4.37 Before lifting the heavy components, soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc. The capacity, number of sheave pulleys, size of the rope, guide pulley locations are to be decided at site with respect to the capacity and positioning of the winch. The end caps provided at shop for various stubs are to be removed during final fit up only.
- 1.14.4.38 Certain instruments like pressure switches, gauges, air sets, regulators, filters, junction boxes, power cylinders, dial gauges, thermometers, flow meters, valve actuators, flow indicators etc., are received in assembled conditions as integral part of equipments. Contractor shall dismantle such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.
- 1.14.4.39 Roof Insulation:
Insulation of ESP inner roof shall be applied before outer roof is placed. The work to be carried out as per the drawing and within the quoted rates.
- 1.14.4.40 Loading of Emitting / electrodes should be done only after the clearance from BHEL Engineer. The contractor has to carry out this work after getting clearance from BHEL Engineer whose decision shall be final and binding in this regard.

1.14.5 APPLICATION OF INSULATION AND REFRACTORY

- 1.14.5.1 Application of refractory, wool insulation, sheet metal cladding, welding of hooks / supports to hold insulation and refractory's under this contract including but are not limited to the following. Insulation of main boiler portion, boiler drum, ceiling heat recovery area, air and flue gas ducts, and connected ducts, HP & LP piping, temporary acid cleaning and steam blowing piping connected tubes, oil and coal burners, oil and steam tracing, lines, complete and fuel and draft plants, all drain lines, traps, flanges, fine fittings, sampling lines etc.
- 1.14.5.2 The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.
- 1.14.5.3 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor

TECHNICAL CONDITIONS OF CONTRACT (TCC)

from time to time. In case of ambiguity or deviation the decision / clarification of BHEL Engineer will have to be followed.

- 1.14.5.4 All insulations and refractory materials including iron components and other sheets casing materials, etc., required as per drawing will be supplied by BHEL and the same have to be erected / applied as per the drawings and specifications of BHEL by the contractor.
- 1.14.5.5 Clean the Surface to be Insulated from Rust, Dust, Grease, Loose scale, Oil, Moisture, etc. Care shall be taken that flexible insulation is not unduly compressed. After insulating the equipment, the gaps / joints shall be filled with loose wool/ moulded insulation as applicable.
- 1.14.5.6 Painting of inner side of sheet metal covering over the insulation walls with two coats of anti-corrosive paint (IS-158) to be applied to the entire satisfaction of BHEL Engineer and application of bituminous sealing compound on cladding/ sheet metal joints shall also be carried out by the contractor. Retainer type 'A' must be coated with Aluminum paint. For which the required amount of paint, thinner and other accessories for painting, cleaning the surfaces etc., shall be arranged by the contractor within the quoted rate.
- 1.14.5.7 Bituminous sealing compound will be provided by BHEL free of cost which is supplied by the respective Mfg. Units. However, supply and application of bituminous coating inside aluminum sheet is within the scope of the bidder at no extra cost.
- 1.14.5.8 It is the responsibility of the contractor to ensure that the insulation and refractory materials and sheet metal covering issued to him for application are well protected against loss or damage or weather conditions tending to affect its quality by the provision of close / semi closed sheds at his cost.
- 1.14.5.9 All the insulation and refractory materials and sheet metal covering etc., issued to the contractor shall be properly stored and handled before application due the same. If any damage occurs to the materials due to improper storage or due to any causes attributable to the contractor except for normal breakage or damaged material shall be to the cost of the contractor.
- 1.14.5.10 Contractor is liable for the exact accounting of the materials issued to him and any unaccountable losses shall be made good by him. The necessary accounting of the material issued will have to be furnished by the contractor periodically.
- 1.14.5.11 The contractor shall provide the required quantity of wire, nails and other materials for centering works at their cost.
- 1.14.5.12 Wherever iron components are to be welded on non-pressure parts, the contractor shall employ only approved structural welders. It shall also be

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- the responsibility of the contractor to arrange for welding hooks, flats, plates, supports and other fixtures also. All consumables tools and plants etc., required for the work shall be arranged by the contractor at their cost.
- 1.14.5.13 Special type of insulation wool used in penthouse shall not be cut indiscriminately. All chicken mesh, cut bits shall be accounted for.
- 1.14.5.14 Contractor shall observe all precautions for laying and curing of Castable refractory. Any defective works found shall be re-laid by contractor at his own cost including materials.
- 1.14.5.15 Wool insulations are received at site as bonded and unbonded mattresses in standard sizes. These has to be dressed / cut to suit equipment / site work by the contractor.
- 1.14.5.16 For the insulation of hot air duct, gas duct, ID duct etc., unfaced bonded wool, mattresses is to be used with wire netting (wire netting is supplied separately) on the outside for rigidity.
- 1.14.5.17 Dressing of insulation bricks to suit site conditions curing the refractory concrete applied, sheet cladding over insulations, form the part of this work.
- 1.14.5.18 Removal type of insulation to be provided for valves fittings, expansion joints etc., as per the drawings or as directed by BHEL Engineer.
- 1.14.5.19 All piping insulations shall be carried out in such a manner as to facilitate removal of bolts nuts and washers from the flanges.
- 1.14.5.20 Refractory works at complete combustion chambers, ceiling heat recovery area, oil and coal burner areas and application of castable refractory wherever specified in drawing or as directed by BHEL Engineer have to be carried out. Concrete Mixer for refractory application is in the scope of the contractor.
- 1.14.5.21 Fabrication of covering sheets may be necessary like preparing the sheets to the sizes and shapes specified in drawings, beading, swaging, beveling of sheets crowning of the sheets if necessary the same to supports over wool insulation with screws as specified in BHEL drawings or as instructed by BHEL engineer.
- 1.14.5.22 Fabrication, fixing or welding of hooks / supports to equipment of boiler parts, ESP, piping and other connected equipments to support wool insulation applying of primer paint to welded portion parts welding certain supports on parts other than pressure parts to hold refractory's (by engaging approved welders) as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.
- 1.14.5.23 The contractor shall leave certain gap and opening while doing the work as per the instructions of BHEL Engineer to facilitate inspection by Boiler

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Inspector or doing commissioning to fix gauges, fittings, instruments. Those gaps will have to be finished as per drawings at a later date by the contractor at his cost, as required by BHEL.

- 1.14.5.24 Cladding sheets shall be suitably pressed along with diagonals to form diamond shape so as to improve the strength of the sheets, to avoid humpiness and to give aesthetic look.
- 1.14.5.25 Plates, bars, rods and other materials that are to be cut, and re-welded from the fabricated places to suit erection requirements for which no extra payment will be made to the contractor.
- 1.14.5.26 A log book shall be maintained by the contractor for the clearance of the area for application of refractory and insulation. If the contractor does the work on his own accord without prior permission the area should be redone at his cost.
- 1.14.5.27 The contractor shall draw only one week's requirement of material for their work from BHEL stores and keep them in their semi-closed shed near to the work area. The materials required for a particular space of work only shall be taken to the work spot. At the end of the day's work the leftover or unused materials shall be taken back to their semi-closed shed for keeping the materials safe. Necessary records shall have to be maintained by the contractor in respect of the above draws / deposits, on daily basis as instructed by BHEL.
- 1.14.5.28 Wastages allowance for the materials issued are envisaged as follows:
 - a) Castable refractory 2%
 - b) Insulation bricks & mortar 2%
 - c) Wool mattresses 2%
 - d) Cladding sheets 5%
- 1.14.5.29 Making structural supporting works for pourable insulation, laying pourable insulation, adhering to all specifications and instructions shall be the responsibility of the contractor.
- 1.14.5.30 Upon completion of daily work, the contractor shall remove from the vicinity of work all scrap packing materials rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer. Also, the contractor will demolish all the hutments, sheds, offices, constructed by him and shall clean the debris after the contract is over. In the event of his failure to do so, the same will be arranged / removed by BHEL Engineer and the expenses incurred with overhead will be recovered from the contractors.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.5.31 Welding of hooks as per pitch, non-pressure parts, applying red oxide paint to the welded portion as directed as per drawings before application of mineral wool mattresses will have to be done by the contractor.
- 1.14.5.32 Application of Castable refractory between tubes around burners on ceiling and as directed by Engineers and as per detailed drawings and specifications will have to be done by the contractor.
- 1.14.5.33 Applying different layers of mineral wool as directed and as per drawings and specifications for boiler and its auxiliaries, pipelines valves and other vessels and after fixing require holdings materials, suitably if necessary, fabrication of rings etc., and fixing as directed and as per drawings and specifications shall also form part of this work.
- 1.14.5.34 If necessary the hooks may have to be made from the rods, raw materials supplied in running lengths. The contractor may have to carry out this work also and use the same hooks.
- 1.14.5.35 In case the contractor is required to dismantle and re-erect certain area as and when required for pre-commissioning / commissioning activities the rate as indicated in the rate schedule shall be paid by BHEL for erection. However, for dismantling no extra charge will be paid under any circumstances.
- 1.14.5.36 Wherever additional / clamps, frame works, etc., are required to be fabricated and installed even though not indicated in the drawings shall be fabricated and installed at their cost. Only steel materials shall be given by BHEL free of cost, consumables like electrodes, gases etc., are to arranged by the contractor at his cost.
- 1.14.5.37 Contractor has to arrange required fire retardant covering material at their cost to protect the insulation materials drawn from BHEL before and after erection.
- 1.14.5.38 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, etc., which are required for temporary supporting of the insulation materials at site.
- 1.14.5.39 In case of any class of work for which there is no such specifications as laid down in the contract, the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.
- 1.14.5.40 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. Any damage so to be made good by the contractor at his cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.5.41 Delay in clearance of mechanical equipment and piping for insulations is unlikely to happen. However, if any delay occurs, the contractor shall not claim anything extra, like idle charges.
- 1.14.5.42 Welding of all seal boxes covers after completion of refractory work shall be done by the contractor. No extra charges will be payable for the same.
- 1.14.5.43 Welding of iron components directly on pressure parts and HP piping are to be carried out by certified IBR high pressure welders.
- 1.14.5.44 Application of insulation and removal of the same for temporary piping under scope of erection of this contract is also included in the scope of the work. However, BHEL will supply the insulation materials free of cost.
- 1.14.5.45 Dressing of insulation to suit site conditions, sheet cladding over insulations, form the part of this work.
- 1.14.5.46 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision / clarification of BHEL Engineer will have to be followed.

1.14.6 Field Quality Assurance Formats

- 1.14.6.1 It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and customer as token of their acceptance. Payment to the contractor will be linked with the submission of these FQA log sheets.

VOLUME-IA PART - I CHAPTER - XV
WELDING, HEAT TREATMENT & RADIOGRAPHY
AND NON-DESTRUCTIVE TESTING

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

For Package A & Package B (Includes Bunker fabrication and erection)

For Bunker, the clauses may be applicable as per requirement

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.15.1 The pressure parts, equipments and piping shall be erected in conformity with the provisions of Indian Boiler Regulations and as may be directed, as per other standard / specification in practice in BHEL. The method of welding (viz) ARC, TIG or other methods as indicated in the detailed drawing or as instructed by BHEL Engineer shall be followed. BHEL Engineer will have the option to change the method to suit site conditions.
- 1.15.2 Necessary NDT during fabrication and erection of Bunkers has to be done by the contractor within the quoted rate. Corresponding reports to be periodically submitted to BHEL.
- 1.15.3 Welding of pressure parts, high tensile structural steel, Piping shall be done by certified high pressure welders who possess valid certificate and who are approved by BHEL Engineer. Links and Pipes for interlinking SH headers & RH headers are supplied with P91 & P92 materials.
- 1.15.4 Welding & NDE test are to be carried out, including 100% radiography and the required UT for the welded joints in ceiling girders and 100% RT, 100% Hardness for all T91, T92 joints within the quoted rates. Irrespective of the EWS, the areas of T91, T92 joints shall be tested for 100% RT and 100% Hardness. For Hardness UCI equipment shall be used by the contractor for measurement. The contractor shall make arrangement for testing through portable UCI method only. Arrangements for pre/post weld treatment with ceramic pads for T91 and T92 joints shall be made by the contractor within the quoted rate.
- 1.15.5 All welders including tack welders, structural and high pressure welder shall be tested and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor shall maintain the records of qualification and performance of welders. BHEL Engineer will issue all the welders qualified for the work, an identity card. The welder will keep the same with him at work

TECHNICAL CONDITIONS OF CONTRACT (TCC)

place at all times. He may be stopped from work if he is not found in possession of the same.

- 1.15.6 Engineer may stop any welder from the work if his performance is unsatisfactory for any technical reason or if there is a high percentage of rejection in the joints welded by him. The welders having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance. Welders performance should be submitted to BHEL on weekly basis.
- 1.15.7 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the BHEL quality engineer.
- 1.15.8 The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG welding method only. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas.
- 1.15.9 All expenses for testing of contractor's welders including destructive and Non- destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of tube and pipe material required for making test pieces will be supplied by BHEL free of cost. All consumables are to be procured from BHEL approved vendors list only.
- 1.15.10 Only BHEL approved electrodes and filler wire will be used. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate should have a co-relation with the lot number / batch number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved / accredited test house traceable to National / International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same. Separate ovens shall be used for baking and holding.
- 1.15.11 All butt / fillet welds shall be subject to Non –Destructive testing as per the Drawing / Procedures / Welding Schedules / Documents at no additional cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.12 The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld. He has to maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability or otherwise of the welds shall be final.
- 1.15.13 The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer. Prepared edges to be preserved / applied with weldable primer.
- 1.15.14 All welds shall be painted with anticorrosive primer once radiography and stress relieving works are over. Necessary consumables and scaffolding etc. including paints shall be provided by contractor at his own cost. RG plugs are to be plugged completely before proceeding with stress relieving.
- 1.15.15 Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, Non Pressure Parts like Crown Plate support assembly, including attachment welding wherever necessary, are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.
- 1.15.16 Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor shall arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, ceramic pads, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment / stress-relieving operations. The contractor should take a note of the following,
- Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.
 - All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost. 6 point, 12-point recorder shall be mobilized. Required nos.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

of Resistance Heating Based Local Pre/Post WHT Equipment with Flexible Ceramic Pad should be mobilized.

- The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting and during soaking period of SR operations.

- 1.15.17 The contractor shall also be equipped for carrying out other NDT like LPI / MPI / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price/ rates. Ultrasonic testing, wherever required, will be arranged by contractor within the quoted rate.
- 1.15.18 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.
- 1.15.19 The contractor for radiography work shall use Iridium-192 / Cobalt 60; the geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while carrying out radiography. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC). Contractor shall construct radiography pit for the same within the quoted rate. Location for the pit shall be finalized in consultation with BHEL.
- 1.15.20 Low speed high contrasts, fine grain films (D-7 or equivalent) in 10 cm width only are used for weld joint radiography. Film density shall be between 1.5 and 2.0.
- 1.15.21 All radiographs shall be free from mechanical, chemical or process marks, to the extent they should not confuse the radiographic image and defect finding. Penetrameter as per ASME or ISO must be used for each exposure.
- 1.15.22 Lead numbers and letters are to be used (generally 6mm size) for identification of radiographs. Contract number, joint identification, source used, welder's identification and SFD are to be noted down on paper cover of radiograph.
- 1.15.23 Lead intensifying screens for front and back of the film should be used as per the above-referred ASME specification. The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld. For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.
- 1.15.24 Radiography personnel with sufficient experience and certified by M/s BARC for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection only have to be deployed. These

TECHNICAL CONDITIONS OF CONTRACT (TCC)

personnel should also be registered with DRP / BARC for film badge service.

- 1.15.25 All arrangements for carrying out radiography work including dark room and air conditioner and other accessories shall be provided by contractor within the space allotted for office at his cost. As an alternative the contractor may deploy an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.
- 1.15.26 The contractor shall have a dark room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories. All radiography films shall be developed in the dark room at site. Contractor shall ensure that Radiography personnel be equipped with film badge dosimeter for monitoring cumulative radiation dose absorbed due to ionizing radiation.
- 1.15.27 In case of radiography of less than 100%, the joints identified by BHEL at random shall be radiographed.
- 1.15.28 Contractor shall note that 100% radiography will be done at the initial stages on all the piping welding joints. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out.
- 1.15.29 All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL / customer.
- 1.15.30 Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/ BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work.
- 1.15.31 Radiography of joints shall be so planned after welding, that the same is done either on the same day or next day of the welding to assess the performance of HP welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.
- 1.15.32 Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re- submitted for evaluation. However, if the defect persists after first repair, further repair work followed with radiography shall be repeated till the joint is made acceptable. In case the joint is not

TECHNICAL CONDITIONS OF CONTRACT (TCC)

repairable, the same shall be cut, re-welded and re-radio graphed at contractor's cost.

- 1.15.33 Heat treatment and radiography may be required to be carried out at any time (day and night) to ensure the continuity of the progress. The contractor shall make all necessary arrangements including labour, supervisors/ Engineer required for the work as per directions of BHEL.
- 1.15.34 The contractor shall assist BHEL Engineer in preparing complete field welding schedule for all the field welding activities to be carried out in respect of piping and equipment erected by him involving high pressure welding at least 30 days prior to the scheduled start of erection work at site. The contractor shall strictly adhere to such schedules.
- 1.15.35 The contractor shall deploy required number of H.P. welders to carry out the H.P. weld joints. The welding works should not be held up due to shortage / want of I.B.R/ H.P. welders.
- 1.15.36 All welded joints shall be subjected to acceptance by BHEL Engineer.
- 1.15.37 The technical particulars, specifications and other general details of work shall be in accordance with BHEL welding, Heat treatment and NDE manuals or equivalent as decided by BHEL Engineer.
- 1.15.38 Contractor shall carryout Radiography as per welding Manual booklet applicable as per IBR, enclosed. However, percentage radiography shown in the respective drawings shall be final and binding on the contractors.
- 1.15.39 The field joints are to be radiographed and preheating and post weld heat treatment to be done as per BHEL procedure and manuals.
- 1.15.40 The percentage of Radiography are tentative, which may be increased depending upon the quality of joints at the discretion of BHEL.
- 1.15.41 Penetrometer as per ASME/ISO shall be used for all exposures.
- 1.15.42 Lead numbers and letters (generally of 6mm size) are to be used for identification of radiographic contract No., joints identification, sources used welder's identification, SFD used are to be noted down in the paper cover of radiography. Lead intensifying screens for front and back of the film shall be used as per the instructions of BHEL Engineer
- 1.15.43 The weld joint is to be marked with permanent mark A, B, C, etc. to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the downstream side of the weld. For multiple exposures on pipes, an overlap of about 25 mm of film shall be provided.
- 1.15.44 The contractor shall be fully equipped with radiography equipments, films, chemicals and other dark room facilities. There must be a number of radiographic personnel with sufficient experience and certified by BARC for

TECHNICAL CONDITIONS OF CONTRACT (TCC)

field radiographic inspection. Further, the contractor must follow strictly the safety rules laid down by BARC, from time to time, contractor's radiographers shall also be registered with BARC for film badge service. Minimum of 2 radiography sources shall be made available by the contractor.

- 1.15.45 Contractor shall provide all skilled, unskilled work men required for the job, which will include Engineers, supervisors, operators, as required for timely and satisfactory execution of radiography work.
- 1.15.46 All the radiographs shall be properly preserved in air-conditioned rooms and shall become the property of BHEL.
- 1.15.47 Radiography of joints shall be so planned after welding that the same is done either on the same day or next day of the welding to assess the performance of high pressure welders. If the performance of the welder is unsatisfactory, he shall be replaced immediately.
- 1.15.48 The defects as pointed out by the Engineer shall be rectified immediately to the satisfaction of Engineer and Re-radio graphed. The decision of Engineer regarding acceptance or otherwise of the joint shall be final and binding on the contractor.
- 1.15.49 Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radiographed and new film submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radio graphed at contractor's cost.
- 1.15.50 The contractor shall also be equipped for carrying out other NDT like liquid penetrant inspection, magnetic particle inspection, etc. as and when required in the interest of work within the quoted rates.
- 1.15.51 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work includes such preparation and no extra charges are payable for this.
- 1.15.52 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 and quote the price inclusive of all such work and radiography.
- 1.15.53 The welded surface irrespective of place of welding shall be cleaned of slag and painted at the center with primer paint to prevent corrosion at no extra cost towards this.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.54 All welders shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the required certificate. BHEL reserves the right to reject any welders without assigning any reason. The welder Identification code as approved by the BHEL Engineer shall be stamped by the welder on each joint done by them. The contractor will be responsible for the periodic renewal, retesting of the welders as demanded by BHEL.
- 1.15.55 BHEL Engineer is entitled to stop any Welder from the work if his work is unsatisfactory for any technical reasons or there is a high percentage of rejection of joints welded by him, which in opinion of the BHEL Engineer will adversely affect the quality of the welding though the Welders, has earlier passed the tests prescribed by BHEL Engineers. The welders having passed qualification tests do not relieve the contractor of a contractual obligation to check the welder's performance.
- 1.15.56 All charges towards testing of Welders for destructive and non-destructive test, testing and approval of welders for engaging in the erection work shall be borne by the contractor.
- 1.15.57 The welding process, weld joint details, joint configuration and material specification may change to suit the design requirements. The contractors quoted rates shall be inclusive of each contingency. All welds involved in the erection of temporary pipe lines for hydraulic test, chemical cleaning, steam blowing etc. to be carried out within the quoted rates. The number of joints to be welded as mentioned in the welding schedule consists of butt welds. All other welds viz attachment welds on pressure parts/non-pressure parts, fillet welds in non-pressure parts welding in the boiler and Rotating Machines has to be carried out by the bidder within quoted rates.
- 1.15.58 For uniform heating and better closed loop control, pre heating, post heating, controlled rate of heating & cooling and post weld heat treatment cycles for tube specifications SA213T91 & SA213T92 should be carried out using flexible ceramic pads with suitable heating machine.
- 1.15.59 MPI must be followed on joints which had undergone ultrasonic testing.
- 1.15.60 After completion of Hydro Test (interval) for all relevant joints RT, SR and NDT reports shall be submitted to BHEL
- 1.15.61 The enclosed welding schedule in VOLUME- IA PART II Chapter 2 is for information and the applicable welding schedules will be issued during erection of work at site.

VOLUME-IA PART-I CHAPTER – XVI

HYDRAULIC TEST

(Applicable for Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.16.1 The pressure testing for boiler / piping system shall be carried out as per IBR / Customer / customers' consultant specification / BHEL. Customers' consultant specification forms the part of this tender specification.
- 1.16.2 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall supply necessary labour and other services and make necessary arrangements to carry out the required tests as per the instructions and directions of the BHEL Engineers.
- 1.16.3 The contractor shall make all necessary arrangements including making of temporary closures on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost.
- 1.16.4 Soundness of the welds shall be tested hydraulically under the supervision of the BHEL Engineer and Customer, to the pressure indicated in the drawing. Prior to the test, the boiler / piping system shall be inspected by the BHEL Engineer to the extent necessary to ensure compliance with clearance for the test, which will be obtained by the contractor from the Engineer.
- 1.16.5 Hydraulic testing, as required shall be carried out by the contractor. The servicing, installation, electrical connection, erection, testing and dismantling of Hydraulic Test pump, temporary pipelines, fittings, etc. shall be carried out by the contractor as part of this work.
- 1.16.6 All the hydraulic tests shall be repeated till all the pipelines / boiler to satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of IBR inspectorate / BHEL / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost. The contractor shall carry out all the required tests and pre-commissioning and commissioning activities required for successful and reliable operation. These would include hydraulic test of piping, pre-boiler system detergent flushing/chemical cleaning, steam blowing, water washing etc. as instructed by BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.16.7 Test records shall be made for pressure testing of above piping system. These records shall contain the following information:
- a) Date of test
 - b) Identification of piping tested
 - c) Test fluid
 - d) Test pressure
 - e) Approval of the Engineer.
- 1.16.8 Contractor has to arrange required pumps with sufficient capacity for filling water in the tubes and pipes for conducting Hydraulic testing of LP lines. Contractor has to arrange Hydraulic Test pump / Hand Pump at his cost for Hydraulic testing of LP lines.
- 1.16.9 Hydraulic testing pumps for HP lines shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working condition. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc., shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.
- 1.16.10 Contractor shall lay all necessary electric cables and switches etc. required for the hydraulic tests and other tests, flushing etc., and maintain the system till the tests are completed satisfactorily.
- 1.16.11 Raw materials for all temporary piping necessary for conducting Hydraulic test, Chemical cleaning, Steam blowing, Flushing, effluent disposal, etc. will be provided by BHEL free of cost. However, fabrication, servicing, erection and dismantling the same and return of the temporary piping, flanges, valves etc. to BHEL stores is the responsibility of the contractor without any extra charges.
- 1.16.12 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc. shall be removed by the contractor and returned to BHEL. All thermo well points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. After hydro test, the plugs seal welded are to be removed and weld burrs ground finished for enabling erection of thermowells. Necessary blanks will be provided by BHEL.
- 1.16.13 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable de-aeration / venting / draining points with valves as per

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided without charging extra. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities/scars of cutting weld filled and ground as per BHEL Engineer's instructions.

- 1.16.14 The contractor shall make all necessary arrangements including making of temporary closures / dummy on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost. Necessary blanks will be provided by BHEL.
- 1.16.15 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 1.16.16 In general, Hydraulic testing of piping shall be performed after all eventual pipe branches have been completed and valves installed. Should it be required to hasten erection work, pressure tests may be performed by sections. For this scope of work, the erected pipe lines shall be hydraulically tested as per site requirement in segments. For conducting hydraulic test, both ends of pipe lines shall be blanked by welding of plates. Only one or two set of plates and structural materials for blanking required for one segment will be provided by BHEL free of charge. After completion of hydraulic test in one segment, the same plates are to be cut and removed and utilized / welded on the other segment of the pipe lines, to carry out the hydraulic test for the respective segments. No separate plates for blanking for each segment will be provided. After completion of Hydraulic test, the required edge preparations shall be carried out on the end of pipe lines and to be welded with the respective pipe lines. In such cases joint connection shall be checked during a final and additional test, if required. The contractor shall note this aspect and quote accordingly.
- 1.16.17 During hydraulic test, the pipes being tested shall be isolated from the equipments to which they are connected.
- 1.16.18 Openings on piping for pressure / temperature impulse connections shall be fully closed during the test to prevent dust or foreign matter entering into the instrument piping inadvertently.
- 1.16.19 The following specifications shall also be complied with during hydrostatic test.
 - a. Vent nozzles with valves shall be provided at the highest point of the runs, to eliminate air pockets. At the lowest point drain nozzles, with

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- valves shall be provided to drain water from pipes. The nozzles and valves shall be of the same materials as the pipe
- b. The lowest part of the pipe shall always be filled first with water.
 - c. Pressure shall be slowly increased (without shocks) to the stipulated value and maintained as long as required to visually check all joints.
 - d. Following the control specified above the pressure shall be slowly decreased to the design pressure after which the pipe shall be subjected to the peening test, applying knocks every 150 mm approx. especially in the welded joint areas, with a 0.5 – 1.5 kg. Hammer (depending on the pipe wall thickness). The hammer used shall be a round headed one.
 - e. Following the peening test, the pressure shall be increased to the stipulated value and all welded joints shall be visually inspected.
 - f. Following these test, the pipe shall be drained or pumped out to the other section to be hydro test using the drain out pump to be provided by Contractor and wherever necessary shall be flushed with air for all pipes.
 - g. The pressure test is considered satisfactory if no cracks, unjustified pressure reductions, leakages, seepages etc., appear.
 - h. Should defects be found, these shall be repaired in the same manner as these during radiographic examination. Hydraulic test shall be repeated after defects have been repaired.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER- XVII

TESTING AND COMMISSIONING

(Applicable for Package A and Package B)

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

1.17 TESTING, PRE– COMMISSIONING, COMMISSIONING AND POST COMMISSIONING

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

- 1.17.1 The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation. These would include Air leak test of Boiler, Ducts, hydraulic test of boiler, land flow test, clean air flow test, Gas Distribution Test, chemical cleaning of piping and boiler, water washing, oil flushing of oil system etc. as instructed by BHEL using contractors own consumables, labour and scaffoldings etc. Air leak test on pressure parts preliminary to hydraulic test by compressed air shall also be carried out to check and rectify the various leakage and defects etc. All the chemicals required for carrying out these activities will be supplied by BHEL free of cost.
- 1.17.2 All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications though some of the tests / activities are not listed in these specifications.
- 1.17.3 After completion of erection of furnace, ducts and air heaters, a test shall be performed on the steam generator by the contractor to establish the tightness of the erected equipment from the outlet of Forced Draught (FD) fan through the steam generator up to stack.
- 1.17.4 All the tests may have to be repeated till all the equipment satisfy the requirement / obligation of BHEL at various stages. The contractor shall do all the repairs for site-welded joints arising out of the failure during testing.
- 1.17.5 Raw materials for all temporary piping necessary for conducting Hydraulic test, Chemical cleaning, Steam blowing, Flushing, effluent disposal, etc. will be provided by BHEL free of cost. However, fabrication, servicing, erection and dismantling the same and return of the temporary piping, flanges, valves etc. to BHEL stores is the responsibility of the contractor without any extra charges.
- 1.17.6 The scope of pre-commissioning activities covers installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro

TECHNICAL CONDITIONS OF CONTRACT (TCC)

test, chemical cleaning, steam blowing or for any other tests. The scope also covers the offsite disposal of effluents.

1.17.7 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc. shall be removed by him and returned to BHEL. All thermowell points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.

1.17.8 All items / material required for conducting hydraulic test, alkali boil out, acid cleaning / EDTA cleaning, steam blowing etc., will be supplied by BHEL / its customer. However, servicing, dismantling and returning of the same to stores is the responsibility of the contractor who is erecting the equipment / piping. The contractor may note that **no separate payment shall be released** for any temporary works that are to be carried out for conducting pre-commissioning and commissioning tests. Bidders are advised to include expenses on temporary works along with the rates being quoted by them. Broadly the work on temporary systems will be as under:

- Erection etc. of all temporary piping including valves, tanks, effluent pumps, electrical control panel and cabling along with insulation and supports for steam blowing; chemical cleaning and effluent disposal are to be carried out as part of work. Contractor will be responsible for their operation and any servicing required during the pre-commissioning activities. He will also service the equipment and handover the equipment to the other agency for further erection / commissioning activities. All the pumps, motors and electrical control panels/ switch gear, valves and actuators will be furnished to the contractor after due servicing.
- Erection etc. of blowers and blanks and putty, temporary fixtures & ducts required for conducting air tightness test and GD Test are to be installed. (Putty to be procured by the contractor).
- Dismantling of the temporary equipment, piping and return the same to the BHEL stores is also included in the scope of work.

The above is only a broad breakup of the temporary works. The engineer at site will make final break up. His decision will be final and binding by all the parties.

1.17.9 Contractor shall lay all necessary electric cables and switches etc. required for the hydraulic test and other tests, flushing etc., and maintain the system till the tests are completed satisfactorily.

1.17.10 Commissioning of the boiler will involve trial run of all the equipment erected. The boiler has to be lighted up for refractory drying, alkali boil out, acid

TECHNICAL CONDITIONS OF CONTRACT (TCC)

cleaning / EDTA cleaning, passivation, preservation, steam blowing and floating of safety valves. Flushing of all the lines by air, oil or steam as the case may be, trial run of the boiler, servicing of valves and any other works incidental to commissioning are to be carried out. Contractor shall supply manpower round the clock.

- 1.17.11 It shall be the responsibility of the contractor to preserve the boiler as per BHEL's requirement. The required N₂ will be provided by BHEL for boiler preservation if required.
- 1.17.12 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.
- 1.17.13 It shall be specifically noted that the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including engineers/supervisors.
- 1.17.14 It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.
- 1.17.15 In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
- 1.17.16 During commissioning, opening / closing of valves, changing of gaskets, Re-alignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price /rates shall also include all such work.
- 1.17.17 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and re-alignment are necessary, the contractor at his cost shall do the same as per Engineer's

TECHNICAL CONDITIONS OF CONTRACT (TCC)

instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.

- 1.17.18 All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of pipes, all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.
- 1.17.19 The contractor shall carry out cleaning and servicing of valves and valve actuators prior to pre-commissioning tests and / or trial operations of the plant. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to BHEL Engineer to ensure that no valves and valve actuators are left un-serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.
- 1.17.20 Cleaning and servicing of all the filters / strainers, in the system shall be done by the contractor within the accepted price. All oils and greases to be filled in the main equipments as first fill and subsequent topping up's will be furnished by BHEL.
- 1.17.21 At the time of each inspection, the contractor shall take note of the decisions/ changes proposed by the Engineer and incorporate the same at no additional cost.
- 1.17.22 Hydraulic testing pump for Boiler shall be provided by BHEL free of hire charges. The testing pump will be issued to the contractor in working condition. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc., shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.
- 1.17.23 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall make necessary arrangements including supplying the Low Pressure Hydraulic test pump and other services to carry out the required tests as per the instructions and directions of the BHEL Engineers within the quote rates.
- 1.17.24 The valves, dampers, actuators etc. will have to be checked cleaned and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as may be necessary.
- 1.17.25 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is

TECHNICAL CONDITIONS OF CONTRACT (TCC)

within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided within quoted rate. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo-wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.

- 1.17.26 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Before hydraulic test, all the hangers are to be locked by locking pin / plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired value within quoted value.
- 1.17.27 All the tests shall be repeated till boiler / pipelines / equipments satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of BHEL / Boiler Inspector / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.
- 1.17.28 Transportation of oil drums from customer/ BHEL's stores, filling of lubricants and filling of oil for flushing and first filling and subsequent topping up during commissioning and post commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer / BHEL stores. Similarly, transport of chemicals for various pre-commissioning activities / processes mentioned in the above clauses and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.
- 1.17.29 Replacing / cleaning of filters of the erected equipments, piping system etc. during pre-commissioning / commissioning stage are within the scope of work.
- 1.17.30 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commission pumps, tanks, valves, fittings, hangers and supports and other installations as instructed by BHEL, Engineer for the purpose of chemical cleaning / alkali flushing / steam blowing / steam washing / steam flushing / water flushing / water washing / oil flushing etc. of piping and other equipments are in the scope of work. Necessary, materials for this will be provided by BHEL. Overhauling / cleaning / servicing of valves, pumps, fittings in temporary system and acid cleaning tanks etc. prior to the above operations / activities will also be carried out by the contractor at his cost. All the chemicals will be supplied by BHEL free of cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.17.31 Chemical cleaning (Acid cleaning of piping / EDTA cleaning / alkali flushing) will involve the installation of temporary piping, valves, cutting of some of the existing valves, placing the rubber, wedges in the valves, gagging of valves, and installation of temporary tanks for chemical and for mixing. Necessary temporary access platforms to mixing tank are to be made by the contractor. The dissolving tank, neutralizing tank etc. required for acid pickling will have to be fabricated by the contractor within the quoted rate. Required materials will be provided by BHEL free of cost. Chemicals for chemical cleaning will be provided by BHEL and handling of chemicals & other consumables and other connected activities has to be carried out by the contractor at their cost. All other consumable would have to be provided by the contractor.
- 1.17.32 Laying of insulation of this temporary piping, tanks are to be carried out by the contractor within quoted rate, and required insulation materials will be provided by BHEL. The welding joints in the temporary pipe lines for acid cleaning and steam blowing are to be welded by HP welders only. Required NDT tests are to be carried out for the above joints as part of work as per customer / BHEL requirement.
- 1.17.33 Steam blowing lines for Oil piping shall be erected as per the instructions of BHEL Engineer. Necessary pipes and other items will be supplied by BHEL free of cost. All arrangements for erection including welding have to be arranged by the contractor as a part of the work. After completion of steam blowing, all the temporary lines to be dismantled and restoration of piping to be carried out, within quoted rate.
- 1.17.34 During steam blowing operations the required manpower shall be arranged by the contractor as per the instructions of BHEL Engineer within the quoted rates. The manpower for the above operation may be required round the clock if necessary. The contractor shall carry out the above operation as per the instructions of BHEL Engineer within the quoted rates.
- 1.17.35 During the initial stages of work, trenches for draining water may not be available for alkali flushing or mass flushing for discharging and draining the system and piping. Necessary low point drains and temporary piping for this will have to be erected by contractor from materials provided by BHEL.
- 1.17.36 After the chemical cleaning has been successfully completed, removing all temporary piping, fittings of tanks etc. checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, re-fixing as per BHEL Engineer's instructions is within the scope of work/specification.
- 1.17.37 The contractor as per BHEL requirements will suitably make preservation of cleaned surfaces.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.17.38 Contractor may have to replace old/damaged gaskets / packing etc. for equipments and the same shall be carried out by contractor as per requirement. Materials will be given by BHEL.
- 1.17.39 In case any erection defect is detected during various tests / operations, trial runs as detailed above such as loose components, undue noises or vibration, strain on connected equipment steam or oil or water leakage etc. the contractor shall immediately attend these defects and take necessary corrective measures. The parts to be replaced shall be provided by BHEL free of cost. If the insulation is to be removed to attend any of the defects the cost of removal and reapplication of insulation should be borne by the contractor.
- 1.17.40 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.
- 1.17.41 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
- 1.17.42 During this period though the BHEL's / Client's staff will also be associated in the work, the contractor's responsibility will be to arrange required tools, man and plants till such time the commissioned units are taken over by BHEL's client.
- 1.17.43 Contractor shall cut / open works if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. This contingency shall be included within the quoted value. During commissioning, opening of valves, changing of gaskets, attending to leakages, minor modification / rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning the same has to be rectified by the contractor at his cost.
- 1.17.44 For conducting gas tightness test, it may be required to erect the blowers and connecting ducts and commission the same for tightness test. It is the responsibility of the contractor to erect the blowers & dismantle once the test is over. Contractor shall carry out the work within the quoted rate and BHEL will provide blowers and dummies free of cost for conducting the test.
- 1.17.45 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.17.46 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance for a period of six months after synchronization or till handing over of sets to customer, whichever is earlier.
- 1.17.47 Commissioning of the boiler will involve trial runs of all the equipments erected, lighting up of the boiler for refractory drying, blowing of the steam lines, floating of safety valves, flushing of all the lines by air, oil or steam as the case may be, trial run of the fans, Lube Oil pumps, Mills, servicing of all equipments like dampers, actuators, valves etc. and any other works incidental to commissioning. Contractor shall provide required workers along with supervisors with all the requisite tools round the clock and material for all these works, which shall form part of the work to be done.
- 1.17.48 After floating of safety valves, the commissioning activities and trial operations will continue up to handing over of the unit. Contractor shall provide the manpower for three months from trial operation or submission of final bill with material reconciliation whichever is later. It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers as per the work requirement along with supervisors including necessary consumables, tools etc., during this period. The rate quoted shall indicate all these contingencies also. The various categories of workers required for pre-commissioning, commissioning and post-commissioning activities are as follows:
- a) Pipe fitters
 - b) Millwright Fitters
 - c) HP& structural welders
 - d) Riggers
 - e) Unskilled workers
 - f) Supervisors
 - g) Electricians
 - h) Lagers
 - i) Sheet metal fabricator/fitter
 - j) Any other category of workers as may be required.

Further in addition to the above, contractor has to arrange the following minimum manpower exclusively for assisting BHEL commissioning engineers during stabilization and trial operation period. This manpower will be directly controlled by BHEL commissioning engineers.

1. One Engineer In charge for three shifts.
2. Two supervisors per shift for three shifts
3. Three fitters per shift for three shifts
4. Six helpers per shift for three shifts

TECHNICAL CONDITIONS OF CONTRACT (TCC)

It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL commissioning Engineers and hence, overtime, may be involved. The contractor's quoted rate shall be inclusive of all these factors also.

- 1.17.49 During commissioning any improvement or rectification due to design requirement is involved and if the contractor is asked to carry out the job, they shall be paid at man-day rates. For this purpose, daily labour report indicating therein nature of work carried out, consumables used, etc. shall be maintained by contractor, and got signed by BHEL Engineer every day. It is not obligatory on the part of BHEL to get the works done by the contractor. They can employ any other agency if they so desire at that time.
- 1.17.50 During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.
- 1.17.51 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 1.17.52 The contractor has to provide required man power assistance during pre-commissioning and commissioning checks of motor operated valves, actuators, control valves etc. without any extra charges.
- 1.17.53 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of electrical hoist. Required loads will be provided by BHEL free of cost.
- 1.17.54 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works for dismantling, cleaning, lubricating and refitting are to be carried out by contractor at his cost.
- 1.17.55 **Boroscopic examination of headers etc. to be conducted after steam blowing. This requires cutting of tubes to facilitate the boroscopic examination and re welding etc. are part of work and the same to be carried out with in the quoted rate.**
- 1.17.56 All oils and greases to be filled in the main equipment's as first fill and subsequent topping ups will be furnished by BHEL. All services including labor and T&P will be provided by the contractor for transporting from BHEL/ customer stores handling, filling, emptying, refilling etc. The consumption of

TECHNICAL CONDITIONS OF CONTRACT (TCC)

lubricants/chemicals shall be properly accounted for. Surplus material if any shall be properly stacked/tagged and returned to BHEL/Customer stores at no extra cost to BHEL. BHEL reserves the right to recover costs for wastage by the contractor

- 1.17.57 Assistance for calibrating / testing the power cylinders / actuators / valves, gauges, instruments, etc. and setting to actuators shall be provided by contractor within the quoted rates.
- 1.17.58 Air tightness shall be performed on each pass of precipitator on completion of erection of ESP casing, hopper, inlet and outlet funnels with all internals fitted as per the approved drawings.
- 1.17.59 The activity shall be completed prior to installation of insulation of ESP and the work front for insulation shall be made available to the insulation agency without any delay.
- 1.17.60 All instruments brought by contractor shall be calibrated and the calibration certificates shall be submitted to BHEL prior to commencement of the activity.
- 1.17.61 The test team should be aware of all emergency procedures/ safety procedures.
- 1.17.62 The method of execution will be decided by BHEL Engineer. Any decision in this regard is final and binding on the contractor.
- 1.17.63 The completion criteria shall be that as given in the commissioning procedure, and shall be done up to the satisfaction of BHEL Engineer.

VOLUME-IA PART- I CHAPTER-XVIII

PAINTING

(Applicable for Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.18.1 PAINTING FOR BUNKER SHELL

1.18.1.1 Blast cleaning by shot / metal blasting of steel structures to near white metal surface (Sa 2½) as per SIS05-5900 and applying 2 coats of zinc silicate primer (one coat at fabrication yard and one coat after erection) instead of primer coat of red oxide zinc-chromate, including touch-up painting etc. all complete as per specification to be done within the quoted rate.

1.18.1.2 Providing and applying two coats of High built epoxy finish paint of approved brand over steel sections already having primer coats. Dry film thickness of each finish coat shall be 90 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness with primer shall not be less than 300 microns. The item includes protection, cleaning, touch-up painting etc. all complete as per specification.

1.18.2 FINAL PAINTING

1.18.2.1 The scope of work shall also include supply and application of final painting of all the erected equipment for the components of boiler and its auxiliaries, mill bunker structures, ESP, rotating machines etc. including bunkers as required and specified as per enclosed painting schedules in Chapter 5 to 8 of Part II in Technical Conditions of Contract (Volume-I Book-I).

1.18.2.2 Required paints, thinner other consumables such as wire brush, brush etc. shall have to be arranged by the contractor at their own cost. The required manpower, other required consumables, T & P etc. shall be provided by the contractor within the quoted rate. The arrangement of primer/paint will be in contractor's scope.

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

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

1.18.2.5 All the exposed metal parts of the equipments including piping, structures, hangers etc., wherever applicable after installation unless otherwise specified the surface protected, are to be first painted with at least one coat

TECHNICAL CONDITIONS OF CONTRACT (TCC)

of suitable primer and required number of finish coats as indicated in the Painting Specification in Technical Conditions of Contract (TCC) which matches the shop primer paint used, after thoroughly cleaning the dust, rust, scales, grease oil, and other foreign materials by wire brushing scrapping and chemical cleaning and the same being inspected and approved by BHEL engineers for painting. Afterwards the above parts shall be finished with as per the instructions of BHEL / Customer official.

- 1.18.2.6 Normally Paint shall be applied by brushing as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimum. If needed and insisted either by BHEL / Customer in certain cases, spray painting has to be carried out within the Quoted rates. Spray painting gun and compressed air arrangement has to be made by the contractor himself within the Quoted rates.
- 1.18.2.7 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.18.2.8 Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted for the painting. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,
- 1.18.2.9 The scope of painting includes application of colour bands, lettering the names of the systems, equipments, tag nos. of valves, marking the directions of flow and other data required by BHEL within the quoted rate.
- 1.18.2.10 All surfaces to be painted shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots.
- 1.18.2.11 Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor. (Refer Painting Schedule for Required DFT).
- 1.18.2.12 Finish coat paint, no. of coat and DFT shall be as indicated in the painting specification enclosed in this tender / relevant BHEL document/ customer's specifications. The painting specification which is forming part of this tender as in TCC shall be used as guidelines to be followed.
- 1.18.2.13 The actual colour to be applied shall be approved by the customer before starting of actual painting work.
- 1.18.2.14 Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only, and the paints should be as per the customer

TECHNICAL CONDITIONS OF CONTRACT (TCC)

painting specification. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities. The batch certificates of paints to be submitted to BHEL Engineer before using the same.

- 1.18.2.15 No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.
- 1.18.2.16 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
- 1.18.2.17 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.18.2.18 Wherever applicable, supply and application of primer / final painting of all the insulation items erected under the scope of this tender. The painting shall be as required and specified in the painting schedule, which forms the part of this tender book.
- 1.18.2.19 Painting of inner side of sheet metal covering over the insulation walls with two coats of anti-corrosive paint (IS-158) to be applied to the entire satisfaction of BHEL Engineer and application of bituminous sealing compound on cladding / sheet metal joints shall also be carried out by the contractor. Retainer type 'A' must be coated with Aluminum paint. For which the required amount of paint, thinner and other accessories for painting, cleaning the surfaces etc., shall be arranged by the contractor within the quoted rate.
- 1.18.2.20 The contractor shall effectively protect the finished work from action of weather and from damage of defacement and shall cover the finished parts, then and there, for their protection.
- 1.18.2.21 The painting scheme for Bunker structures will be similar to the boiler structures. However, changes if any as per design documents / drawing will have to be carried out within the quoted rate.

1.18.3 PRESERVATION / TOUCH UP PAINTING

- 1.18.3.1 Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipments under this tender specification right from pre-assembly stage to till the equipment is cleared for final painting. The primer paint shall be matching shop primer.
- 1.18.3.2 Any rust on the issued/pre-assembled materials shall be suitably cleaned and painted before erection of the material. Cleaning of rust and painting

TECHNICAL CONDITIONS OF CONTRACT (TCC)

shall be done by the contractor within the rates awarded in the contract and no additional cost will be provided for the same.

- 1.18.3.3 Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with touch up coat of same primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.
- 1.18.3.4 Mostly the equipment / items / components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour.
- 1.18.3.5 Required paints, thinner other consumable such as wire brush, brush etc. shall have to be arranged by the contractor at their own cost. The required manpower, other required consumables, T & P etc. shall be provided by the contractor within the quoted rate. The arrangement of primer/paint will be in contractor's scope
- 1.18.3.6 The contractor shall clean, wherever necessary and paint inside surfaces of the equipments as per instruction of BHEL Engineer during erection at the quoted rate. The Contractor has to arrange necessary paints within the quoted price.
- 1.18.3.7 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.
- 1.18.3.8 Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other consumables like wire brushes, emery paper, cotton waste, cloth etc. at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.
- 1.18.3.9 Painting of portions of Employer's structures wherever connection/welding is carried out by contractor for supporting structures.
- 1.18.3.10 All rectification including painting of Employer's structure which are damaged by contractor during his work.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART - I CHAPTER – XIX

ACCOUNTING OF MATERIALS ISSUE

(FOR BUNKER FABRICATION & ERECTION of Package A and Package B)

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

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.19.1 ISSUE OF STEEL

1.19.1.1 The steel shall be issued to the contractor on the following basis:

Sl. No.	Description	Basis
(a)	Structural Steel	Weighment basis (Unit – MT)

1.19.1.2 All the steels (structural, reinforcement, earthing MS rod) issued by BHEL shall be properly accounted for. The total quantity of steel required for the work will be calculated from the approved Bar Bending schedule, fabrication drawings, approved laps, chairs and lugs. The measurement for payment as well as for accounting (issue, reconciliation and return of materials) shall be based on the sectional weights as indicated in the following IS standards. No rolling tolerance shall be accepted in any case for issue, reconciliation, return of materials and payment purposes

IS: 808-1964 Beams, Channels and Angles

IS: 1730-1961 Plates, Sheets and Strips / Flats

1.19.1.3 The steel issued to the contractor shall be mainly in standard length and sections as received from the supplier. However, the contractor shall be bound to accept the steel in length as available in the project stores no claims for extra payment because of issue of non-standard length will be entertained.

1.19.1.4 The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.

1.19.1.5 The contractor shall submit to the engineer, a statement indicating estimated quantity of steel required during a quarter, at least two months in advance of the quarter. In addition, the contractor shall also furnish the estimated requirement of steel during a month by the third week of the previous month indicating his requirement.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.19.1.6 Following shall be limit for the maximum quantity of BHEL issue materials that would be with the contractor at any point of time when work is in progress (excluding what has already been incorporated in the works).

SL. No.	Issue of Materials	Maximum Quantity in contractor's store.
1	Structural Steel	Requirement of one month

Bidders to ensure that no lamination materials are taken over by them from BHEL.

Fabrication wastage, if any due to above, shall not be compensated by BHEL.

Bidder to note that steel materials required for embedment, inserts, MS Grating, Galvanised Grating, GI Handrail, Stainless Steel Handrail, SS Sheets for Bunker liner, Stop Lock Gate, Stationery Screen, fasteners like MS / HT / HSFG bolts / nuts, lock nuts, washers and foundation bolts other than those supplied by BHEL, shall be supplied by the bidder. However, Bidder shall use the scrap materials available with BHEL or with the respective bidders, for their use in the permanent works as embedment / inserts etc. after necessary store issue formalities, if taken from BHEL and shall be accounted for monthly reconciliation, if it belongs to the bidder's scrap materials.

1.19.2 RETURN OF MATERIALS

- 1.19.2.1 All surplus steel and all wastage materials will be taken back on weighment basis.
- 1.19.2.2 Surplus, unused and untampered steel shall be sorted section-wise and returned separately for a place directed by BHEL/Engineer within the project area. Return of such materials will not be entitled to any handling and incidental charges.
- 1.19.2.3 All wastage / scrap (including melting scrap, wastage, and unusable scrap) shall be promptly returned to the stores and a receipt obtained for material accounting purposes. Return of such material will not be entitled to any transportation and incidental charge. Bidder shall use the scrap materials for their use in the permanent works as embedment / inserts etc. after necessary store issue formalities and site clearance

1.19.3 SCRAP & SERVICEABLE MATERAILS:

- 1.19.3.1 All Structural steel of length above 2 M except M.S. Plate shall be considered as serviceable materials provided the materials is in good and acceptable condition. Structural steel in length less than 2 M shall be treated as scrap.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.19.3.2 Plates having both sides greater than 1 M or if any side is less than 1 M but greater than 0.5 M and the total area is equal or greater than 2 Sq. M shall be considered as serviceable.
- 1.19.3.3 All pipes measuring 2 M and above in length shall be treated as serviceable materials provided they are in good and acceptable condition. Pipe in less than 2 M length shall be treated as scrap.
- 1.19.3.4 All TMT measuring 3 M and above in length shall be treated as serviceable materials provided they are in good and acceptable condition. TMT in less than 3 M length shall be treated as scrap.

1.19.4 STEEL CONSUMPTION AND WASTAGE

1.19.4.1 STRUCTURAL STEEL, (ROLLED SECTION, PLATES ETC.) CONSUMPTION & WASTAGE.

a) CONSUMPTION.

The theoretical consumption of various sections shall be based on approved drawings. Weights shall be calculated considering the sectional weights as per Indian standard. No extra shall payable to the contractor for any deviation in weights for the two different procedures adopted for issue and calculation of the theoretical consumption including rolling tolerances.

i). Actual consumption = Issue – Surplus.

ii). Surplus = Untampered, unused, uncut quantity of steel and Serviceable materials as stipulated under clause “Scrap and Serviceable Materials (Refer Clause 1.19.3 above)” returned by the contractor to BHEL store along with relevant documents.

iii). Wastage = Actual consumption – Theoretical consumption.

b) WASTAGE

Allowable wastage: - 4% (FOUR percent) of the theoretical consumption shall be considered. Wastage shall be considered as cut pieces and scrap material, measured as per actual weight basis. Invisible wastage (max limit to 0.5%), if any, shall be considered to be included in the specified 4% allowable wastage.

Sl. No.	CONSUMPTION OF STRUCTURAL STEEL (ROLLED SECTION, PLATES & SS liner)	BASIS OF ISSUE
S-1	Theoretical consumption (without Considering any wastage, scrap or loss) as per spec. & drawing.	Free

TECHNICAL CONDITIONS OF CONTRACT (TCC)

SI. No.	CONSUMPTION OF STRUCTURAL STEEL (ROLLED SECTION, PLATES & SS liner)	BASIS OF ISSUE
S-2	Wastage limited to plus Four percent (+4%) of the aforesaid theoretical consumption (S-1) towards allowable wastage.	Free
S-3	Wastage beyond Four percent (4%) of the aforesaid theoretical consumption (S-1).	Penal Rate

1.19.5 RECONCILIATION OF MATERIALS

- 1.19.5.1 The contractor shall submit a reconciliation statement of steel issued to him and steel procured by him with each RA Bill.
- 1.19.5.2 At the time of submission of bills, the contractor shall properly account for the material issued to him as specified herein to the satisfaction of BHEL certifying that the balance materials are available with contractor's custody at site.
- 1.19.5.3 At the time of submission of bills by the contractor, if it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then, BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified.
- 1.19.5.4 The reference drawings for actual material consumption to be used for the purpose of reconciliation shall be drawings prepared by the BHEL and drawings approved by BHEL for fabrication works and such other drawings approved by BHEL. This shall also include the bar bending schedule prepared by the contractor and approve by BHEL.

1.19.6 RECOVERY OF MATERIAL

If wastage exceeds the specified limit, the recovery of excess wastage shall be made from monthly Running Account Bill at the Penal Rate.

PENAL RATE OF MATERIALS

A	STRUCTURAL STEEL MS plates, MS flats, rolled steel joists, channels, and angles, MS pipes, Chequered Plates, etc. in sizes and lengths as available	Rs. 59,693 /- per MT plus GST

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – II CHAPTER 1

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

Sl. No.: 1

Clause 4.1.11 of SCC is deleted.

Sl. No.: 2:

OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME

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

Chapter IX Clause 9.1 is modified as below:

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

Chapter IX Clause 9.1.1 to 9.1.25 stands deleted.

Chapter IX Clause 9.2 to 9.62 stands deleted.

Sl. No.: 3:

Clause No. 10.5 on RA Bill Payments, in Special Conditions of Contract (SCC), Volume-IB, Book-II, is revised as under:

The payment for running bills will normally be released within 30 days of submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc., and other dues in the meanwhile.

Sl. No.: 4

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

1.9 EARNEST MONEY DEPOSIT

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

- i) Electronic Fund Transfer credited in BHEL account (before tender opening).
- ii) Through Online EMD payment portal of BHEL with SBI (before tender opening) by following steps as below: -

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1. Visit www.onlinesbi.com -> Go to State Bank Collect (In the tab section)
 2. Click Check box to proceed for payment -> Click on Proceed
 3. Under State of Corporate/Institution -> Select Tamilnadu
 4. Under Type of Corporate/Institution -> Select PSU – Public Sector Undertaking -> Go
 5. Under PSU – Public Sector Undertaking Name -> Select BHEL PSSR CHENNAI and Submit
 6. Under Select Payment Category ->-> SCT Tender EMD & Tender Fees
- iii) Banker's Cheque or Pay order or Demand Draft in favour of 'Bharat Heavy Electricals Limited' (along with offer) and payable at Chennai.
- iv) Fixed Deposit Receipt (FDR) issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL) along with the offer.
- v) In case EMD amount is more than Rs. Two Lakhs, Tenderer has the option to submit Rs. Two lakhs in any one of form described above in clause no. 1.9.1. (i) to (iv) and the remaining amount over and above Rs. Two Lakhs in the form of Bank Guarantee from Scheduled Bank, along with the Offer.

Note:

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

Bank Details for the purpose of Taking EMD

Name and Address of Beneficiary:	Bharat Heavy Electricals Ltd. #690, EVR Periyar Building, Nandanam, Anna Salai, Chennai – 600 035
Name of Bank :	State Bank of India
Bank Branch Address:	SBI Saidapet Branch, EVR Periyar Building, Nandanam, Anna Salai, Chennai - 35
IFSC Code :	SBIN0000912
Account No. :	10610819499

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

1.9.2 EMD shall not carry any interest.

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

- i. After opening the tender and within the offer validity period, the Tenderer revokes his tender or makes any modification in his tender which is not acceptable to BHEL.
- ii. The Contractor fails to deposit the required Security deposit or commence the work within the period as per LOI/Contract

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

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

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

Sl. No.: 5

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

1.10 Security Deposit:

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

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

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

1.10.4 Modes of deposit:

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

- 1 Cash (as permissible under the extant Income Tax Act)
- 2 Local cheques of Scheduled Banks (subject to realization) / Pay Order / Demand Draft / Electronic Fund Transfer in favour of BHEL

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 3 Bank Guarantee from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats.
- 4 Fixed Deposit Receipt issued by Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C BHEL, duly discharged on the back.
- 5 Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor furnishing the security and duly endorsed / hypothecated / pledged, as applicable, in favour of BHEL and discharged on the back)

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

- 1.10.5 At least 50% of the Security Deposit including the EMD should be deposited in any form as prescribed before start of the work and the balance 50% of the Security Deposit will be recovered by deducting 10% of the gross amount progressively from each running bills of the contractor till the total amount of the required Security Deposit is collected.
- 1.10.6 The recoveries made from running bills (cash deduction towards balance SD amount) will be released against submission of equivalent Bank Guarantee in the prescribed formats, but only once, before completion of work.
- 1.10.7 The Security Deposit shall not carry any interest.
- 1.10.8 If the value of work done at any time exceeds the contract value, the amount of Security Deposit shall be correspondingly enhanced and the excess Security Deposit due the enhancement shall be immediately deposited by the Contractor or recovered from payment/s due to the Contractor.
- 1.10.9 The validity of Bank Guarantees towards Security Deposit shall be initially upto the completion period as stipulated in the Letter of Intent/Award + 3 months, and the same shall be kept valid by proper renewal till the acceptance of Final Bills of the Contractor, by BHEL.
- 1.10.10 BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfill any of the contractual obligations or in the event of termination of contract as per terms and conditions of contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.10.11 Penalty for Delayed Remittance of Security Deposit

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

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

Sl. No: 6

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

2.7.2.

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

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

Risk & Cost Amount against Balance Work:

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

Where,

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

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

H = Overhead Factor to be taken as 5

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

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

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

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

quantities as per amended Contract shall be considered as Contract Quantities.

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

total Quantities as per issued drawings would be deemed to be contract quantities.

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

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

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

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

Following sequence shall be applicable for recoveries from contractor:

- a) Dues available in the form of Bills payable to contractor, SD, BGs against the same contract.
- b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above.
- c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery.
- ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions / Units for making recovery from the Unpaid Bills / Running Bills / SD /BGs /Final Bills of contractor.
- iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

Sl. No.: 7

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

2.7.9.1 Penalty for Intermediate Milestones

- 2.7.9.1.1 M1 and M2 shall be intermediate Milestones for each unit of this work.
- 2.7.9.1.2 In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to Form 14.
- 2.7.9.1.3 Incase delay in achieving M1 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to Maximum 2% of executable contract value will be withheld.
- 2.7.9.1.4 Incase delay in achieving M2 milestone is solely attributable to the contractor, 0.5% per week of executable contract value* limited to maximum 3% of executable contract value will be withheld.
- 2.7.9.1.5 Amount already withheld, if any, against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 milestone.
- 2.7.9.1.6 Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
- 2.7.9.1.7 Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of intermediate milestones shall be adjusted against LD or released as the case may be.
- 2.7.9.1.8 In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted in to recovery.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

Sl. No: 8

OVERRUN COMPENSATION (ORC)

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

2.12 OVERRUN COMPENSATION (ORC)

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

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

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

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

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

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

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

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

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

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

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

Sl. No.: 9

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

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

- 7.1.1 Clause 2.13.1 in GCC is revised as "Normally no advance payment shall be payable to the contractor. Mobilization advance payment in exceptional circumstances shall be interest bearing and secured through a Bank Guarantee and shall be limited to a maximum of 5% of contract value. This 'Interest Bearing Recoverable Advance' shall be payable in not less than two installments with any of the installment not exceeding 60% of the total eligible advance".
- 7.1.2 Clause 2.13.6 in GCC is revised as "The rate of interest applicable for the above advances shall be the Base rate of State Bank of India prevailing at the time of disbursement of the advance + 6%, and such rate will remain fixed till the total advance amount is recovered".
- 7.1.3 Clause 2.13.7 in GCC is revised as "Unadjusted amount of advances paid shall not exceed 5% of the total contract value at any point of time. Recovery of advances shall be made progressively from each Running Bill such that the advance amounts paid along with the interest is fully recovered by the time the contractor's billing reaches 90% of contract value."

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No.: 10

Void

Sl No: 11

PRICE VARIATION COMPENSATION (PVC)

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

2.17 PRICE VARIATION COMPENSATION

- 2.17.1 In order to take care of variation in cost of execution of work on either side, due to variation in the index of LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS, Price Variation Formula as described herein shall be applicable (only for works executed during extended period, if any, subject to other conditions as described in this section).
- 2.17.2 **85%** component of executed Contract Value shall be considered for PVC calculations and remaining 15% shall be treated as fixed component. The basis for calculation of price variation in each category, their component, Base Index, shall be as under:

Sl. No	CATEGORY	BASE INDEX	PERCENTAGE COMPONENT ('K')				
			CIVIL PACKAGES (See Note A/B/C)			MECHANICAL PACKAGES	Electrical, C&I, Material Management / Handling and other labour oriented packages
			A	B**	C		
i)	LABOUR (ALL CATEGORIES)	'MONTHLY ALL-INDIA AVERAGE CONSUMER PRICE INDEX NUMBERS FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)	40	25	30	65	80
ii)	HIGH SPEED DIESEL OIL	Name of Commodity: HSD Commodity code: 1202000005 (See Note E)	5	3	5	5	5
iii)	WELDING ROD	Name of Commodity: MANUFACTURE OF BASIC METALS Commodity code:1314000000 (See Note E)				15	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

iv)	CEMENT	Name of Commodity: ORDINARY PORTLAND CEMENT Commodity code: 1313050003 (See Note E)		20	30		
v)	STEEL (Structural and Reinforcement Steel)	Name of Commodity: MILD STEEL: LONG PRODUCTS Commodity code: 1314040000 (See Note E)		25			
vi)	ALL OTHER MATERIALS (Other than Cement & Steel)	Name of Commodity: ALL COMMODITIES Commodity code: 1000000000 (See Note E)	40	12	20		

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

B) Cement & Steel: In Contractor Scope

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

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

E) As per the 'MONTHLY WHOLE SALE PRICE INDEX' for the respective Commodity and Type, published by Office of Economic Adviser, Ministry of Commerce and Industry, Government of India. (Website: http://www.eaindustry.nic.in/download_data_0405.asp). Revisions in the index or commodity will be re adjusted accordingly.

2.17.3 **Void**

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

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

Where

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

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

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

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

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

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

i) For the portion of shortfall/backlog not attributable to contractor, PVC shall be worked out on the basis of indices applicable for the respective month in which work is done. Base index shall be applicable as defined in clause 2.17.5

ii) In case of Force Majeure, the PVC shall be regulated as per (a) or (b) below.

a) Force Majeure is invoked before “Base Date” / “revised base date” (as explained below) OR immediately after “base date” / “revised base date” in continuation (i.e. during the period when PVC is not applicable):

1. Base date shall be revised: Revised Base date = Previous base date + duration of Force Majeure.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

Sl. No.: 12

Clause 2.21 on Arbitration in General Conditions of Contract (GCC), Volume-IC, Book-II, is revised as under:

2.21 ARBITRATION & CONCILIATION

2.21.1 ARBITRATION:

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice'). The Notice shall contain the particulars of all claims to be referred to arbitration in sufficient detail and shall also indicate the monetary amount of such claim. The arbitration shall be conducted by a sole arbitrator to be appointed by the Head of the BHEL Power Sector Region issuing the Contract within 60 days of receipt of the complete Notice. The language of arbitration shall be English.

The Arbitrator shall pass a reasoned award.

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

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

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

- 2.21.1.3 The cost of arbitration shall initially be borne equally by the Parties subject to the final allocation thereof as per the award / order passed by the Arbitrator.
- 2.21.1.4 Notwithstanding the existence of any dispute or differences and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and expedition in a professional manner unless the dispute inter-alia relates to cancellation, termination or short-closure of the Contract by BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.21.2 CONCILIATION:

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

Notes:

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

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

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

Note: Procedure 2.3 that forms the part of Forms and Procedures is published as Chapter 11 in Volume 1A Part II of this booklet (Volume-I Book-I).

2.21.3 NO INTEREST PAYABLE TO CONTRACTOR

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No.: 13

Procedure 2.3 that forms the part of the “forms and Procedures (Volume 1 Book 2)” is published as chapter 11 in Volume 1A Part II of this booklet (Volume-I Book-I).

Sl. No.: 14

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

2.22 Performance Security Deposit

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

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

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

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

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

2.22.2 Refund of Performance Security Deposit:

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

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

Sl. No.: 15

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Sl. No.: 16

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

Sl. No.: 17

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

Sl. No.: 18

Existing format for Integrity Pact, as available in Volume ID Forms and procedure stands Deleted. Revised Format is enclosed as Chapter 9 of TCC (Volume-1 Book-1).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER 2 to 19

In next 442 pages as below

Welding Schedule	28 pages
Drawing of Mill and Bunker Building	02 pages
Technical Specification - BHEL	58 pages
TANGEDCO Specification	16 pages
Painting Schedule for Boiler, valves etc.,	12 pages
Painting schedule for APH, Fans, Gates etc	19 pages
Painting Schedule for Bowl mills	06 pages
Painting Schedule for Aux.Boiler	11 pages
Revised forms – Form 14 and Form 15	15 pages
Procedure 2.3 of Arbitration & Conciliation	10 pages
Integrity pact	06 pages
Health, Safety and Environment Plan for Site Operation By Subcontractors” (Doc. No. HSEP:14 Rev 00),	72 pages
Hire charges on issue of capital tools & Plants (Only corresponding charges)	14 pages
Guidelines for Welding	98 pages
Guidelines for Heat treatment	18 pages
General Guidelines for Insulation works	54 pages
Proforma of Bank Guarantee for Earnest Money	03 pages

		ERECTION WELDING SCHEDULE								PG NO : 07									
		CUST No : 1723,1724								PG NAME : Circulation System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Circulation System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.										
																Ø2.5			Ø3.15
11	0-00-027-34115	F-10TI+F-10F	SA213T12 + SA182F12CL2	38.1	9.65	GTAW + SMAW	9.65 ▽ 360	ER80S-B2 2048	E8018-B2 5484 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
12	0-00-027-34114	F-19TI+F-19F L&R	SA213T12 + SA182F12CL2	38.1	9.65	GTAW + SMAW	9.65 ▽ 666	ER80S-B2 3788	E8018-B2 10144 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
13	0-00-027-34115	F-03+F-02TO	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 120	ER80S-B2 910	E8018-B2 906 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
14	0-00-027-34115	F-09+F-08TO	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 120	ER80S-B2 910	E8018-B2 906 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
15	0-00-027-34114	F-18+F-17TO L&R	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 222	ER80S-B2 1684	E8018-B2 1676 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
16	0-00-027-34111	F-02U+CORNER+TRANS	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 304	ER80S-B2 2305	E8018-B2 2295 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
17	0-00-027-34111	F-02U+SOFA	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 198	ER80S-B2 1502	E8018-B2 1495 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
18	0-00-027-34111	F-02U+WB+F-02L	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 738	ER80S-B2 5596	E8018-B2 5571 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
19	0-00-027-34113	F-02L+F-02L	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 267	ER80S-B2 2025	E8018-B2 2016 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
20	0-00-027-34113, 0-06-737-03933	F-02L+CORNER	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽ 364	ER80S-B2 2760	E8018-B2 2748 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-07-CIR-EWS		0		2/6	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE								PG NO : 07									
		CUST No : 1723,1724								PG NAME : Circulation System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Circulation System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.										
									Ø2.5	Ø3.15					Ø4.0				
21	0-00-027-34115	F-02TO+F-02F	SA213T12 + SA182F12CL2	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							120	910	906	-	-								
22	0-00-027-34111	F-08U+CORNER+TRANS	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							308	2336	2325	-	-								
23	0-00-027-34111	F-08U+SOFA	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							198	1502	1495	-	-								
24	0-00-027-34111	F-08U+WB+F-08L	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							738	5596	5571	-	-								
25	0-00-027-34113	F-08L+F-08L	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							267	2025	2016	-	-								
26	0-00-027-34113	F-08L+CORNER	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							364	2760	2748	-	-								
27	0-00-027-34113	F-08TO+F-08F	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							120	910	906	-	-								
28	0-00-027-34114,0-06-753-04031	F-17TO+F-17F	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							222	1684	1676	-	-								
29	0-00-027-34110	F-17U+CORNER+TRANS	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							608	4610	4590	-	-								
30	0-00-027-34110	F-17U+SOFA	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							396	3003	2989	-	-								
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-07-CIR-EWS		0		3/6	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE										PG NO : 07							
		CUST No : 1723,1724										PG NAME : Circulation System							
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Circulation System							
		WELDING CODE : I.B.R / ASME										CUST DOC NO : - CUST DOC REV : -							
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC				WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.										
																Ø2.5	Ø3.15		
31	0-00-027-34110	F-17U+WB+F-17L	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							1476	11191	11141	-	-								
32	0-00-027-34112	F-17L+CORNER	SA213T12 + SA213T12	38.1	6.6	GTAW + SMAW	6.6 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							730	5535	5510	-	-								
33	0-00-027-34115,0-06-734-03851	F-11+F-10F	SA213T12 + SA213T22	38.1	9.65	GTAW + SMAW	9.65 ▽	ER80S-B2	E8018-B2			1012/04	150	680-720	20% RT subject to min 2 weld/ welder/ shift			100% HC, 260HB (MAX)	
							360	2048	5484	-	-			30					
34	0-00-027-34107	F-11+F-12	SA213T22 + SA213T22	38.1	9.65	GTAW + SMAW	9.65 ▽	ER90S-B3	E9018-B3			1084/00	200	740 ± 10	20% RT subject to min 2 weld/ welder/ shift			100% HC, 260HB (MAX)	
							300	1706	4570	-	-			60					
35	0-00-027-34107	F-11+F-13	SA213T22 + SA213T22	38.1	9.65	GTAW + SMAW	9.65 ▽	ER90S-B3	E9018-B3			1084/00	200	740 ± 10	20% RT subject to min 2 weld/ welder/ shift			100% HC, 260HB (MAX)	
							60	342	914	-	-			60					
36	0-00-027-34107	F-12+F-14	SA213T22 + SA213T22	38.1	9.65	GTAW + SMAW	9.65 ▽	ER90S-B3	E9018-B3			1084/00	200	740 ± 10	20% RT subject to min 2 weld/ welder/ shift			100% HC, 260HB (MAX)	
							300	1706	4570	-	-			60					
37	0-00-027-34107	F-13+F-14	SA213T22 + SA213T22	54	12	GTAW + SMAW	12 ▽	ER90S-B3	E9018-B3			1084/00	200	740 ± 10	20% RT subject to min 2 weld/ welder/ shift			100% HC, 260HB (MAX)	
							60	551	461	338	-			60					
38	0-00-027-34097	F-02TI+F-01 NIPPLE	SA210GRC + SA210GRC	38.1	5.08	GTAW + SMAW	5.08 ▽	ER70S-A1	E7018-1			1003/04	20	Nil	20% RT subject to min 2 weld/ welder/ shift				
							231	1970	1101	-	-								
39	0-00-027-34097	F-08TI+F-07 NIPPLE	SA210GRC + SA210GRC	38.1	5.08	GTAW + SMAW	5.08 ▽	ER70S-A1	E7018-1			1003/04	20	Nil	20% RT subject to min 2 weld/ welder/ shift				
							231	1970	1101	-	-								
40	0-00-027-34097,0-06-737-03933	F-02TI+F-02L	SA210GRC + SA213T12	38.1	5.08	GTAW + SMAW	5.08 ▽	ER70S-A1	E7018-1			1017/03	125	Nil	20% RT subject to min 2 weld/ welder/ shift				
							223	1902	1063	-	-								
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-07-CIR-EWS		0		4/6	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE								PG NO : 07									
		CUST No : 1723,1724								PG NAME : Circulation System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Circulation System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD Qty in Nos.	ELECTRODE FILLER SPEC SMAW Qty in gms			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS	REV	
				SIZE	THICK										SPEC. NO	ACC NORM			
									Ø2.5	Ø3.15									Ø4.0
41	0-00-027-34097,0-06-737-03933	F-08TI+F-08L	SA210GRC + SA213T12	38.1	5.08	GTAW + SMAW	5.08 ∇	ER70S-A1	E7018-1			1017/03	125	Nil	20% RT subject to min 2 weld/ welder/ shift				
							223	1902	1063	-	-								
42	0-00-027-34112,0-00-027-34112	F-02TI+F-17L	SA210GRC + SA213T12	38.1	5.08	GTAW + SMAW	5.08 ∇	ER70S-A1	E7018-1			1017/03	125	Nil	20% RT subject to min 2 weld/ welder/ shift				
							8	69	39	-	-								
43	0-00-027-34112,0-00-027-34112	F-08TI+F-17L	SA210GRC + SA213T12	38.1	5.08	GTAW + SMAW	5.08 ∇	ER70S-A1	E7018-1			1017/03	125	Nil	20% RT subject to min 2 weld/ welder/ shift				
							8	69	39	-	-								
44	0-00-027-34097	F-01+F-16	SA106GrC + SA234WPC	406.4	60	GTAW + SMAW	52.5 ∇∇	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	268	59	96	535		150						
45	0-00-027-34097	F-07+F-16	SA106GrC + SA234WPC	406.4	60	GTAW + SMAW	52.5 ∇∇	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	268	59	96	535		150						
46	0-00-027-34098	F-31+F-49	SA182F22CL3 + SA335P12	355.6	50	GTAW + SMAW	43.75 ∇∇	ER80S-B2	E8018-B2			1012/04	150	680-720	100% RT				
							2	239	51	84	348		125						
47	0-00-027-34098	F-49+F-50	SA335P12 + SA182F12CL2	355.6	50.8	GTAW + SMAW	44.45 ∇∇	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							2	238	51	84	357		130						
48	1-07-318-01005	F-06+F-05	SA335P12 + SA182F12CL2	273	40	GTAW + SMAW	35 ∇∇	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							2	182	40	65	170		100						
49	1-07-318-01005	F-06+F-06	SA335P12 + SA335P12	273	40	GTAW + SMAW	35 ∇∇	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							7	636	137	225	594		100						
50	1-07-316-01004	F-15+F-14	SA335P12 + SA182F12CL2	273	40	GTAW + SMAW	35 ∇∇	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							2	182	40	65	170		100						
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-07-CIR-EWS		0		5/6	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE								PG NO : 07									
		CUST No : 1723,1724								PG NAME : Circulation System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Circulation System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.										
							Qty in Nos.	Qty in gms	Ø2.5	Ø3.15	Ø4.0								
51	1-07-316-01004	F-15+F-15	SA335P12 + SA335P12	273	40	GTAW + SMAW	35 ☑☑	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							4	364	79	129	340			100					
52	1-07-315-01002	F-21+F-20	SA335P12 + SA182F12CL2	273	40	GTAW + SMAW	35 ☑☑	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							4	364	79	129	340			100					
53	1-07-315-01003	F-21+F-21	SA335P12 + SA335P12	273	40	GTAW + SMAW	35 ☑☑	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							6	545	118	193	509			100					
54	0-00-027-34098	F-06+F-31	SA335P12 + SA182F22CL3	273	40	GTAW + SMAW	35 ☑☑	ER80S-B2	E8018-B2			1012/04	150	680-720	100% RT				
							2	182	40	65	170			100					
55	0-00-027-34098	F-15+F-31	SA335P12 + SA182F22CL3	273	40	GTAW + SMAW	35 ☑☑	ER80S-B2	E8018-B2			1012/04	150	680-720	100% RT				
							2	182	40	65	170			100					
56	0-00-027-34098	F-21+F-31	SA335P12 + SA182F22CL3	273	40	GTAW + SMAW	35 ☑☑	ER80S-B2	E8018-B2			1012/04	150	680-720	100% RT				
							4	364	79	129	340			100					
57	-	INS.NOZ.+FEC	SA105 + SA234WPC	168.3	39.7	GTAW + SMAW	34.74 ☑☑	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							8	363	97	159	368			100					
58	1-05-330-01743, 1-05-327-01741,0-05-350-00608	INS.NOZ.+FEC	SA182F12CL2 + SA234WP12CL1	168.3	39.7	GTAW + SMAW	34.74 ☑☑	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							8	363	97	159	368			100					
59		GAMMA PLUG	SA105 + SA106GRC			SMAW	7 ▴	-	E7018			1101/01	100	Nil	100% LPI or MPI				
							4	-	2	-	-								
60		GAMMA PLUG	SA335P12 + SA182F22CL3			SMAW	7 ▴	-	E8018-B2			1102/01	200	Nil	100% LPI or MPI				
							92	-	24	-	-								
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-07-CIR-EWS		0		6/6	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		<u>ERECTION WELDING SCHEDULE</u>										PG NO : 19							
		CUST No : 1723,1724										PG NAME : Economiser System							
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Economiser System							
		WELDING CODE : I.B.R / ASME					PRESSURE PARTS/ ~~NON-PRESSURE PARTS~~					CUST DOC NO : - CUST DOC REV : -							
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC				WPS NO/REV NO.	MIN. PRE HEAT TEMP. in °C	PWHT TEMP. in °C	NDT METHOD/ QUANTUM	* REF..		REMARKS	REV
				SIZE	THICK			GTAW	SMAW										
							Qty in Nos.		Qty in gms	Qty in Nos.				Ø2.5		Ø3.15	Ø4.0		
1	0-19-851-01909 0-00-027-34106 1-19-702-02821	E-09+EF-01	SA106GRC + SA106GrC	457	55	GTAW + SMAW	48.12	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	320	66	108	535		140						
2	0-19-851-01909 0-00-027-34106	EF-01+EF-01	SA234WPC + SA106GrC	457	55	GTAW + SMAW	48.12	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							10	1597	328	537	2675		140						
3	0-19-851-01909 1-19-852-02808 0-00-027-34106	EF-01+EF-02	SA234WPC + SA106GrC	457	55	GTAW + SMAW	48.12	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	320	66	108	535		140						
4	0-19-853-01941 1-19-852-02808 0-00-027-34106	EF-02+EF-03	SA234WPC + SA106GrC	457	55	GTAW + SMAW	48.12	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	320	66	108	535		140						
5	0-19-853-01941 0-00-027-34106	EF-03+EF-03	SA234WPC + SA106GrC	457	55	GTAW + SMAW	48.12	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	320	66	108	535		140						
6	0-19-851-01909 0-00-027-34106 1-05-155-01752	EF-03+F-16	SA234WPC + SA106GrC	457	55	GTAW + SMAW	48.12	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% RT				
							2	320	66	108	535		140						
7	0-00-027-34088	E-07+E-08L	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-		30						
8	0-00-027-34088	E-08L+R-04L	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-		30						
9	0-00-027-34088	R-04L+R-04I-1	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-		30						
10	0-00-027-34088	R-04I-1+R-04I-2	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-		30						
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-19-ECO-EWS		0		1/3	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											



ERECTION WELDING SCHEDULE

PG NO : 19

CUST No : 1723,1724

PG NAME : Economiser System

PROJECT : ENNORE SEZ STPP 2*660MW

SYSTEM DESCRIPTION : Economiser System

WELDING CODE : I.B.R / ASME

PRESSURE PARTS/~~NON-PRESSURE PARTS~~

CUST DOC NO : - CUST DOC REV : -

SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
							Qty in Nos.		Qty in gms	Qty in Nos.									
								Ø2.5	Ø3.15	Ø4.0					SPEC. NO	ACC NORM			
11	0-00-027-34088	R-04I-2+R-04I-3	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-			30					
12	0-00-027-34088	R-04I-3+R-04I-4	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-			30					
13	0-00-027-34088	R-04I-4+R-04U	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-			30					
14	0-00-027-34088	R-04U+E-08U	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-			30					
15	0-00-027-34088	E-08U+E-08TO	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-			30					
16	0-00-027-34088	E-08TO+E-09	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							364	3984	3222	872	-			30					
17	0-00-027-34088	E-07+E-08L	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							34	373	301	82	-			30					
18	0-00-027-34088	E-08UB+E-08UB	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							68	745	602	163	-			30					
19	0-00-027-34088	E-08UB+E-09	SA210GrC + SA210GrC	54	9.14	GTAW + SMAW	9.14 ∇	ER70S-A1	E7018-1			1004/04	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift				
							34	373	301	82	-			30					
20	0-19-851-01914	E-05+E-04 E-04+E-04	SA106GrC + SA106GrC	559	72	GTAW + SMAW	63 ∇∇	ER70S-A1	E7018-1			1004/04	100	610 ± 15	100% (ISRT + UT)				
							12	2295	481	789	6073			180					
PREPARED				CHECKED (W.T.C)				APPROVED			DATE		DOC NO.			REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S			19-07-2018		1723-19-ECO-EWS			0		2/3	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		<u>ERECTION WELDING SCHEDULE</u>										PG NO : 19							
		CUST No : 1723,1724										PG NAME : Economiser System							
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Economiser System							
		WELDING CODE : I.B.R / ASME					PRESSURE PARTS/ ~~NON PRESSURE PARTS~~					CUST DOC NO : - CUST DOC REV : -							
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.	Qty in gms					Qty in Nos.				
								Ø2.5	Ø3.15	Ø4.0					SPEC. NO	ACC NORM			
21	0-00-027-34088	E-05+E-06L	SA210GrC + SA210GrC	44.45	6.6	GTAW + SMAW	6.6 ▽	ER70S-A1	E7018-1			1003/04	20	Nil	20% RT subject to min 2 weld/ welder/ shift				
							736	7033	6481	-	-								
22	0-00-027-34088	E-06L+E-06U	SA210GrC + SA210GrC	44.45	6.6	GTAW + SMAW	6.6 ▽	ER70S-A1	E7018-1			1003/04	20	Nil	20% RT subject to min 2 weld/ welder/ shift				
							736	7033	6481	-	-								
23	0-00-027-34088	E-06U+E-07	SA210GrC + SA210GrC	44.45	6.6	GTAW + SMAW	6.6 ▽	ER70S-A1	E7018-1			1003/04	20	Nil	20% RT subject to min 2 weld/ welder/ shift				
							736	7033	6481	-	-								
24		GAMMA PLUG	SA105 + SA106GRC			SMAW	7 ▴	-	E7018			1101/01	150	Nil	100% LPI or MPI			FOR T >75 MM	
							36	-	10	-	-								
25		GAMMA PLUG	SA105 + SA106GRC			SMAW	7 ▴	-	E7018			1101/01	100	Nil	100% LPI or MPI			FOR T- (25-75) MM	
							10	-	3	-	-								
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-19-ECO-EWS		0		3/3	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.										* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98							

		<u>ERECTION WELDING SCHEDULE</u>										PG NO : 17						
		CUST No : 1723,1724										PG NAME : Reheater System						
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Reheater System						
		WELDING CODE : I.B.R / ASME					PRESSURE PARTS/ ~~NON-PRESSURE PARTS~~					CUST DOC NO : - CUST DOC REV : -						
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP. in °C	PWHT TEMP. in °C	NDT METHOD/ QUANTUM	* REF..		REMARKS	REV
				SIZE	THICK			GTAW	SMAW						SPEC. NO	ACC NORM REF.		
							Qty in Nos.		Qty in gms	Ø2.5			Ø3.15					
1	0-15-136-00340	R-03+R-03	SA106GRC + SA106GRC	508	30	GTAW + SMAW	26.25 	ER70S-A1	E7018-1		1004/04	100	610 ± 15	100% RT				
							2	403	73	120	204		75					
2	0-00-027-34088 0-00-027-34108	R-03+R-04TI	SA213T12 + SA213T12	69.85	4.57	GTAW + SMAW	4.57 	ER80S-B2	E8018-B2		1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							64	1198	468	-	-							
3	0-00-027-34088 0-00-027-34108	R-03+R-04L	SA213T12 + SA213T12	69.85	4.57	GTAW + SMAW	4.57 	ER80S-B2	E8018-B2		1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							664	12424	4856	-	-							
4	0-00-027-34088 0-00-027-34108	R-04L+R-04I-1	SA213T12 + SA213T12	69.85	4.57	GTAW + SMAW	4.57 	ER80S-B2	E8018-B2		1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							728	13621	5323	-	-							
5	0-00-027-34088 0-00-027-34108	R-04I-1+R-04I-2	SA213T12 + SA213T12	69.85	4.57	GTAW + SMAW	4.57 	ER80S-B2	E8018-B2		1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							728	13621	5323	-	-							
6	0-00-027-34088 0-00-027-34108	R-04I-2+R-04I-3	SA213T12 + SA213T22	69.85	4.57	GTAW + SMAW	4.57 	ER80S-B2	E8018-B2		1011/01	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							728	13621	5323	-	-							
7	0-00-027-34088 0-00-027-34108	R-04I-3+R-04I-4	SA213T22 + SA213T22	69.85	4.57	GTAW + SMAW	4.57 	ER90S-B3	E9018-B3		1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							728	13621	5323	-	-							
8	0-00-027-34088 0-00-027-34108	R-04I-4+R-04U	SA213T91 + SA213T91	69.85	4.57	GTAW	4.57 	ER90S-B9	E9015-B91		1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							728	73072	-	-	-		30					
9	0-00-027-34088 0-00-027-34108	R-04U+R-07	SA213T91 + SA213T91	69.85	4.57	GTAW	4.57 	ER90S-B9	E9015-B91		1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							728	73072	-	-	-		30					
10	0-00-027-34088	R-07+R-08	SA213T91 + SA213T91	63.5	5.08	GTAW	5.08 	ER90S-B9	E9015-B91		1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							728	79365	-	-	-		30					
PREPARED				CHECKED (W.T.C)				APPROVED			DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S			19-07-2018		1723-17-RH-EWS		0		1/3	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98										

		<u>ERECTION WELDING SCHEDULE</u>								PG NO : 17										
		CUST No : 1723,1724								PG NAME : Reheater System										
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Reheater System										
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -										
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV		
				SIZE	THICK			GTAW	SMAW											
									Qty in Nos.											
																Ø2.5			Ø3.15	Ø4.0
11	1-17-174-00568	R-08+R-09	SA335P22 + SA234WP12CL1	762	76	GTAW + SMAW	66.5	ER80S-B2	E8018-B2			1012/04	150	680-720	100% (ISRT + UT)					
							2	554	110	180	1552			190						
12	1-17-174-00568	R-09+R-09	SA335P22 + SA234WP12CL1	812.8	65	GTAW + SMAW	56.88	ER80S-B2	E8018-B2			1012/04	150	680-720	100% (ISRT + UT)					
							2	615	117	191	1304			165						
13	1-17-174-00568	R-09+R-10	SA335P12 + SA335P12	812.8	65	GTAW + SMAW	56.88	ER80S-B2	E8018-B2			1010/06	150	650-670	100% (ISRT + UT)					
							2	615	117	191	1304			165						
14	0-17-174-00580	R-10+R-11	SA335P12 + SA335P12	812.8	65	GTAW + SMAW	56.88	ER80S-B2	E8018-B2			1010/06	150	650-670	100% (ISRT + UT)					
							2	615	117	191	1304			165						
15	0-17-174-00580	R-11+R-11	SA335P12 + SA234WP12CL1	812.8	65	GTAW + SMAW	56.88	ER80S-B2	E8018-B2			1010/06	150	650-670	100% (ISRT + UT)					
							4	1230	234	382	2608			165						
16	0-15-174-00580	R-11+R-12	SA234WP12CL1 + SA335P12	610	65	GTAW + SMAW	56.88	ER80S-B2	E8018-B2			1010/06	150	650-670	100% (ISRT + UT)					
							2	438	88	144	954			165						
17	0-00-027-34124	R-12+R-13	SA213T22 + SA213T22	76.2	5.08	GTAW + SMAW	5.08	ER90S-B3	E9018-B3			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							44	897	420	-	-									
18	0-00-027-34124	R-12+R-13	SA213T22 + SA213T22	63.5	4.5	GTAW + SMAW	4.5	ER90S-B3	E9018-B3			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							44	739	286	-	-									
19	0-00-027-34124	R-12+R-13	SA213T22 + SA213T22	63.5	5.6	GTAW + SMAW	5.6	ER90S-B3	E9018-B3			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							264	4250	2481	-	-									
20	0-00-027-34124	R-12+R-13	SA213T22 + SA213T22	54	5.6	GTAW + SMAW	5.6	ER90S-B3	E9018-B3			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							264	3471	2110	-	-									
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.			REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-17-RH-EWS			0		2/3	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98												

		ERECTION WELDING SCHEDULE							PG NO : 17										
		CUST No : 1723,1724							PG NAME : Reheater System										
		PROJECT : ENNORE SEZ STPP 2*660MW							SYSTEM DESCRIPTION : Reheater System										
		WELDING CODE : I.B.R / ASME							PRESSURE PARTS/ NON PRESSURE PARTS							CUST DOC NO : - CUST DOC REV : -			
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.										
																Ø2.5			Ø3.15
21	0-00-027-34124	R-13+R-13TO	SA213UNS S30432 + SA213UNS S30432	76.2	5.08	GTAW	5.08 ∇	Nittetsu YT304H	-			1054/02	Nil	Nil	20% RT subject to min 2 weld/ welder/ shift				
							4 ∇	Nittetsu YT304H	-			1054/02	Nil	Nil	20% RT subject to min 2 weld/ welder/ shift				
22	0-00-027-34124	R-13+R-13TO	SA213UNS S30432 + SA213UNS S30432	63.5	4	GTAW	4 ∇	Nittetsu YT304H	-			1054/02	Nil	Nil	20% RT subject to min 2 weld/ welder/ shift				
							572	42870	-	-	-	1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
23	0-00-027-34124	R-13TO+R-14	SA213T91 + SA213T91	76.2	5.6	GTAW + SMAW	5.6 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							44	882	827	-	-	-	30						
														24	0-00-027-34124	R-13TO+R-14	SA213T91 + SA213T91	63.5	4.19
							44	3485	-	-	-	1036/08	220	745 ± 15	30				
																25	0-00-027-34124	R-13TO+R-14	SA213T91 + SA213T91
							264	4250	4135	-	-	-	30						
														26	0-00-027-34124	R-13TO+R-14	SA213T91 + SA213T91	54	5.6
							264	3471	3517	-	-	-	30						
														27	0-00-027-34088	R-03+CRH LINE	SA106GRC + SA105	508	30
							2	403	73	120	204	1004/04	100	75					
															28	0-00-027-34077	R-14+HRH LINE	SA335P91 + SA182F91	762
							2	548	183	243	2352	1050/06	220	200					
															29		GAMMA PLUG	SA335P12 + SA182F22CL3	
							2	-	1	-	-	1102/01	200						
															30		GAMMA PLUG	SA335P22 + SA182F22CL3	
							2	-	1	-	-	1103/01	200						
															PREPARED				CHECKED (W.T.C)
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-17-RH-EWS		0		3/3	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.							* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98										

		<u>ERECTION WELDING SCHEDULE</u>								PG NO : 12									
		CUST No : 1723,1724								PG NAME : Superheater System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Superheater System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD Qty in Nos.	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW Qty in gms	SMAW Qty in Nos.						SPEC. NO	ACC NORM			
									Ø2.5	Ø3.15									Ø4.0
11	0-00-027-34109	S-14+S-15	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 186	ER80S-B2 2086	E8018-B2 2143 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
12	0-00-027-34109	S-14(NIPPLE)+S-14(BENT TUBE)	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 6	ER80S-B2 68	E8018-B2 70 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
13	0-00-027-34109	S-13(NIPPLE)+S-13(BENT TUBE)	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 30	ER80S-B2 337	E8018-B2 346 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
14	0-00-027-34109	S-13+S-15	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 6	ER80S-B2 68	E8018-B2 70 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
15	0-00-027-34109	S-15+S-16	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 186	ER80S-B2 2086	E8018-B2 2143 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
16	0-00-027-34109	S-13+S-12L	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 200	ER80S-B2 2243	E8018-B2 2304 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
17	0-00-027-34109	S-17+S-20L	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 186	ER80S-B2 2086	E8018-B2 2143 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
18	0-00-027-34109	S-17+S-17	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 6	ER80S-B2 68	E8018-B2 70 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
19	0-00-027-34109	S-12L-L&R+S-12U-L&R	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 200	ER80S-B2 2243	E8018-B2 2304 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
20	0-00-027-34109	S-20L+S-20U	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 186	ER80S-B2 2086	E8018-B2 2143 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
PREPARED				CHECKED (W.T.C)				APPROVED			DATE		DOC NO.		REV NO :		PAGE NO.		
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S			19-07-2018		1723-12-SH-EWS		0		2/10		
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.								* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98									

		ERECTION WELDING SCHEDULE								PG NO : 12									
		CUST No : 1723,1724								PG NAME : Superheater System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Superheater System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD Qty in Nos.	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW Qty in gms	SMAW Qty in Nos.						SPEC. NO	ACC NORM			
									Ø2.5	Ø3.15									Ø4.0
21	0-00-027-34109	S-21+S-20U	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 186	ER80S-B2 2086	E8018-B2 2143 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
22	0-00-027-34109	S-12U-L&R+S-11-L&R	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 200	ER80S-B2 2243	E8018-B2 2304 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
23	0-00-027-34109	S-22+S-21	SA213T12 + SA213T12	50.8	7.11	GTAW + SMAW	7.11 ▽ 186	ER80S-B2 2086	E8018-B2 2143 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
24	0-00-027-34109	S-16+S-22	SA213T12 + SA213T12	50.8	7.62	GTAW + SMAW	7.62 ▽ 186	ER80S-B2 2027	E8018-B2 2432 - -			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
25	0-00-027-34121 0-00-027-34122 0-10-176-01609	S-26+S-27	SA213T22 + SA213T22	51	6.6	GTAW + SMAW	6.6 ▽ 29	ER90S-B3 337	E9018-B3 293 - -			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
26	0-00-027-34121 0-00-027-34122	S-26+S-27	SA213T22 + SA213T22	42.4	5.59	GTAW + SMAW	5.59 ▽ 116	ER90S-B3 1108	E9018-B3 726 - -			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
27	0-00-027-34121 0-00-027-34122	S-26+S-27	SA213T22 + SA213T22	38.1	5.08	GTAW + SMAW	5.08 ▽ 145	ER90S-B3 1237	E9018-B3 691 - -			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
28	0-00-027-34121 0-00-027-34122	S-26+S-27	SA213T22 + SA213T22	38.1	5.59	GTAW + SMAW	5.59 ▽ 29	ER90S-B3 239	E9018-B3 164 - -			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
29	0-00-027-34121 0-00-027-34122	S-26+S-27	SA213T22 + SA213T22	33.4	5.59	GTAW + SMAW	5.59 ▽ 87	ER90S-B3 588	E9018-B3 429 - -			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
30	0-00-027-34121 0-00-027-34122	S-26+S-27	SA213T22 + SA213T22	33.4	5.1	GTAW + SMAW	5.1 ▽ 29	ER90S-B3 205	E9018-B3 122 - -			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-12-SH-EWS		0		3/10	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE								PG NO : 12									
		CUST No : 1723,1724								PG NAME : Superheater System									
		PROJECT : ENNORE SEZ STPP 2*660MW								SYSTEM DESCRIPTION : Superheater System									
		WELDING CODE : I.B.R / ASME								CUST DOC NO : - CUST DOC REV : -									
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
									Qty in Nos.										
									Ø2.5	Ø3.15					Ø4.0				
31	0-00-027-34121 0-00-027-34122	S-27+S-27TO	SA213T91 + SA213T91	50.8	6.1	GTAW + SMAW	6.1 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							29	344	423	-	-			30					
32	0-00-027-34121 0-00-027-34122	S-27+S-27TO	SA213T91 + SA213T91	42.4	5.08	GTAW	5.08 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							116	8444	-	-	-			30					
33	0-00-027-34121 0-00-027-34122	S-27+S-27TO	SA213T91 + SA213T91	31.8	4.19	GTAW	4.19 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							116	4601	-	-	-			30					
34	0-00-027-34121 0-00-027-34122	S-27+S-27TO	SA213T91 + SA213T91	38.1	4.57	GTAW	4.57 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							174	9527	-	-	-			30					
35	0-00-027-34121 0-00-027-34122	S-27TO+S-28	SA213T91 + SA213T91	50.8	6.1	GTAW + SMAW	6.1 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							29	344	423	-	-			30					
36	0-00-027-34121 0-00-027-34122	S-27TO+S-28	SA213T91 + SA213T91	42.4	5.08	GTAW	5.08 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							116	8444	-	-	-			30					
37	0-00-027-34121 0-00-027-34122	S-27TO+S-28	SA213T91 + SA213T91	31.8	4.19	GTAW	4.19 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							116	4601	-	-	-			30					
38	0-00-027-34121 0-00-027-34122	S-27TO+S-28	SA213T91 + SA213T91	38.1	4.57	GTAW	4.57 ▽	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							174	9527	-	-	-			30					
39	0-12-179-02745	S-28+S-29	SA335P91 + SA234WP91	508	60	GTAW + SMAW	52.5 ▽▽	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT				
							2	357	122	162	964			150					
40	0-12-179-02745	S-29+S-29	SA335P91 + SA234WP91	508	60	GTAW + SMAW	52.5 ▽▽	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT				
							2	357	122	162	964			150					
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-12-SH-EWS		0		4/10	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE										PG NO : 12								
		CUST No : 1723,1724										PG NAME : Superheater System								
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Superheater System								
		WELDING CODE : I.B.R / ASME										CUST DOC NO : - CUST DOC REV : -								
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD Qty in Nos.	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS	REV		
				SIZE	THICK			GTAW Qty in gms	SMAW											
									Qty in Nos.											
									Ø2.5	Ø3.15					Ø4.0					
41	0-12-179-02745	S-29+S-29	SA335P91 + SA335P91	508	60	GTAW + SMAW	52.5 ∇∇	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT					
							4	713	243	324	1927			150						
42	0-12-179-02745	S-29+S-30	SA335P91 + SA335P91	508	60	GTAW + SMAW	52.5 ∇∇	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT					
							2	357	122	162	964			150						
43	0-12-179-02746	S-30+S-31	SA335P91 + SA335P91	508	60	GTAW + SMAW	52.5 ∇∇	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT					
							2	357	122	162	964			150						
44	0-12-179-02746	S-31+S-32	SA335P91 + SA234WP91	508	60	GTAW + SMAW	52.5 ∇∇	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT					
							2	357	122	162	964			150						
45	0-00-027-34341 0-00-027-34342	S-32+S-33	SA213T91 + SA213T91	50.8	6.6	GTAW + SMAW	6.6 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)		
							29	335	487	-	-			30						
46	0-00-027-34341 0-00-027-34342	S-32+S-33	SA213T91 + SA213T91	42.4	5.59	GTAW + SMAW	5.59 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)		
							116	1108	1210	-	-			30						
47	0-00-027-34341 0-00-027-34342	S-32+S-33	SA213T91 + SA213T91	38.1	5.08	GTAW	5.08 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)		
							145	9485	-	-	-			30						
48	0-00-027-34341 0-00-027-34342	S-32+S-33	SA213T91 + SA213T91	38.1	5.6	GTAW + SMAW	5.6 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)		
							29	238	273	-	-			30						
49	0-00-027-34341 0-00-027-34342	S-32+S-33	SA213T91 + SA213T91	33.4	5.59	GTAW + SMAW	5.59 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)		
							87	588	715	-	-			30						
50	0-00-027-34341 0-00-027-34342	S-32+S-33	SA213T91 + SA213T91	33.4	5.1	GTAW	5.1 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)		
							29	1675	-	-	-			30						
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.			REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-12-SH-EWS			0		5/10	
CAUTION :		THE INFNM ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98												

		ERECTION WELDING SCHEDULE										PG NO : 12						
		CUST No : 1723,1724										PG NAME : Superheater System						
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Superheater System						
		WELDING CODE : I.B.R / ASME										CUST DOC NO : - CUST DOC REV : -						
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD Qty in Nos.	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS	REV
				SIZE	THICK			GTAW Qty in gms	SMAW Qty in Nos.									
									Ø2.5	Ø3.15					Ø4.0			
51	0-00-027-34341 0-00-027-34342	S-33+S-33TO	SA213T91 + SA213T91	50.8	6.1	GTAW + SMAW	6.1 ∇ 29	ER90S-B9 344	E9015-B91 423 - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
52	0-00-027-34341 0-00-027-34342	S-33+S-33TO	SA213T91 + SA213T91	42.4	5.08	GTAW	5.08 ∇ 116	ER90S-B9 8444	E9015-B91 - - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
53	0-00-027-34341 0-00-027-34342	S-33+S-33TO	SA213T91 + SA213T91	31.8	4.19	GTAW	4.19 ∇ 116	ER90S-B9 4601	E9015-B91 - - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
54	0-00-027-34341 0-00-027-34342	S-33+S-33TO	SA213T91 + SA213T91	38.1	4.57	GTAW	4.57 ∇ 174	ER90S-B9 9527	E9015-B91 - - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
55	0-00-027-34341 0-00-027-34342	S-33TO+S-34	SA213T91 + SA213T91	50.8	6.1	GTAW + SMAW	6.1 ∇ 29	ER90S-B9 344	E9015-B91 423 - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
56	0-00-027-34341 0-00-027-34342	S-33TO+S-34	SA213T91 + SA213T91	42.4	5.08	GTAW	5.08 ∇ 116	ER90S-B9 8444	E9015-B91 - - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
57	0-00-027-34341 0-00-027-34342	S-33TO+S-34	SA213T91 + SA213T91	31.8	4.19	GTAW	4.19 ∇ 116	ER90S-B9 4601	E9015-B91 - - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
58	0-00-027-34341 0-00-027-34342	S-33TO+S-34	SA213T91 + SA213T91	38.1	4.57	GTAW	4.57 ∇ 174	ER90S-B9 9527	E9015-B91 - - -		1036/08	220	745 ± 15 30	100% RT			100% HC, 300HB (MAX)	
59	0-12-178-02734	S-34+S-35	SA335P91 + SA234WP91	508	65	GTAW + SMAW	56.88 ∇ 2	ER90S-B9 349	E9015-B91 122 162 1089		1050/06	220	740-770 165	100% UT				
60	0-12-178-02734	S-35+S-36	SA335P91 + SA335P91	508	65	GTAW + SMAW	56.88 ∇ 2	ER90S-B9 349	E9015-B91 122 162 1089		1050/06	220	740-770 165	100% UT				
PREPARED				CHECKED (W.T.C)				APPROVED			DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S			19-07-2018		1723-12-SH-EWS		0		6/10	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.									* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98							



ERECTION WELDING SCHEDULE

PG NO : 12

CUST No : 1723,1724

PG NAME : Superheater System

PROJECT : ENNORE SEZ STPP 2*660MW

SYSTEM DESCRIPTION : Superheater System

WELDING CODE : I.B.R / ASME

PRESSURE PARTS/~~NON~~ PRESSURE PARTS

CUST DOC NO : - CUST DOC REV : -

SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHIT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF..		REMARKS	REV	
				SIZE	THICK			Qty in Nos.	GTAW Qty in gms	SMAW Qty in Nos.									
							Ø2.5			Ø3.15					Ø4.0				
61	1-12-178-01837	S-36+S-37	SA335P91 + SA335P91	508	65	GTAW + SMAW	56.88 $\sqrt{V}$	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT				
							2	349	122	162	1089								
62	1-12-178-01837	S-37+S-37	SA335P91 + SA335P91	508	65	GTAW + SMAW	56.88 $\sqrt{V}$	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT				
							2	349	122	162	1089								
63	1-12-178-01837	S-37+S-38	SA234WP91 + SA335P91	508	90	GTAW + SMAW	78.75 $\sqrt{V}$	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT				
							2	311	122	162	1775								
64	0-00-027-34123 0-10-174-01608	S-39TI+S-38	SA213T91 + SA213T91	47.63	5.6	GTAW + SMAW	5.6 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							89	994	1046	-	-			30					
65	0-00-027-34123 0-10-174-01608	S-39TI+S-38	SA213T91 + SA213T91	44.45	5.08	GTAW	5.08 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							712	54335	-	-	-			30					
66	0-00-027-34123	S-39 FRONT+S-39TI	SA213T91 + SA213T91	44.45	5.08	GTAW	5.08 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							712	54335	-	-	-			30					
67	0-00-027-34123	S-39 FRONT+S-39TI	SA213T92 + SA213T91	44.45	5.6	GTAW + SMAW	5.6 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							89	906	976	-	-			30					
68	0-00-027-34123	S-39 FRONT+S-39 INTER	SA213T92 + SA213T92	44.45	7.11	GTAW + SMAW	7.11 ∇	9CrWV TIG/Thermanit-MTS616	E9015-B92			1058/02	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							89	823	1495	-	-			30					
69	0-00-027-34123	S-39 FRONT+S-39 INTER	SA213T91 + SA213T91	44.45	8.13	GTAW + SMAW	8.13 ∇	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							712	6127	8674	1214	-			30					
70	0-00-027-34123	S-39 INTER+S-40	SA213TP347H + SA213TP347H	44.45	7.6	GTAW + SMAW	7.6 ∇	ER347	E347			1016/02	Nil	Nil	20% RT subject to min 2 weld/ welder/ shift				
							801	7293	9120	-	-								
PREPARED				CHECKED (W.T.C)				APPROVED			DATE		DOC NO.		REV NO :		PAGE NO.		
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S			19-07-2018		1723-12-SH-EWS		0		7/10		
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.							* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98										

		ERECTION WELDING SCHEDULE										PG NO : 12							
		CUST No : 1723,1724										PG NAME : Superheater System							
		PROJECT : ENNORE SEZ STPP 2*660MW										SYSTEM DESCRIPTION : Superheater System							
		WELDING CODE : I.B.R / ASME					PRESSURE PARTS/NON-PRESSURE PARTS					CUST DOC NO : - CUST DOC REV : -							
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC			WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV	
				SIZE	THICK			GTAW	SMAW										
							Qty in Nos.		Qty in gms	Ø2.5					Ø3.15	Ø4.0			
71	0-00-027-34123	S-40+S-40TO	SA213T92 + SA213TP347H	44.45	6.6	GTAW + SMAW	6.6 ▽	ERNiCr-3	ENiCrFe-3			1047/02	220	730-770	100% RT				
							801	8229	11756	-	-			30					
72	0-00-027-34123	S-40TO+S-41	SA213T92 + SA213T92	44.45	6.6	GTAW + SMAW	6.6 ▽	9CrWV TiG/ Thermanit-MTS616	E9015-B92			1058/02	220	745 ± 15	100% RT			100% HC, 300HB (MAX)	
							801	7654	11756	-	-			30					
73	0-00-027-34123	S-41+MS LINE	SA335P91 + SA335P91	609.6	123.8	GTAW + SMAW	108.32 ▽	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT				
							2	348	146	195	3541			310					
74	0-00-027-34088 1-12-184-01832	S-09+S-10	SA182F12CL2 + SA335P12	273	39.7	GTAW + SMAW	34.74 ▽	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							2	183	40	65	168			100					
75	0-00-027-34088 1-12-184-01832	S-10+S-10	SA335P12 + SA335P12	273	39.7	GTAW + SMAW	34.74 ▽	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							4	365	79	129	335			100					
76	0-00-027-34088 1-12-184-01832	S-10+S-10	SA234WP12CL1 + SA335P12	273	39.7	GTAW + SMAW	34.74 ▽	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							4	365	79	129	335			100					
77	0-00-027-34088 1-12-184-01832	S-14+S-10	SA234WP12CL1 + SA335P12	273	39.7	GTAW + SMAW	34.74 ▽	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT				
							2	183	40	65	168			100					
78	0-00-027-34108	S-09+S-08	SA213T12 + SA213T12	44.45	7.11	GTAW + SMAW	7.11 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							150	1386	1512	-	-								
79	0-00-027-34108	S-08+S-07	SA213T12 + SA213T12	44.45	6.1	GTAW + SMAW	6.1 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							150	1480	1148	-	-								
80	0-00-027-34108	S-07+S-06	SA213T12 + SA213T12	44.45	6.1	GTAW + SMAW	6.1 ▽	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift				
							150	1480	1148	-	-								
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.		REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-12-SH-EWS		0		8/10	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98											

		ERECTION WELDING SCHEDULE							PG NO : 12											
		CUST No : 1723,1724							PG NAME : Superheater System											
		PROJECT : ENNORE SEZ STPP 2*660MW							SYSTEM DESCRIPTION : Superheater System											
		WELDING CODE : I.B.R / ASME							PRESSURE PARTS/ NON-PRESSURE PARTS							CUST DOC NO : - CUST DOC REV : -				
SL. NO	DRG NO. FOR WELD LOCATION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	DIMENSIONS		PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC					WPS NO/REV NO.	MIN. PRE HEAT TEMP.	PWHT TEMP. in TIME in mins	NDT METHOD/ QUANTUM	* REF.-		REMARKS	REV
				SIZE	THICK			GTAW	SMAW											
									Qty in Nos.											
												Ø2.5					Ø3.15	Ø4.0		
81	0-00-027-34091	S-06+S-05	SA234WP12CL1 + SA335P12	457	100	GTAW + SMAW	87.5	ER80S-B2	E8018-B2			1010/06	150	650-670	100% (ISRT + UT)					
						2	251	66	108	1303		250								
82	0-00-027-34092	S-05+S-04	SA213T12 + SA213T12	57	8.13	GTAW + SMAW	8.13	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							180	2251	1779	270	-									
83	0-00-027-34092	S-04+S-04	SA213T12 + SA213T12	57	8.6	GTAW + SMAW	8.6	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							180	2199	1744	352	-									
84	0-00-027-34092	S-04+S-03	SA213T12 + SA213T12	57	8.13	GTAW + SMAW	8.13	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							180	2251	1779	270	-									
85	0-00-027-34092	S-03+S-02	SA213T12 + SA213T12	57	8.13	GTAW + SMAW	8.13	ER80S-B2	E8018-B2			1009/03	150	Nil	20% RT subject to min 2 weld/ welder/ shift					
							180	2251	1779	270	-									
86	0-00-027-34088	S-06+S-11-L&R	SA234WP12CL1 + SA335P12	355.6	75	GTAW + SMAW	65.62	ER80S-B2	E8018-B2			1010/06	150	650-670	100% (ISRT + UT)					
							2	201	51	84	634									190
87	0-12-850-02720	S-02+S-01	SA182F12CL2 + SA335P12	323.9	50	GTAW + SMAW	43.75	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT					
							4	422	93	153	625									125
88	0-12-850-02720	S-01+S-01	SA234WP12CL1 + SA335P12	323.9	50	GTAW + SMAW	43.75	ER80S-B2	E8018-B2			1010/06	150	650-670	100% RT					
							4	422	93	153	625									125
89	0-12-850-02720	S-01+F-31	SA335P12 + SA182F22CL3	323.9	50	GTAW + SMAW	43.75	ER80S-B2	E8018-B2			1012/04	150	680-720	100% RT					
							4	422	93	153	625									125
90	0-00-027-34116	S-09+S-44	SA213UNS S30432 + SA213UNS S30432	50.8	7.11	GTAW	7.11	Nittetsu YT304H	-			1054/02	Nil	Nil	20% RT subject to min 2 weld/ welder/ shift					
							6	577	-	-	-									
PREPARED				CHECKED (W.T.C)				APPROVED				DATE		DOC NO.			REV NO :		PAGE NO.	
ANEET KUMAR DIXIT				LAKAVATH PRAVEEN KUMAR				ANAND KUMAR S				19-07-2018		1723-12-SH-EWS			0		9/10	
CAUTION :		THE INFMN ON THIS DOCUMENT IS THE PROPERTY OF BHEL. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO INTEREST OF BHEL.						* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98												

[illegible]

TRIM PIPING

Sl. No	DESCRIPTION OF PARTS TO BE WELDED	Weld Type (Butt/Fillet)	OD	THK	SPEC 1	SPEC 2	Quantity	Remarks	Rev
1	PIPE+ELBOW(OR) PIPE(OR)VALVE	BUTT	141.3	29.35	SA335P91	SA234WP91	40		
2	PIPE + BEND	BUTT	60.3	11.07	SA335P22	SA335P22	12		
3	PIPE + VALVE	FILLET	60.3	11.07	SA335P22	SA182F22	4		
4	PIPE+BEND(OR) VALVE	BUTT	88.9	20	SA335P22	SA335P22	14		
5	PIPE + BEND (OR)VALVE(OR)ELBOW	BUTT	88.9	15.24	SA335P22	SA335P22	16		
6	PIPE+PIPE(OR)BEND(OR)VALVE(OR)END COVER(OR)PIPE WITH STUB	BUTT	168.3	27.5	SA106GrC	SA106GrC	16		
7	PIPE+PIPE WITH STUB	BUTT	33.4	6.35	SA106GrC	SA106GrC	1		
8	PIPE+VALVE	FILLET	33.4	6.35	SA106GrC	SA105	4		
9	PIPE+PIPE (OR)BEND	BUTT	33.4	9.09	SA335P91	SA335P91	140		
10	PIPE + VALVE	FILLET	33.9	9.09	SA335P91	SA182F91	24		
11	PIPE+TEE(OR) VALVE	FILLET	48.3	7.14	SA335P22	SA182F22CL3	8		
12	PIPE+PIPE (OR)BEND	BUTT	48.3	7.14	SA335P22	SA335P22	42		
13	PIPE+ELBOW(OR) REDUCER	BUTT	88.9	15.24	SA335P91	SA234WP91	15		
14	PIPE+ELBOW(OR) TEE(OR)PIPE WITH STUB	BUTT	127	20	SA335P91	SA234WP91	14		
15	REDUCER+TEE	BUTT	127	20	SA234WP91	SA234WP91	2		
16	PIPE+BEND	BUTT	33.4	9.09	SA335P91	SA335P91	6		
17	PIPE+TEE(OR) FVALVE	FILLET	33.4	9.09	SA335P91	SA182F91	3		
18	PIPE+VALVE	FILLET	33.9	9.09	SA335P91	SA182F22	6		
19	PIPE+PIPE(OR)PIPE WITH STUB (OR)BEND(OR)REDUCER(ORTEE	BUTT	33.4	9.09	SA335P22	SA182F22CL3	300		
20	PIPE+PIPE WITH STUB(OR)END COVER	BUTT	114.3	20	SA335P22	SA182F22CL3	20		
21	PIPE+VALVE	FILLET	33.4	9.09	SA335P22	SA182F22	12		

TRIM PIPING

Sl. No	DESCRIPTION OF PARTS TO BE WELDED	Weld Type (Butt/Fillet)	OD	THK	SPEC 1	SPEC 2	Quantity	Remarks	Rev
22	PIPE+PIPE(OR) ELBOW(OR)PIPE WITHSTUB(OR) VALVE	BUTT	114.3	20	SA335P22	SA234WP22	25		
23	PIPE+PIPE(OR)BEND(OR)PIPE WITH STUB(OR)VALVE	BUTT	88.9	20	SA335P22	SA217WC9	30		
24	PIPE+VALVE	FILLET	33.4	6.35	SA106GrC	SA105	4		
25	PIPE+BEND	BUTT	60.3	11.07	SA106GrC	SA106GRC	6		
26	PIPE+BEND (OR) REDUCER	BUTT	48.3	10.16	SA106GrB	SA234WPC	40		
27	TEE+REDUCER	FILLET	48.3	10.16	SA105	SA234WPC	2		
28	PIPE+TEE(OR) VALVE	FILLET	60.3	11.07	SA106GrC	SA105	6		
29	PIPE+PIPE(OR) BEND	BUTT	48.3	10.16	SA335P22	SA335P22	20		
30	PIPE+VALVE(OR)TEE(OR)REDUCER	FILLET	48.3	10.16	SA335P22	SA182F22	6		
31	PIPE+VALVE	FILLET	33.4	6.35	SA106GrC	SA105	6		
32	PIPE+PIPE	BUTT	33.4	6.35	SA106GrC	SA106GrC	8		
33	PIPE+PIPE STUB(OR)BEND (OR)LR ELL	BUTT	88.9	15.24	SA106GrC	SA106GrC	10		
34	PIPE+VALVE	BUTT	88.9	15.24	SA106GrC	SA216WCC	4		
35	PIPE+PIPE(OR) BEND(OR)REDUCER	BUTT	60.3	11.07	SA106GrC	SA234WPC	30		
36	PIPE+VALVE(OR) TEE	FILLET	60.3	11.07	SA106GrC	SA105	10		
37	PIPE+PIPE(OR) REDUCER	BUTT	48.3	10.16	SA106GrB	SA105	12		
38	TEE+PIPE(OR)REDUCER(OR)VALVE	BUTT	88.9	15.24	SA234WPC	SA216WCC	4		
39	PIPE+BEND(OR) PIPE	BUTT	60.3	11.07	SA106GrC	SA106GrC	13		
40	PIPE+TEE(OR) VALVE	FILLET	60.3	11.07	SA106GrC	SA105	10		
41	TEE+REDUCER	FILLET	60.3	11.07	SA105	SA182F12CL2	1		
42	PIPE+REDUCER	FILLET	31.8	6	SA213TP347H	SA182F12CL2	1		

TRIM PIPING

Sl. No	DESCRIPTION OF PARTS TO BE WELDED	Weld Type (Butt/Fillet)	OD	THK	SPEC 1	SPEC 2	Quantity	Remarks	Rev
43	PIPE+BEND(OR)VALVE(OR)TEE(OR) REDUCER(OR) END COVER	BUTT	168.3	27.5	SA106GrC	SA216WCC	25		
44	PIPE+BEND(OR) VALVE(OR)REDUCER	BUTT	114.3	17.12	SA106GrC	SA216WCC	8		
45	PIPE+BEND(OR) VALVE	BUTT	73	14.02	SA335P22	SA217WC9	65		
46	PIPE+REDUCER(OR)VALVE(OR)TEE	FILLET	31.8	6	SA213TP347H	SA182F316	88		
47	PIPE+BEND(OR) PIPE	BUTT	31.8	6	SA213TP347H	SA213TP347H	400		
48	PIPE+PIPE STUB (OR)VALVE	BUTT	33.4	3.38	SA106GrB	SA105	28		
49	PIPE+PIPE (OR)REDUCER	BUTT	33.4	3.38	SA106GrB	SA234WPB	7		
50	PIPE+VALVE	FILLET	60.3	3.91	SA106GrB	SA105	4		
51	PIPE+PIPE (OR)REDUCER	BUTT	60.3	3.91	SA106GrB	SA234WPB	4		
52	PIPE STUB+GATE VALVE(OR)HRH ERV	BUTT	223	26.55	SA182F91	SA217C12A	4		
53	PIPE+ELBOW (SEPARATOR)	BUTT	168.3	7.11	SA182F91	SA234WP22CL1	16		
54	SV STUB+SV (SEPARATOR)	BUTT	184	57.05	SA182F12	SA217WC6	8		
55	MS LINE STUB+SAFETY VALVE	BUTT	184	57.05	SA182F91	SA217C12A	4		
56	PIPE+ELBOW(MS SV)	BUTT	168.3	7.11	SA335P91	SA335P91	8		
57	PIPE STUB+GATE VALVE(OR)MS ERV	BUTT	127	34	SA182F91	SA217C12A	4		
58	PIPE STUB+SV(HRH)	BUTT	245	43.1	SA182F91	SA217C12A	6		
59	PIPE+ELBOW (HRH)	BUTT	273	6.35	SA335P91	SA335P91	12		
60	CRH LINE STUB+SAFETY VALVE	BUTT	222.3	31.75	SA105	SA216WCB	4		
61	PIPE+ELBOW (CRH)	BUTT	273	6.35	SA106GrC	SA234WPC	8		
62	PIPE+ELBOW	FILLET	47.63	5	SA213T91	SA182F91	6		
63	PIPE+ELBOW	FILLET	76.2	5.1	SA213T91	SA182F91	36		
64	PIPE+ELBOW	BUTT	73	5.16	SA106GrB	SA234WPB	36		

TRIM PIPING

Sl. No	DESCRIPTION OF PARTS TO BE WELDED	Weld Type (Butt/Fillet)	OD	THK	SPEC 1	SPEC 2	Quantity	Remarks	Rev
65	PIPE+FLANGE	FILLET	168.3	7.11	SA335P91	SA182F91	16		
66	PIPE+FLANGE	FILLET	273	6.35	SA335P91	SA182F91	6		
67	PIPE+FLANGE	FILLET	273	6.35	SA106GrB	SA105	7		
68	PIPE+DRIP PAN(OR)PLATE	FILLET	273	6.35	SA335P91	SA387GR22	175		

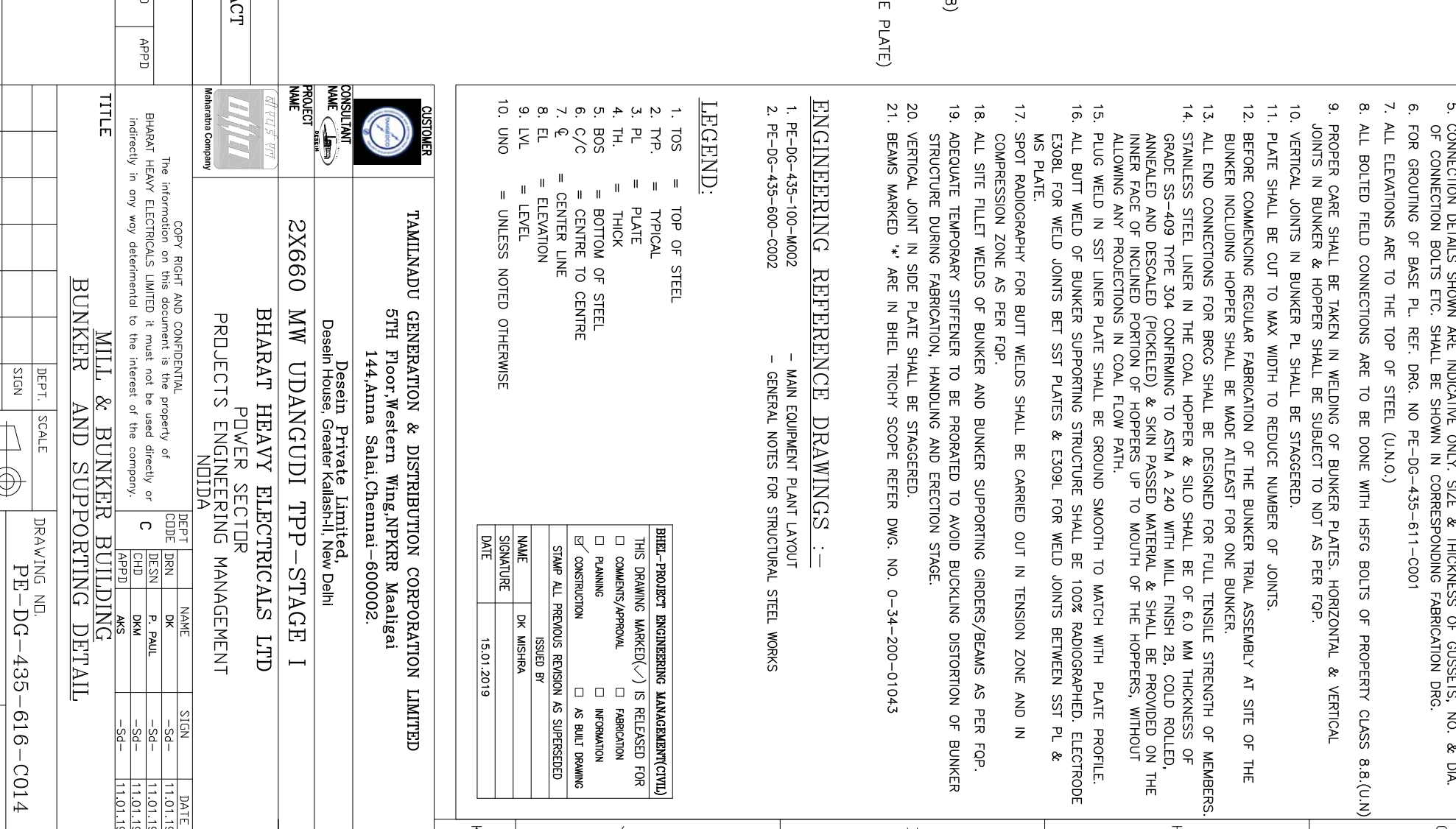
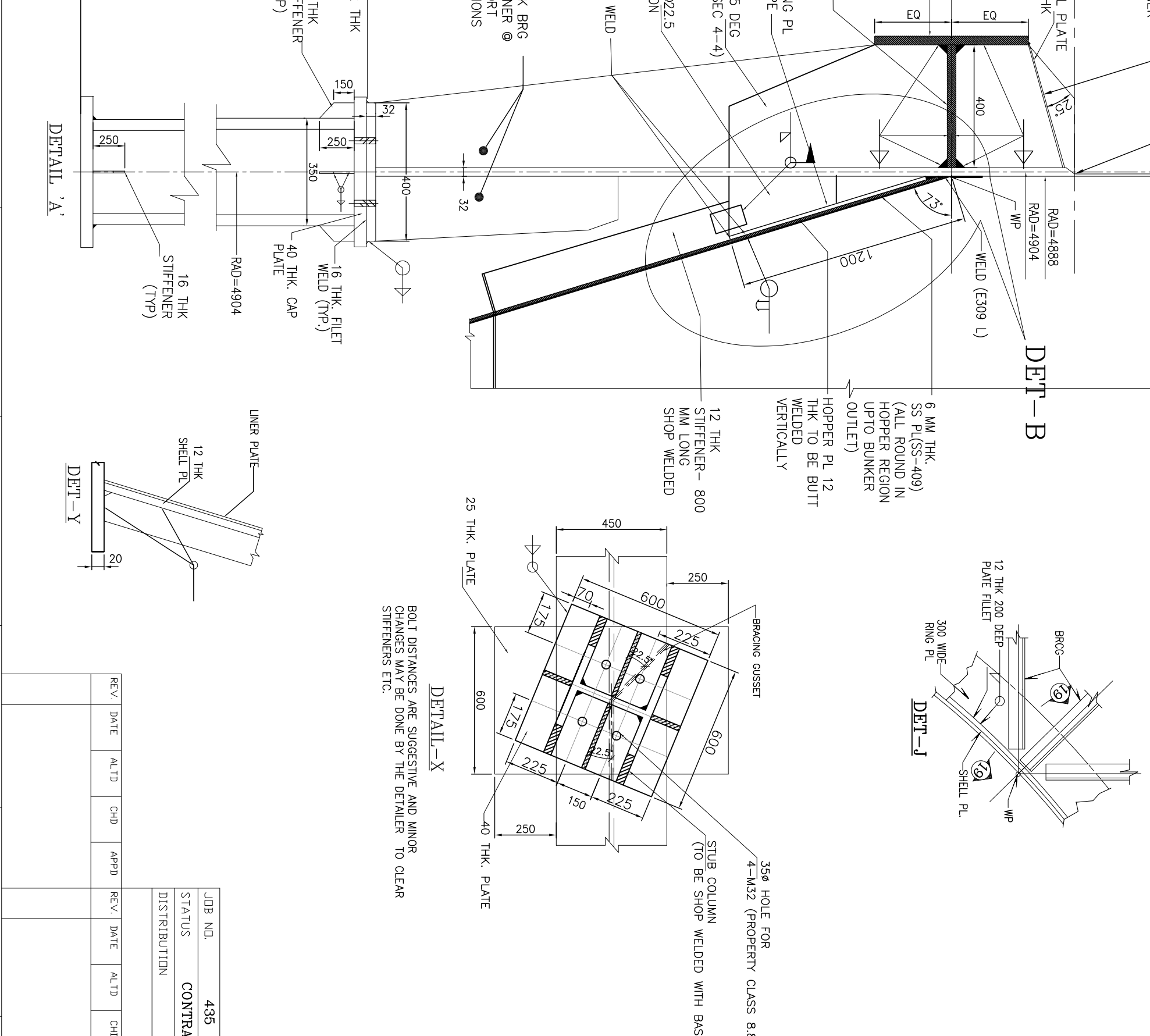
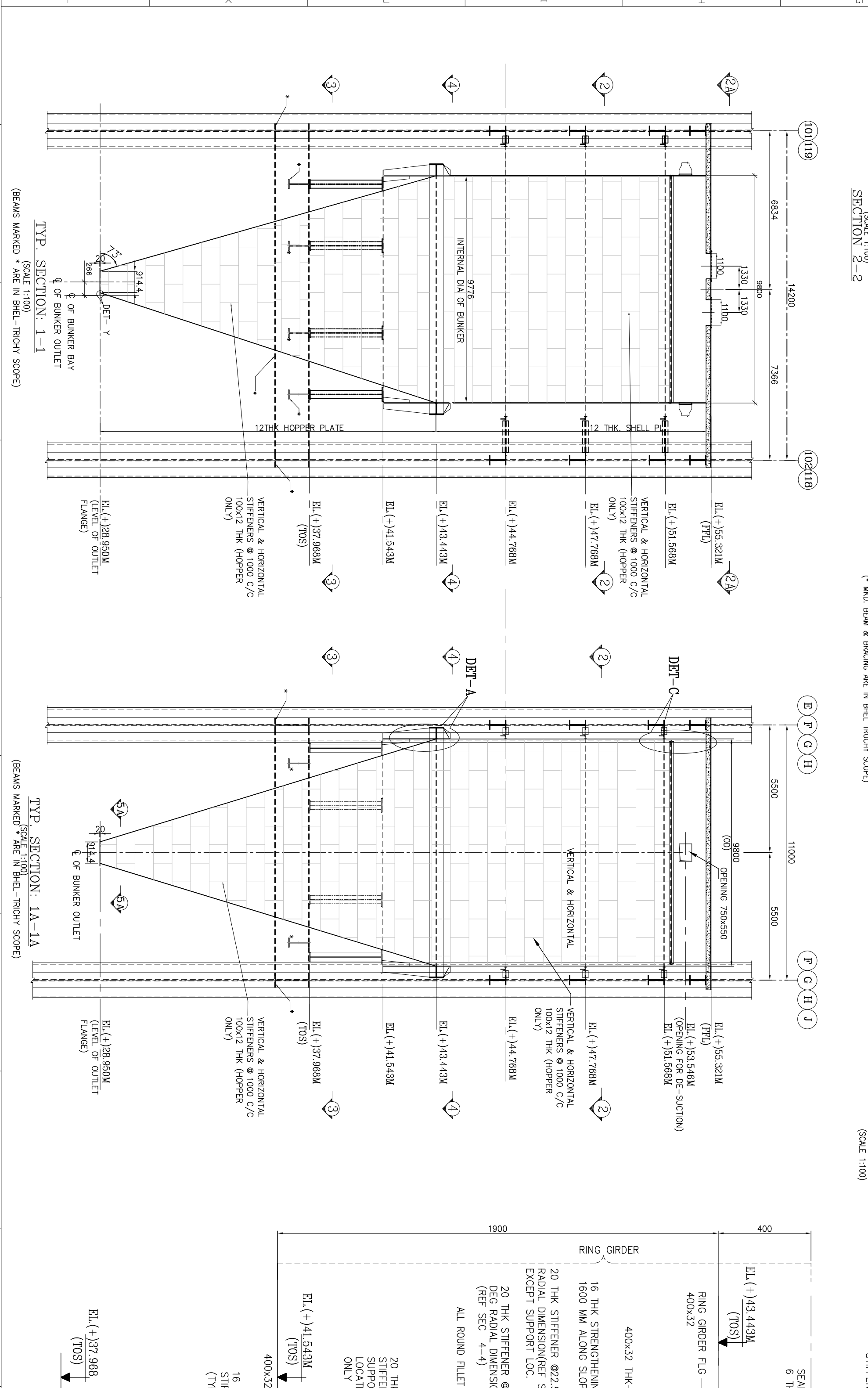
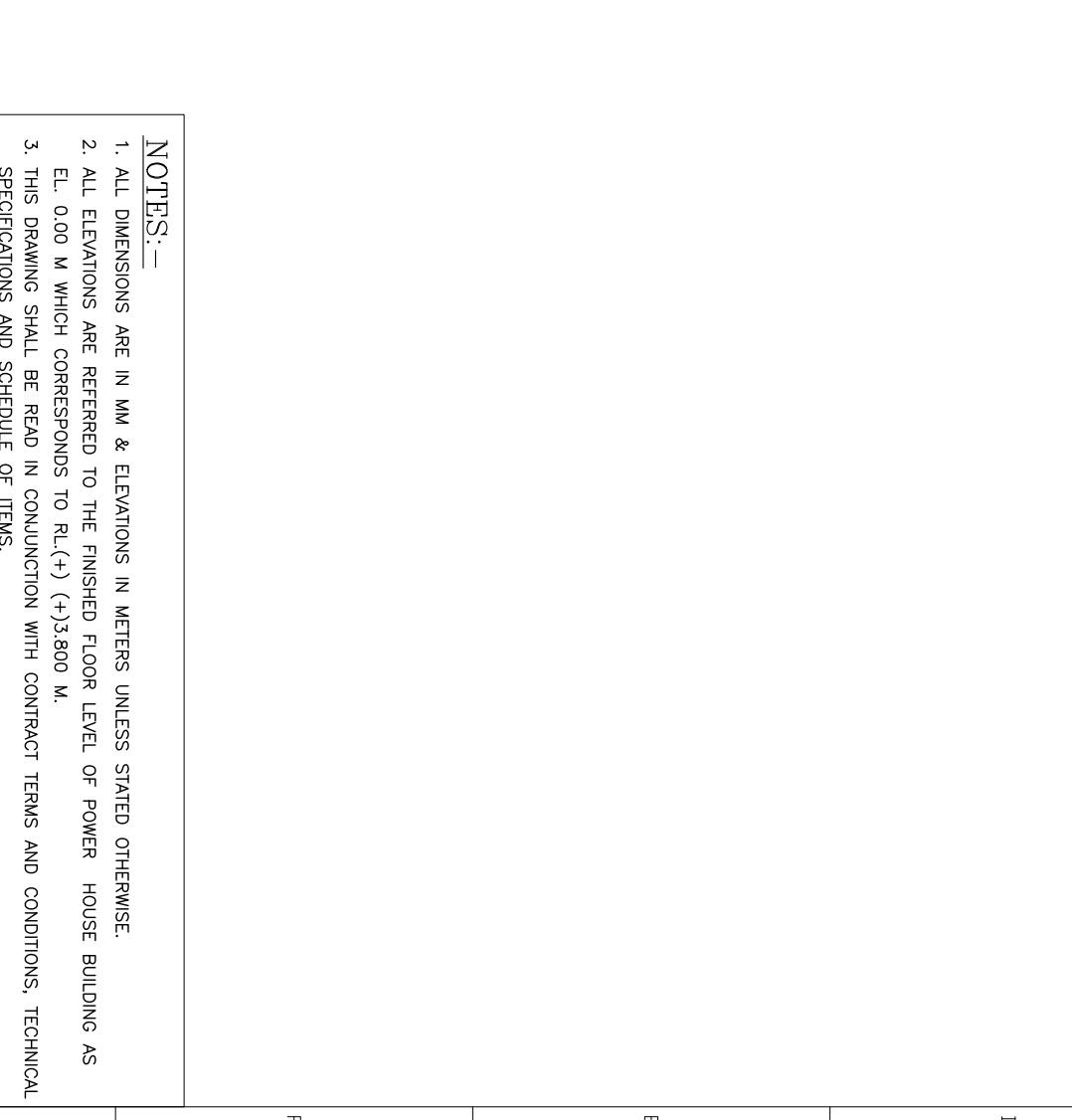
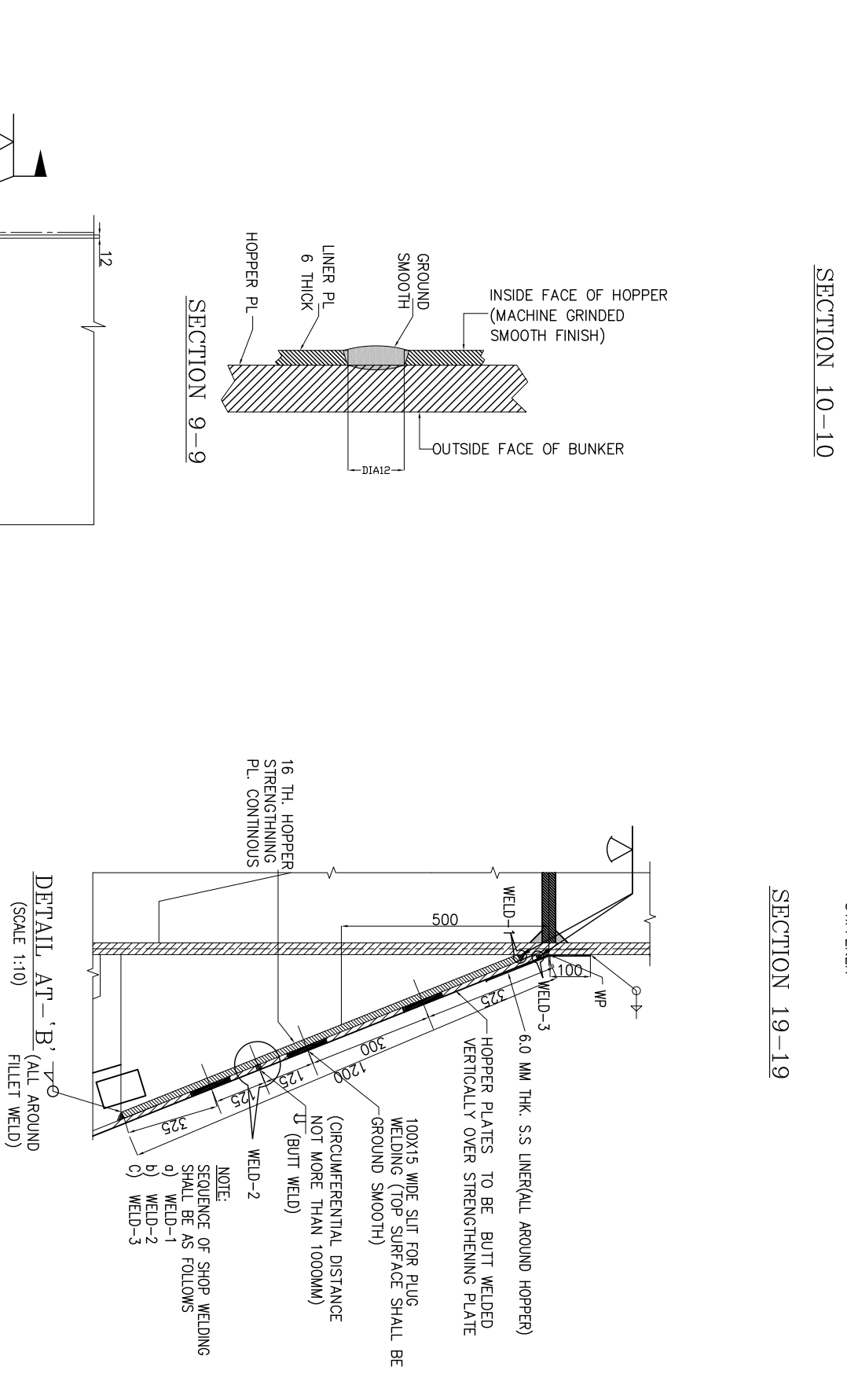
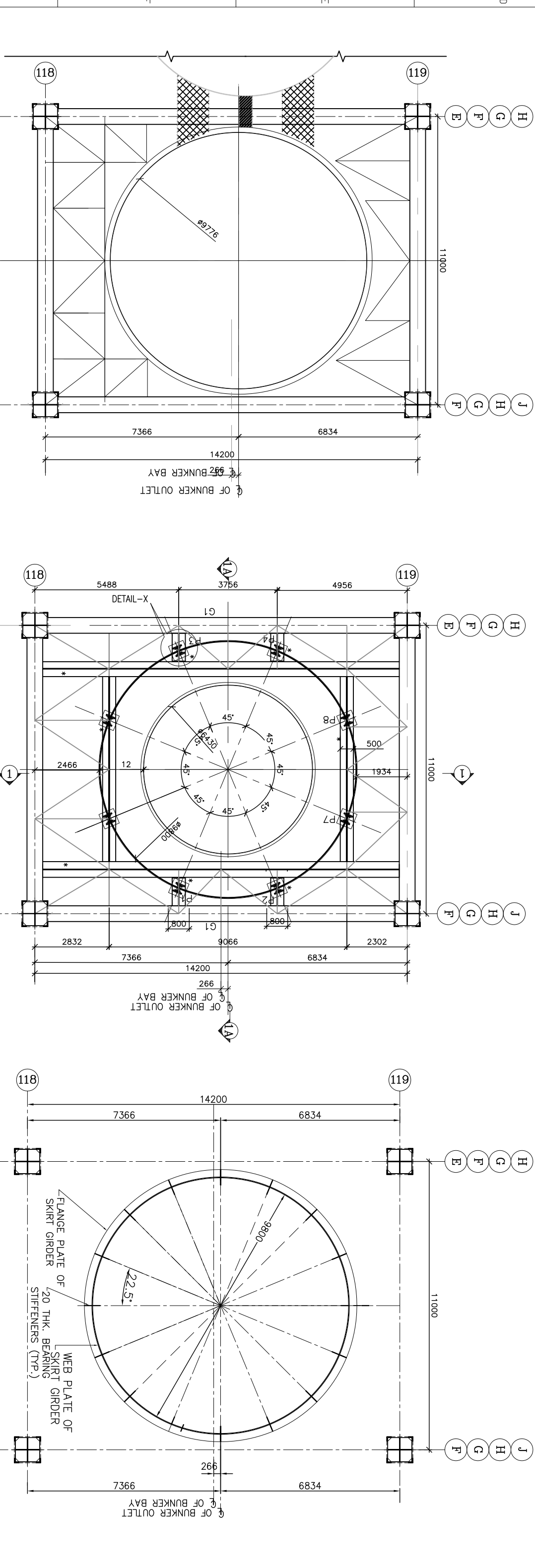
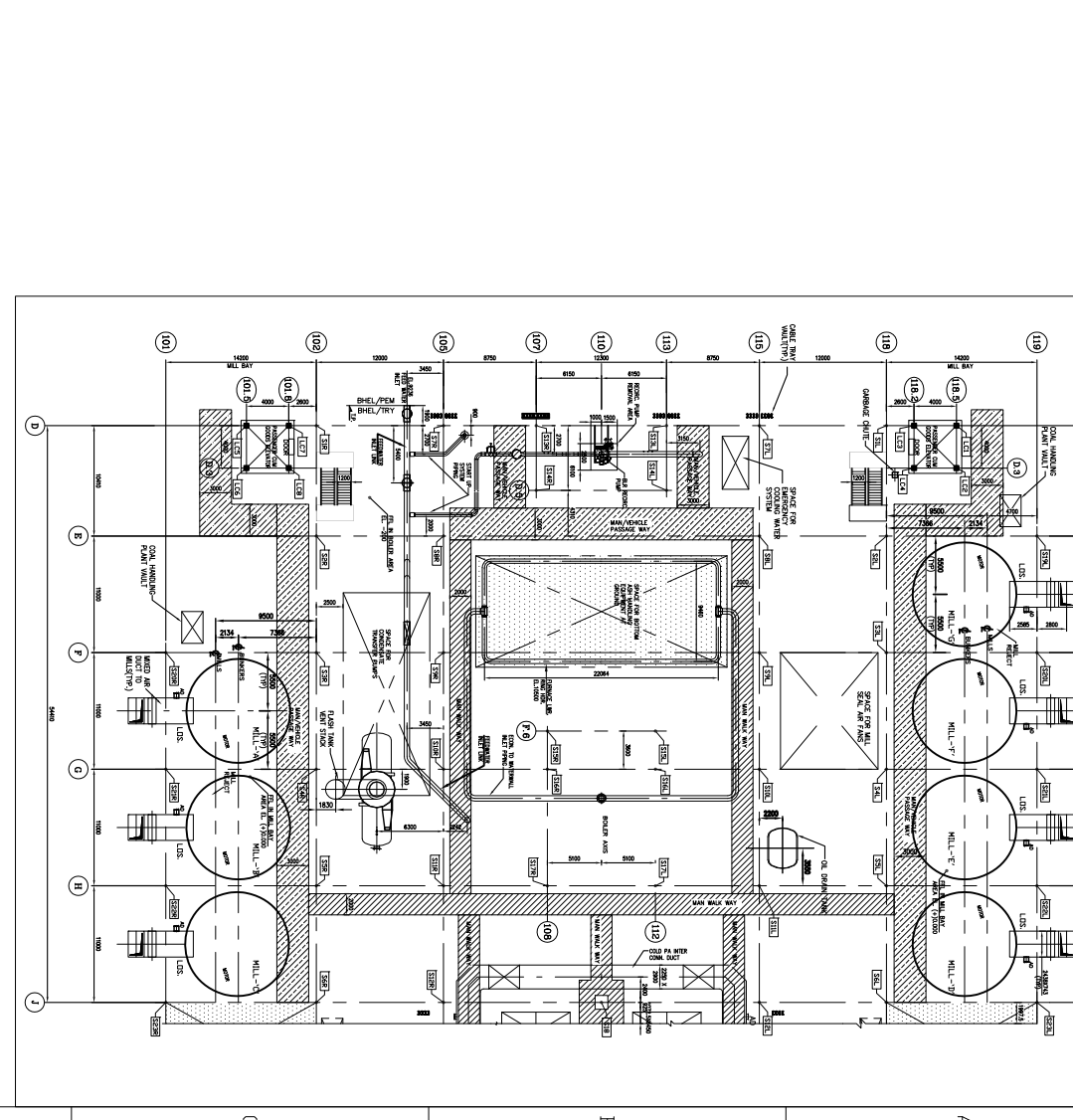
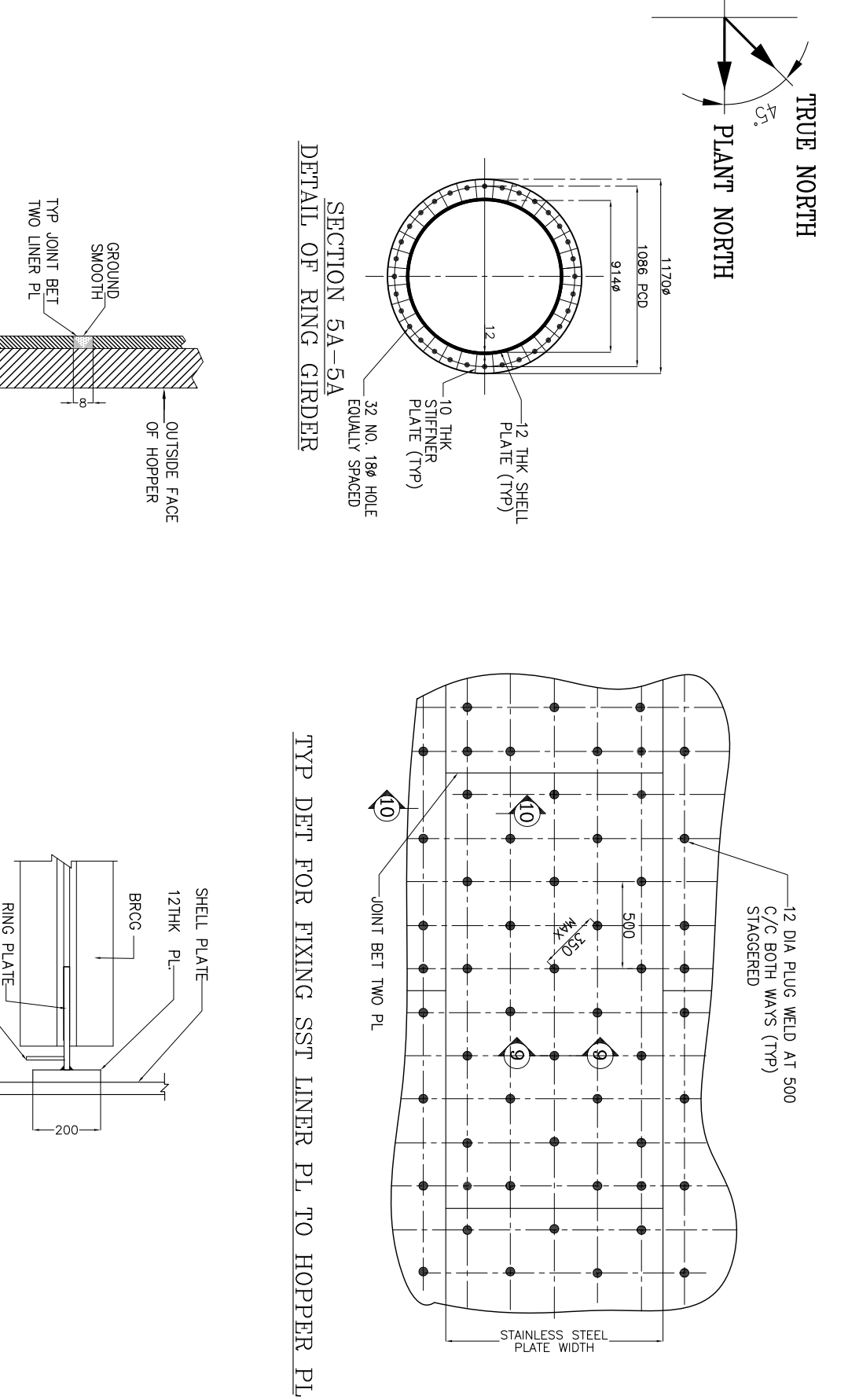
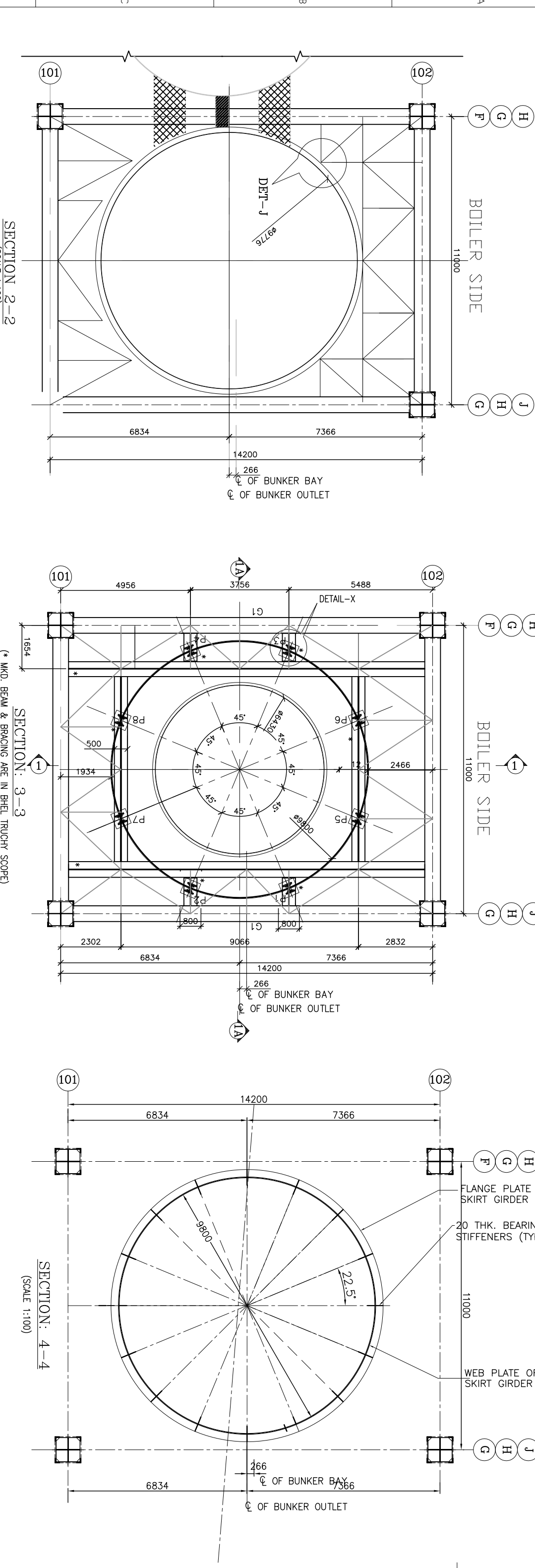
SOOT BLOWER PIPING

1	PIPE+BEND(OR) PIPE	BUTT	21.3	7.47	SA335P91	SA335P91	2		
2	PIPE+BEND(OR) PIPE	BUTT	33.4	6.35	SA335P91	SA335P91	2		
3	PIPE+BEND(OR) PIPE	BUTT	127	20	SA335P91	SA335P91	30		
4	PIPE+ELBOW	BUTT	21.3	4.78	SA106GrC	SA234WPC	20		
5	PIPE+REDUCER	BUTT	33.4	4.55	SA106GrC	SA234WPC	60		
6	PIPE+REDUCER+ PIPE	BUTT	60.3	5.54	SA106GrC	SA106GrC	500		
7	PIPE+REDUCER+ PIPE	BUTT	73	5.16	SA106GrC	SA106GrC	200		
8	PIPE+REDUCER+ PIPE	BUTT	127	12.5	SA106GrC	SA106GrC	20		
9	PIPE+BEND(OR) PIPE	BUTT	33.4	6.35	SA106GrC	SA106GrC	100		
10	PIPE+BEND(OR) PIPE	BUTT	21.3	4.78	SA106GrC	SA106GrC	20		
11	PIPE+REDUCER+ PIPE	BUTT	127	12.5	SA335P22	SA335P22	1		
12	PIPE+REDUCER+ PIPE	BUTT	127	20	SA335P22	SA335P22	1		
13	PIPE+REDUCER+ PIPE	FILLET	60.3	5.54	SA106GrC	SA106GrC	500		

Note to Welding Schedule	
1)	Imported electrodes/TIG welding wires released and supplied by the manufacturing units will be given by BHEL. All electrodes are to be supplied by contractor under his scope.
2)	The welding joints indicated above is approximate and is liable for variation in PG, description, size, materials, NDT requirements etc., The indicated joints will be grouped into category of carbon steel(inclusive of SA106GrC or equivalent) and Alloy steel(inclusive of T91/P91) (please refer the power plant material specification list below) and convert them in to equivated joints (Dia 63.5x6.3mm) as per the formula below: $\text{No of equivated Joints} = \text{Dia} \times \text{Thickness} / (63.5 \times 6.3)$ $= \text{Dia} \times \text{Thickness} / 400.05$ The rate quoted for executing pressure parts shall also include welding joints. No additional payments shall be made upto +25% of equated joints over and above in each category (Carbon steel (CS) & Alloy steel (AS)) indicated in the Tender. In case of variation in equivated joints exceed beyond 125% the quantity exceeding +125% of the tendered quantity of each category will be paid as indicated below: a) One extra equivated joints (CS) = Rs 254/- b) One extra Equivated Joints (AS) =Rs 561/- Non Destructive Testing (NDT) and Stress Relieving (SR) if applicable shall be carried out by the contractor within these rates. Please refer POWER PLANT MATERIAL SPECIFICATION LIST attached with this Tender for classification of Alloy Steel and Carbon Steel.
3)	The welding joints indicated above is only butt weld joints of IBR category and does not include the joints for drains, vents, root valves, temporary piping for Hydro test, chemical cleaning, steam blowing etc., and contractor shall carry out these joints with in the quoted rate
4)	All the other welds via pressure parts attachments, fillet welding of flanges, valves, inserts, couplings, instrument tapings, supports & supporting arrangements, on pressure parts/non- pressure parts, panel to panel fin welding, buck stay attachments etc., are not covered in the above schedule and contractor shall carry out these joints with in the quoted rate
5)	Filler wires & electrodes, if any, which are supplied against PGMA will be supplied to the contractor on free of cost. Contractor to use the same economically and account for the same as and when it is requested. All other filler wires and electrodes are in the scope of contractor and shall carry out the work within the quoted rate
6)	Oil system piping under PG 42 is not included in this schedule and contractor shall carry out these joints with in the quoted rate
7)	Piping for trim piping system , soot blower system, oil system etc shall be supplied mostly in running meters which will be erected & welded as per the drawing/site routing with in the quoted rate.

POWER PLANT MATERIAL SPECIFICATION LIST

P.No	Type of Steel	Tube	Pipe	Plate	Casting	Forging	Fittings	Welded Fittings
P1	Carbon Steel	SA192	--	SA36	--	SA105	--	--
P1	Carbon Steel	SA179	--	SA515 Gr70	--	--	--	--
P1	Carbon Steel	SA210Gr A1	SA106 Gr B	SA516 Gr60	SA216WCB	--	SA234WPB	SA234WPB-W
P1	Carbon Steel	SA210 Gr C	SA106 Gr C	SA516 Gr70	SA216WCC	SA672 Gr B70	SA234 WPC	SA234WPC-W
P1	Carbon Steel	--	--	SA299	--	SA266M Gr 2	--	--
P1	Carbon Steel	--	--	IS2062 Gr A/B/C	--	--	--	--
P1	Carbon Steel	--	--	IS8500 - 540	--	--	--	--
P3	Alloy Steel	SA209T1	--	--	--	--	--	--
P4	Alloy Steel	SA213T5	--	BSEN10025 Gr420N	--	--	--	--
P4	Alloy Steel	SA213T9	--		--	--	--	--
P4	Alloy Steel	SA213T11	SA335P11	SA387 Gr11 CLASS2	--	SA182F11 CLASS 2/3	SA234WP11	SA243WP11-W
P4	Alloy Steel	SA213 T12	SA335 P12	SA387 Gr12 CLASS2	--	SA182F12 CLASS 2/3	SA234WP12 CLASS 1	SA234WP12-W
P5A	Alloy Steel	SA213 T22	SA335 P22	SA387 Gr22 CLASS2	SA217WC9	SA182 F22 CLASS 2/3	SA234 WP22 CLASS 1/3	SA234 WP22-W
P5B	Alloy Steel	SA213T23	--	--	--	--	--	--
P15E	Alloy Steel	SA213T91	SA335 P91	SA387 Gr91	SA217WC12A	SA182F91	SA234 WP91	SA234 WP91-W
P15E	Alloy Steel	SA213T92	SA335P92		--	SA182F92	SA234WP92	SA234WP92-W
P8	Stainless Steel	SA213TP304H	SA312TP304H	SA240 Gr304H	SA351CF8	AISI 321	--	--
P8	Stainless Steel	SA231 TP347H	--	--	SA351CF8M	--	--	--
P8	Stainless Steel	SA213 S304H	--	--	SA335CF8C	--	--	--
P8	Stainless Steel	--	--	--	SA351CH20	--	--	--





TITLE:

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

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D

SUBSECTION -D17

REV.NO. 0

DATE 13/02/2018

SHEET 1

OF 41

**SECTION - D
(PART I)**

SUB-SECTION – D 17

FABRICATION OF STRUCTURAL STEEL WORK



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

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

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D

SUBSECTION -D17

REV.NO. 0

DATE 13/02/2018

SHEET 2 OF 41

C O N T E N T

CLAUSE NO.	DESCRIPTION	SHEET NO.
1.00.00	SCOPE	3
2.00.00	GENERAL	3
3.00.00	WORKMANSHIP	19
4.00.00	INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY	29
5.00.00	INFORMATION TO BE SUBMITTED	33
6.00.00	RATES AND MEASUREMENTS	34

	TITLE:		SPECIFICATION NO. PE-TS-635-600-C001	
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		VOLUME -	
			SECTION - D	SUBSECTION -D17
			REV.NO. 0	DATE 13/02/2018
			SHEET 3	OF 41

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.

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION -D17
		REV.NO. 0	DATE 13/02/2018
		SHEET 4	OF 41
	i) Maintain a fully equipped workshop at site for fabrication, modification 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		

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO.	0	DATE	13/02/2018
		SHEET	5	OF	41
IS: 961 - Structural Steel (High Tensile) 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 l 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					

 BHEL Bharat Heavy Electricals Limited	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION -D17
		REV.NO. 0	DATE 13/02/2018
		SHEET 6	OF 41
	IS: 3757 - High strength structural bolts IS: 4759 - Specifications for Hot-Dip Zinc Coatings on Structural Steel and other allied products IS: 7205 - Safety Code for Erection of Structural Steelwork IS: 7215 - Tolerances for fabrication of steel structures IS: 7280 - Bare wire electrodes for submerged arc welding of structural steels. IS: 9595 - Recommendations for metal arc welding of carbon and carbon manganese steels.		
2.04.00	Conformity with Designs The contractor shall design all connections, supply and fabricate all steelwork and furnish all connection materials in accordance with the approved drawings and/or as instructed by the Engineer keeping in view the maximum Utilization of the available sizes and sections of steel materials. The methods of painting, marking, packing and delivery of all fabricated materials shall be in accordance with the provisions of the contract and/or as approved by the Engineer. Provision of all relevant Indian Standard Specifications and Codes of Practice shall be followed unless otherwise specified in the contract.		
2.05.00	Materials to be used		
2.05.01	General All steel materials required for the work will be supplied by the contractor unless otherwise specified elsewhere in the contract. The materials shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. All materials shall be of tested quality only unless otherwise permitted by the Engineer and/or Consultant. If desired by the Engineer, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are required to be used from unidentified stocks, if permitted by the Engineer, a random sample shall be tested at an approved laboratory from each lot of 50 tones or less of any particular section. The arc welding electrodes shall be of approved reputed manufacture and conforming to the relevant Indian Standard Codes of Practice and Specifications and shall be of heavily coated type and the thickness of the coating shall be uniform and concentric. With each container of electrodes, the manufacturer shall furnish instructions giving recommended voltage and		

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 7 OF 41
amperage (Polarity in case of D.C. supply) for which the electrodes are suitable.		
2.05.02	Steel All steel materials to be used in construction within the purview of this specification shall comply with any of the following Indian Standard Specifications as may be applicable: a) IS: 2062 - Steel for general structural purposes b) IS: 961 - Structural steel High Tensile c) IS: 1977 - Structural steel (Ordinary quality) St-42-0 In case of imported steel materials being used, these shall conform to specifications equivalent to any of the above as may be applicable.	
2.05.03	Rivet Steel All rivet steel used in construction within the purview of this Specification shall comply with one of the following Indian Standard Specifications as may be applicable: a) IS: 1148 - Rivet Bars for structural purpose b) IS: 1149 - High tensile rivet bars for structural purposes. Where high tensile steel is specified for rivets, steps shall be taken to ensure that the rivets are so manufactured that they can be driven and heads formed satisfactorily without the physical properties of steel being impaired.	
2.05.04	Electrodes All electrodes to be used under the Contract shall be of approved reputed manufacture, low hydrogen electrode and shall comply with any of the following Indian Standard Specifications as may be applicable a) IS: 814 - Covered electrodes for metal arc welding of structural steel b) IS: 815 - Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel c) IS: 1442 - Covered electrodes for the metal arc welding of high tensile structural steel	

 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001			
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO.	0	DATE	13/02/2018
		SHEET	8	OF	41
	d) IS: 7280 -	Bare wire electrodes for submerged arc welding of structural steels			
2.05.05	Bolts and Nuts				
	All bolts and nuts shall conform to the requirements of Indian Standard Specification IS: 1367 - Technical Supply Conditions for Threaded Fasteners.				
	Materials for Bolts and nuts under the purview of this contract shall comply with any of the following Indian Standard Specifications as may be applicable.				
	a) Mild Steel				
	All mild steel for bolts and nuts when tested in accordance with the following Indian Standard Specification shall have a tensile strength of not less than 44 Kg/mm ² 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			

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO.	0	DATE	13/02/2018
		SHEET	9	OF	41
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.					
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 been 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.					

 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001			
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO.	0	DATE	13/02/2018
		SHEET	10	OF	41
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.				

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 12 OF 41																					
	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 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 (As per BOQ item) 2.10.01 Material In case SS Hopper is to be fabricated & erected as per BOQ item with SS415M, following specification shall be followed. Stainless steel hopper of grade SS 415M as manufactured by SAIL or equivalent shall be provided in the lower portion of bunker hopper. SS 4 15M having the following chemical composition shall be used. <table> <thead> <tr> <th>Material</th><th>%</th><th>Remarks</th></tr> </thead> <tbody> <tr> <td>Carbon</td><td>10.03%</td><td>Max.</td></tr> <tr> <td>Silicon</td><td>1.60%</td><td>Max.</td></tr> <tr> <td>Manganese</td><td>0.80% to 1.50%</td><td></td></tr> <tr> <td>Phosphorous</td><td>0.03%</td><td>Max.</td></tr> <tr> <td>Sulphur</td><td>0.03%</td><td>Max.</td></tr> <tr> <td>Chromium</td><td>10.80% to 12.50%</td><td></td></tr> </tbody> </table>		Material	%	Remarks	Carbon	10.03%	Max.	Silicon	1.60%	Max.	Manganese	0.80% to 1.50%		Phosphorous	0.03%	Max.	Sulphur	0.03%	Max.	Chromium	10.80% to 12.50%	
Material	%	Remarks																					
Carbon	10.03%	Max.																					
Silicon	1.60%	Max.																					
Manganese	0.80% to 1.50%																						
Phosphorous	0.03%	Max.																					
Sulphur	0.03%	Max.																					
Chromium	10.80% to 12.50%																						

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		SPECIFICATION NO. PE-TS-635-600-C001																		
			VOLUME -																		
			SECTION - D		SUBSECTION -D17																
			REV.NO.	0	DATE	13/02/2018															
			SHEET	13	OF	41															
Nickel 1.50% Max. Titanium 0.75% Max. Nitrogen 0.03% Max. The mechanical properties shall be as follows: <table><tr><th>Description</th><th>Value</th><th>Remarks</th></tr><tr><td>Hardness Rock Well B Scale</td><td>90</td><td>Max.</td></tr><tr><td>Tensile Strength</td><td>450 MPa</td><td>Min.</td></tr><tr><td>Yield Strength</td><td>300 MPa</td><td>Min.</td></tr><tr><td>Elongation</td><td>25%</td><td>Min.</td></tr></table>							Description	Value	Remarks	Hardness Rock Well B Scale	90	Max.	Tensile Strength	450 MPa	Min.	Yield Strength	300 MPa	Min.	Elongation	25%	Min.
Description	Value	Remarks																			
Hardness Rock Well B Scale	90	Max.																			
Tensile Strength	450 MPa	Min.																			
Yield Strength	300 MPa	Min.																			
Elongation	25%	Min.																			
2.10.02 Fabrication The fabrication, erection, alignment and welding shall be carried out as per the accepted practice and in accordance with relevant I.S. and international specification as well as stipulations contained herein. Fabrication drawings shall be prepared by the contractor on the basis of the design / scope drawings furnished by Engineer. The fabrication and erection works shall be done as per the approved fabrication drawings.																					
2.10.03 Fabrication Drawings a) Fabrication drawing shall give the cutting plan for each hopper plate. Such, cutting plan shall be based on the size of the Stainless Steel plate available at store. In order to reduce the wastage and ensure the maximum utilization of stainless steel plate, the cutting plan shall take in the consideration of the reverse curvature and place the various elements of hopper plate in opposite fashion to reduce the end wastage. Similarly, the hopper plate element having different radii shall be placed one inside the other, to optimize the stainless steel plate use. Such optimization may also require adjustment in the size of 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																					

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001
		VOLUME -
		SECTION - D SUBSECTION -D17
		REV.NO. 0 DATE 13/02/2018
	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. 2.10.07 Welding sequence The type of electrodes, welding sequence, preheat and interpass temperature and post weld heat treatment shall be as approved by the Engineer. 2.10.08 Acceptance Criteria of Fabricated Structures The acceptance of the fabricated structure work shall depend upon correct dimensions and alignment, absence of distortion in the structure, satisfactory	SHEET 14 OF 41

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 15 OF 41
	results from the inspection and testing of the welded structure joints and the test specimens, general workmanship being good meeting the tolerance requirements given in IS: 7215. 2.11.00 BEARINGS 2.11.01 PTFE (Poly tetra fluorethylene) slide bearing a) General The bearings shall consist of upper and lower units. The upper unit shall include a sole plate with mirror finish stainless steel facing bonded to the bottom surface of the sole plate. The lower unit shall consist of a relevant laminated elastomers pad surfaced with PTFE. A rigid confining medium substructure bonds the PTFE to the pad. When the upper and lower units are mated the stainless steel slides on the PTFE surface with an extremely low coefficient of friction. These bearings shall be designed as per the performance requirements. The bearing shall be of reputed make and manufacturer as approved by Engineer, for required vertical loads, as per the construction drawings and for a maximum displacement of ± 50 mm. b) Material PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/cm². In order to prevent cold flow in the PTFE surface it shall be rigidly bonded by a special high temperature resistant adhesive to the stainless steel sub-strata. The stainless steel surface, which slides against the PTFE, is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of the stainless steel shall be between 1.0 to 1.5mm. The resilient bearing pad shall consist of multiple layers of lightweight fabric impregnated with a high quality elastomer compound vulcanized into slabs of uniform standard thickness as per the requirement. This shall withstand vertical (compressive) load not less than 500 kg/cm² and shear loads upto 40 kg/cm². c) Installation The seating area for PTFE bearing shall be prepared accurately level and furnished with a thin layer of epoxy resin mortar. The bearing will be placed on this layer while it is still workable and the bearing is levelled. The bearing should not be displaced as the beam is lowered into position. When the mortar and adhesive are fully set and the beam slightly above the top of the bearing. The upper surface of the bearing shall then be coated with sufficient thickness of epoxy resin mortar so that when the	

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 16 OF 41
	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 off the ground with a coating of suitable protective oil. These shall be stored in separate gunny bags or compartments according to diameter, length, and quality. 2.12.05 Paints Paints shall be stored under cover in air tight containers. Paints supplied in sealed containers shall be used up as soon as possible once the container is opened.	

	TITLE:		SPECIFICATION NO. PE-TS-635-600-C001	
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		VOLUME -	
			SECTION - D	SUBSECTION -D17
			REV.NO. 0	DATE 13/02/2018
			SHEET 17	OF 41

2.13.00 Quality Control

The Contractor shall establish and maintain quality control procedures for different items of work and materials to the extent he deems necessary to ensure that all work is performed in accordance with this specification. In addition to the Contractor's quality control procedures, materials and workmanship at all times shall be subjected to inspection by the Engineer or Engineer's representative. As far as possible, all inspection by the Engineer or Engineer's representative shall be made at the Contractor's fabrication shop whether located at Site or elsewhere. The Contractor shall co-operate with the Engineer or Engineer's representative in permitting access for inspection to all places where work is being done and in providing free of cost all necessary help in respect of tools and plants, instrument, labour and materials required to carry out the inspection. The inspection shall be so scheduled as to provide the minimum interruption to the work of the Contractor.

Materials or workmanship not in reasonable conformance with the provisions of this Specification may be rejected at any time during the progress of the work.

The quality control procedure shall cover but not be limited to the following items of work

- a) Steel: Quality manufacturer's test certificates, test reports of representative samples of materials from unidentified stocks if permitted to be used.
- b) Rivets, Bolts, Nuts & Washers : Manufacturer's certificate, dimension checks, material testing.
- c) Electrodes : Manufacturer's certificate, thickness and quality of flux coating.
- d) Welders : Qualifying Tests
- e) Welding sets : Performance Tests
- f) Welds : Inspection, X-ray, Ultrasonic tests
- 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.

	TITLE:		SPECIFICATION NO. PE-TS-635-600-C001	
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK		VOLUME -	
			SECTION - D	SUBSECTION -D17
			REV.NO. 0	DATE 13/02/2018
			SHEET 18	OF 41

2.14.00 Standard dimensions, forms and weights

The dimensions, forms, weights and tolerances of all rolled shapes rivets, bolts, nuts, studs, washers etc. and other members used in the fabrication of any structure shall, wherever applicable, conform to the requirements of the latest relevant Indian Standards, wherever they exist, or, in the absence of Indian Standards, to other equivalent standards.

2.15.00 Fabrication Drawings

The contractor shall within thirty (30) days after the award of the Contract submit to the Engineer the Schedule of Fabrication and erection of structural Steelworks, for approval. Within one week after receipt of approval on design of any steel structure (part or full) based on the approved design. As decided by the Engineer, six (6) copies each of some or all of the detailed fabrication drawings will have to be submitted for approval.

The sequence of preparation of fabrication drawings shall match with the approved fabrication and erection schedule. The above-mentioned approval for fabrication drawings will be accorded only towards the general conformity with the design requirements as well as specifications. The approval of drawing however shall not relieve the contractor of his sole responsibility in carrying out the work correctly and fulfilling the complete requirements of contract documents.

The fabrication drawings shall include but not limited to the following:

- Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections.
- Dimensional drawings of base plates, foundation bolts location etc.
- Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings.
- Complete Bill of Materials and detailed drawings of all sections as also their billing weights.
- Any other drawings or calculations that may be required for the clarification of the works or substituted parts thereof.

These drawings shall give all the necessary information for the fabrication, erection, and painting of the steelwork in accordance with the provisions of this Specification. Fabrication drawings shall be made in accordance with the best modern practice and with due regard to sequence, speed and economy in fabrication and erection. Fabrication drawings shall give complete information

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 19 OF 41
	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. 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	

 BHEL Bharat Heavy Electricals Limited	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION -D17
		REV.NO. 0	DATE 13/02/2018
		SHEET 20	OF 41
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 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			



TITLE:

TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION -D17

REV.NO. 0 DATE 13/02/2018

SHEET 21 OF 41

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 1 125°C they shall not be driven after their temperature has fallen below 540°C.

Rivets shall be driven by power riveters, of either compression or manually operated type, employing pneumatic, hydraulic or electric power. Hand driven rivets shall not be allowed unless in exceptional cases specifically approved by the Engineer. After driving, rivets shall be tight, shall completely fill the holes and their heads shall be in full contact with the surface. In case of countersunk rivets, the countersinking shall be fully filled by the rivet, any proudness of the countersunk head being dressed off flush, if required.

Riveted members shall have all parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

All loose, burnt, or otherwise defective rivets shall be cut out and replaced and special care shall be taken to inspect all single riveted connections. Special care shall also be taken in heating and driving long rivets. The Contractor shall prove the quality of riveting by cutting some rivets chosen at random by the Engineer. No extra payment will be made to the Contractor for such cutting and replacing. Riveting work, for any particular section or group, will be considered satisfactory when at least 90% of the corresponding cut rivets is found to be sound. If the ratio is below 75%, all the rivets in the particular

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 22 OF 41
	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 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.	

 BHEL Bharat Heavy Electricals Limited	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001
		VOLUME -
		SECTION - D SUBSECTION -D17
		REV.NO. 0 DATE 13/02/2018
		SHEET 23 OF 41
3.03.04	Welding Sequence In assembling and joining parts of a structure or of built-up members, the procedure and sequence of welding shall be such as will avoid needless distortion and minimize shrinkage stresses in the closing welds of a rigid assembly, such closing welds shall be made in compression elements. In the fabrication of cover-plated beams and built-up members, all shop splices in each component part shall be made before such component part is welded to other parts of the member. Long girders or girder sections may be made by shop splicing not more than three sub-sections, each made in accordance with this paragraph. When required by the Engineer, welded assemblies shall be stress relieved by heat-treating in accordance with the provisions of the relevant Indian Standard or any other Standard approved by the Engineer.	
3.03.05	Welding technique	
	All complete penetration groove welds made by manual welding, except when produced with the aid of backing material not more than 8 mm thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section. Groove welds made with the use of the backing of the same material, as the base metal shall have the weld metal thoroughly fused with the backing material. Backing strips need not be removed. If required, they may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and weld metal and the weld metal surface is left flush or slightly convex with full throat thickness. Groove welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates need not be removed upon completion of the weld unless otherwise specified elsewhere in the contract. To get the best and consistent quality of welding, automatic submerged arc process shall be preferred. The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall all conform to the relevant Indian Standards.	
3.03.12	Temperature	
	No welding shall normally be done on parent material at a temperature below (-) 5°C. However, if welding is to undertaken at low temperature, adequate	

 BHEL Bharat Heavy Electricals Limited	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 24 OF 41
	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. 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.	

 BHEL Bharat Heavy Electricals Limited	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION -D17
		REV.NO. 0	DATE 13/02/2018
		SHEET 26	OF 41
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.	

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO. 0		DATE 13/02/2018	
		SHEET 27		OF 41	
3.15.00 Shop painting					
3.15.01 General					
Unless otherwise specified, steelwork, which will be concealed by interior building finish, need not be painted; steelwork to be encased in concrete shall not be painted. Unless specifically exempted, all other steelwork shall be given one coat of shop paint, applied thoroughly and evenly to dry surfaces which have been cleaned, in accordance with the following paragraph, by brush, spray, roller coating, flow-coating or dipping as may be approved by the Engineer. After inspection and approval and before leaving the shop, all steelwork specified to be painted shall be cleaned by hand-wire brushing or by other methods of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by the solvent. Steelwork specified to have no shop paint shall, after fabrication, be cleaned of oil or grease by solvent cleaners and be cleaned of dirt and other foreign material by trough sweeping with a fibre brush.					
3.15.02 Inaccessible parts					
Surfaces not in contact, but inaccessible after assembly, shall receive two coats of shop paint, positively of different colours to prove application of two coats before assembly. This does not apply to the interior of sealed hollow sections.					
3.15.03 Contact surfaces					
Contact surface shall be cleaned in accordance with sub-clause 3.13.1 before assembly.					
3.15.04 Finished surfaces					
Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.					
3.15.05 Surfaces adjacent to field welds					
Unless otherwise provided for, surfaces within 50 of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.					

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D	SUBSECTION -D17		
		REV.NO. 0	DATE 13/02/2018		
		SHEET 28	OF 41		
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			

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001 VOLUME - SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 13/02/2018 SHEET 29 OF 41
	not to injure the skin on galvanized surfaces during transport, handling, and 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.	

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO.	0	DATE	13/02/2018
		SHEET	30	OF	41
4.02.02	Welding a) The weld surface shall be cleaned with steel wire brush to remove spatter metal, slag etc. and 100% of welds shall be inspected visually for size, length of weldment and external defects. Weld gauges shall be used for checking weld sizes. The surface shall be clean with regular beads and free from slags, cracks, blow-holes etc. b) Non-destructive examination shall be carried out to determine soundness of weldments as follows: i) 10% at random on fillet-joints. ii) 100% on all butt-joints. c) Should the ND tests indicate defects like improper root penetration, extensive blowholes, slag intrusion etc., such welds shall be back gauged, joints prepared again and rewelded. All defects shall be rectified by the Contractor at no extra costs. d) All electrodes shall be procured from approved reputed manufacturers with test certificates. The correct grade and size of electrode, which has not deteriorated in storage, shall be used. The inspection and testing of welding shall be performed in accordance with the provisions of the relevant Indian Standards or other equivalents. For every 50 tones of welded fabrication, the Engineer may ask for 1(one) test-destructive or non-destructive including X -ray, ultrasonic test or similar, the cost of which shall be borne by the Contractor.				
4.02.04	Rivets, bolts, nuts and washers All rivets, bolts, nuts, and washers shall be procured from M/s. Guest Keen William Ltd. or equivalent and shall confirm to the relevant Indian Standards. If desired by the Engineer, representative samples of these materials may have to be tested in an approved laboratory and in accordance with the procedures described in relevant Indian Standards. Cost of all such testing shall have to be borne by the Contractor. In addition to testing the rivets by hammer, 2% (two per cent) of the rivets done shall have to be cut off by chisels to ascertain the fit, quality of material and workmanship. The removal of the cut rivets and re-installing new rivets shall be done by the Contractor at his own cost.				
4.02.05	Shop painting All paints and primers shall be of standard quality and procured from approved manufacturers and shall conform to the provisions of the relevant Indian Standards.				

 Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO. 0		DATE 13/02/2018	
		SHEET 31		OF 41	
4.02.12	Galvanizing All galvanizing shall be uniform and of standard quality when tested in accordance with IS: 2633 - Method for testing uniformity of coating on Zinc Coated Articles and 15: 4759 - specification for Hot-Dip Zinc Coatings on Structural Steel & other allied products.				
4.03.00	Tolerance The tolerances on the dimensions of individual rolled steel components shall be as specified in IS: 1852 - specification for rolling and Cutting Tolerances for Hot-rolled Steel Products. The tolerances on straightness, length etc. of various fabricated components (such as beams and girders, columns, crane gantry girder etc.) of the steel structures shall be as specified in IS: 721 - Tolerances for Fabrication of Steel Structures.				
4.04.00	Acceptance Should any structure or part of a structure be found not to comply with any of the provisions of this specification, the same shall be liable to rejection. No Structure or part of the structure once rejected, shall be offered again for test, except in cases where the Engineer considers the defects rectifiable. The Engineer may, at his discretion, check some of the tests at an appropriate laboratory at the contractors cost. When all tests to be performed in the Contractor’s shop under the terms of this contract have been successfully carried out, the steelwork will be accepted forthwith and the Engineer will issue acceptance certificate, upon receipt of which, the items will be shop painted, packed and dispatched. No item to be delivered unless an acceptance certificate for the same has been issued. The satisfactory completion of these tests or the issue of the certificates shall not bind the Owner to accept the work, should it, on further tests before or after erection, be found not in compliance with the Contract.				
4.05.00	Delivery of materials				
4.05.01	General The Contractor will deliver the fabricated structural steel materials to site with all necessary field connection materials in such sequence as will permit the most efficient and economical performance of the erection work. The Owner may prescribe or control the sequence of delivery of materials, at his own discretion.				

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D	SUBSECTION -D17		
		REV.NO. 0	DATE 13/02/2018		
		SHEET 32	OF	41	
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					

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001
		VOLUME -
		SECTION - D SUBSECTION -D17
		REV.NO. 0 DATE 13/02/2018
		SHEET 33 OF 41
	e) A schedule of parts or pieces, giving the parts or piece number with 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 advice 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.	



TITLE:

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

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION -D17

REV.NO. 0 DATE 13/02/2018

SHEET 34 OF 41

v) ~~Fabrication and shipping of steelwork for bunkers, tanks and/or silos~~
as applicable.

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.

 BHEL Bharat Heavy Electricals Limited	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D	SUBSECTION -D17		
		REV.NO. 0	DATE 13/02/2018		
		SHEET	35	OF	41
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.				
6.01.02	The bidder's rates shall include cost of all minor details which are obviously and fairly intended and which may not have been included in the description in these documents but are essential for the satisfactory completion of the work. Rates shall also include for taking all safety measures.				
6.01.03	The bidder's -rates for all items of schedule of items shall include complete cost towards plant, equipment, erection and dismantling of scaffolding, men, materials and consumables, skilled and unskilled labour, levies, taxes, royalties, duties, transport, storage, repair/rectification/maintenance until handing over, contingencies, overhead and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work.				
6.01.04	No claims shall be entertained, if the details shown on the 'Released for Construction' drawings differ from those shown on the bid/tender drawings.				
6.01.05	Rates shall be inclusive of all leads and lifts/elevation.				
6.01.06	The bidder's rates for Structural Steel shall include for fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, erection scheme, alignment, welding, including preheating and 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 transit, stability of 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.				

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION -D17
		REV.NO. 0	DATE 13/02/2018
		SHEET 36	OF 41
	The rates for fabrication are inclusive of all tests on welds and material and no extra shall be payable for quality tests specified for fabrication of structure in shop or at site. Separate BOQ items for test on welds like radiography or Ultrasonic, DPT, magnetic particle tests are kept for tests on material/fabrication not covered under regular fabrication item of BOQ. 6.01.07 The bidder's rates for foundation bolts assembly shall include fabrication, threading, heat treatment, erection, installation, and alignment of complete bolt assembly with nuts, locknuts, anchor plates, stiffener plates, protective tape, etc. This shall also include the cost of all materials not issued by the Owner. Material issued by Owner will be specified in GCC. 6.01.08 The bidder's rates for application of inorganic primer shall include surface preparation to near white metal surface by blast cleaning, abrasives, touch up painting, suitable enclosure to avoid contamination and the necessary statutory approval from the factory inspector/pollution control board etc. regarding the method of blast cleaning and abrasives used, and getting approval of the specialized agency supplying the primer specified. 6.01.09 The bidder's rates for application of finish painting system shall include surface preparation, application of intermediate (under) coat, finish coat and final finish coat, and getting approval of the specialized agency supplying the 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.		

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION -D17
		REV.NO. 0	DATE 13/02/2018
		SHEET 37	OF 41
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. The bidder should prepare an optimised cutting plan as per fabrication drawing to utilise the steel material upto maximum extent and minimise the wastage/scrap. Quantity of wastage/scrap of material should be limited to the percentage mentioned elsewhere in the conditions of tender/contract specifications.		
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.		
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.		

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001
		VOLUME -
		SECTION - D SUBSECTION -D17
		REV.NO. 0 DATE 13/02/2018
		SHEET 38 OF 41
6.01.18 6.01.19 6.02.00 6.02.01 6.02.02 6.02.03 6.02.04 6.02.05 6.02.06	The bidder's 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. The bidder's rates for Stainless Steel Hand Rail (if specified) shall include complete Hand Rail including, materials, fabrication, grinding & finishing, stainless steel beading, stainless steel cleats, stainless steel fasteners, neoprene gaskets, preparation of shop drawing but excluding the cost of glazing. The Owner shall supply no material for this item of work. MODE OF MEASUREMENT 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. 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. 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. 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 circumscribed rectangle. However, deduction for any notch/skew cut shall be made as mentioned in clause no-6.02.06. 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). For all other plates, where the area of any notch/skew cut in the plate is less than 0.05 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 0.05 sq.m, the area of notch/skew cut shall be deducted	

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001
		VOLUME -
		SECTION - D SUBSECTION -D17
		REV.NO. 0 DATE 13/02/2018
		SHEET 39 OF 41
	from assumed minimum circumscribing rectangular area 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 0.05 sq.m. The weight shall be calculated by deducting the area of holes, if area of individual hole is more than 0.05 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 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.	

	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001			
	TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO.	0	DATE	13/02/2018
		SHEET	40	OF	41

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 load carrying capacity of PTFE 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.
6.02.24	The measurement for the item of stainless steel hopper shall be based on the actual finished weight of hopper weight in Kgs, corrected to second place of decimal. The hopper weight shall be arrived by multiplying of the inner surface area of the hopper with the unit weight of the hopper plate.
6.02.25	The measurement for the item of flexible open-ended bellows straps of neoprene shall be based in running meter, corrected to second place of decimal. Bellow Straps shall be supplied as per the requirement of the approved drawings. The measurement shall be done for the inner circumference of the bunker on which neoprene has been fixed and for the length supplied by the Contractor 'and as accepted by the Engineer.

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-635-600-C001			
		VOLUME -			
		SECTION - D		SUBSECTION -D17	
		REV.NO. 0		DATE 13/02/2018	
		SHEET 41		OF 41	

6.02.26

The measurement for the item of Stainless Steel Hand Railing shall be based on finished weight of handrail in Kgs corrected to second place of decimal. The weight shall also include the weight of Stainless Steel fasteners, Stainless Steel beading, Stainless Steel cleats etc. The weight shall be the finished weight of Hand Rail, as accepted by the Engineer.



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D

SUBSECTION – D18

REV.NO. 0

DATE 13/02/2018

SHEET 1

OF 17

**SECTION - D
(PART I)**

SUB-SECTION – D 18

ERECTION OF STRUCTURAL STEELWORK



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 2 OF 17

C O N T E N T

CLAUSE NO.	DESCRIPTION	SHEET NO.
1.00.00	SCOPE	3
2.00.00	GENERAL	3
3.00.00	WORKMANSHIP	6
4.00.00	TESTING AND ACCEPTANCE CRITERIA	12
5.00.00	INFORMATION TO BE SUBMITTED	16

	TITLE:		SPECIFICATION NO. PE-TS-635-600-C001	
	TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK		VOLUME -	
			SECTION - D	SUBSECTION – D18
			REV.NO. 0	DATE 13/02/2018
			SHEET 3	OF 17

SUB-SECTION – D 18

ERECTION OF STRUCTURAL STEELWORK

1.00.00 SCOPE

This specification covers the erection of structural steelwork including receiving and taking delivery of fabricated structural steel materials arriving at site, installing the same in position, painting and grouting the stanchion bases all complete as per Drawings, this Specification and other provision of the Contract.

2.00.00 GENERAL

2.01.00 Work to be provided for by the Contractor, unless otherwise specified in the Contract, shall include but not be limited to the following:

- a) The Contractor shall provide all construction and transport equipment, tools, tackle, consumables, materials, labour, and supervision required for erection of the structural steelwork.
- b) Receiving, unloading, checking, and moving to storage yard at Site including prompt attendance to all insurance matters as necessary for all fabricated steel materials arriving at Site. The Contractor shall pay all demurrage and/or wharfage charges etc. on account of default on his part.
- c) Transportation of all fabricated structural steel materials from Site storage yard, handling, rigging, assembling, riveting, bolting, welding and satisfactory installation of all fabricated structural steel materials in proper location according to approved erection drawings and/or as directed by the Engineer. If necessary suitable temporary approach roads to be built for transportation of fabricated steel structures.
- d) Checking centre 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, levelling, 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.

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-635-600-C001	
		VOLUME -	
		SECTION - D	SUBSECTION – D18
		REV.NO. 0	DATE 13/02/2018
		SHEET 4	OF 17
	g) All minor modifications of the fabricated steel structures as directed by the Engineer including but not limited to the following: i) Removal of bends, kinks, twists etc. for parts damaged during transport and handling. ii) Cutting, chipping, filling, grinding, etc. if required for preparation and finishing of site connections. iii) Reaming of holes for use of higher size rivet or bolt if required. iv) Refabrication of parts damaged beyond repair during transport and handling or refabrication of parts, which are incorrectly fabricated. v) Fabrication of parts omitted during fabrication by error, or subsequently found necessary. vi) Drilling of holes which are either not drilled at all or are drilled in incorrect location during fabrication. vii) Carry out tests in accordance with this specification. 2.02.00 Work by Others No work under this Specification will be provided for by any agency other than the Contractor unless specifically mentioned elsewhere in the contract. 2.03.00 Codes and Standards All work under this Specification shall, unless specified otherwise, conform to the latest revisions and/or replacements of the following or any other Indian Standard Specification and codes of Practice of equivalent: IS: 800 - Code of practice for general construction in steel. IS: 456 - Code of practice for main or reinforced concrete. 2.04.00 Conformity with Designs The Contractor will erect the entire fabricated steel structure, align all the members, complete all field connections and grout the foundations all as per the provisions of this specification and the sequence and the design criteria laid down by the Engineer. All work shall conform to the provisions of this specification and /or instructions of the engineer. The testing and acceptance of the erected structures shall be in accordance with the provisions of this Specifications and/or the instructions of the Engineer.		

 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001			
	TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	VOLUME -			
		SECTION - D		SUBSECTION – D18	
		REV.NO.	0	DATE	13/02/2018
		SHEET	5	OF	17
2.05.00	Material				
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.			

	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001		
	TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	VOLUME -		
		SECTION - D	SUBSECTION - D18	
		REV.NO. 0	DATE	13/02/2018
		SHEET 6	OF	17

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.

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.

 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001	
	TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	VOLUME -	
		SECTION - D	SUBSECTION – D18
		REV.NO. 0	DATE 13/02/2018
		SHEET 7	OF 17

3.01.02

Method and sequence of erection

The method and sequence of erection shall have the prior approval of the Engineer. The Contractor shall arrange for most economical method and sequence available to him consistent with the drawings and specifications and other relevant stipulations of the contract.

3.01.03

Temporary Bracing

Unless adequate bracing is included as a part of the permanent framing, the erector during erection shall install, free of cost to the Owner, temporary guys and bracings where needed to secure the framing against loads such as wind or seismic forces comparable in intensity to that for which the structure has been designed, acting upon exposed framing as well as loads due to erection equipment and erection operations.

If additional temporary guys are required to resist wind or seismic forces acting upon components of the finished structure installed by others during the course of the erection of the steel framing, arrangement for their installation by the erector shall be made free of cost to the Owner.

The requirement of temporary 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.



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 8 OF 17

Each tier of column shall be plumbed and maintained in a true vertical position subject to the limits of tolerance under this Specification.

No permanent field connections by riveting, bolting or shall be carried out until proper alignment and plumbing has been attained.

3.01.06 Field Riveting

All rivets shall be heated and driven with pneumatic tools. Hand passing or "throwing" of rivets are desirable. Any other method of conveying hot rivets from the furnace to the driving point must be approved by the engineer. No-cold rivets shall be driven. All other requirements of riveting including quality and acceptance criteria shall be in accordance with the relevant portions of the Specification for Fabrication of Structural Steelwork of the Project.

3.01.07 Field Bolting

All relevant Portions in respect of bolted construction of the Specification for Fabrication of Structural Steelwork applicable to the Project shall also be applicable for field bolting in addition to the following:

Bolts shall be inserted in such a way so that they may remain in position under gravity even before fixing the nut. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible materials. When assembled, all joint surfaces, including those adjacent to the washers shall be free of scales except tight mill scales. They shall be free of dirt, loose scales, burns, and other, defects that would prevent solid seating of the parts. Contact surfaces within friction type joints shall be free of oil, paint, lacquer, or galvanizing.

All high tensile bolts shall be tightened to provide, when all fasteners in the joint are tight, the required minimum bolt tension by any of the following methods.

a) Turn-of-nut Method

When the turn-of-nut method is used to provide the bolt tension, there shall first be enough bolts brought to a "snug tight" condition to ensure that the parts of the Joint are brought into good contact with each other. 'Snug tight' is defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in any remaining holes in the connection and brought to snug tightness. All bolts in the joint shall then be tightened additionally by the applicable amount of nut rotation specified in Table-I with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 9 OF 17

there shall be no rotation of the part not turned by the wrench.

TABLE-I

Bolts length not exceeding 8 times Dia or 200 mm	Bolt length exceeding 8 times Dia or 200 mm	Remarks
1/2 turn	2/3 turn	Nut rotation is relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation-30° over or under.

Bolts may be installed without hardened washers when tightening is done by the turn -of-nut -method. However, normal washers shall be used.

Bolts tightened by the turn-of-nut method may have the outer face of the match-marked with the protruding bolt point before final tightening, thus affording the inspector visual means of noting the actual nut rotation. Such marks can be made by the wrench operator by suitable means after the bolts have been brought up snug tight.

b) Torque Wrench Tightening

When torque wrenches are used to provide the bolt tensions, the bolts shall be tightened to the torques specified in TABLE-II (See Note below the Table). Nuts shall be in tightening motion when torque is measured. When using torque wrenches to install several bolts in a single joint, the wrench shall be returned to touch up bolts previously tightened, which may have been loosened by the tightening of subsequent bolts, until all are tightened to the required tension.

TABLE-II

Nominal Bolt Diameter (mm) (Kg.M) of IS:1367	Torque to be applied for bolt class 8.8
20	59.94
22	81.63
24	103.73



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 10 OF 17

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.

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



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 11 OF 17

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.

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



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 12 OF 17

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.

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



TITLE:

**TECHNICAL SPECIFICATION FOR
ERECTION OF STRUCTURAL
STEELWORK**

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 13 OF 17

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.

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.



TITLE:

TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK

SPECIFICATION NO. PE-TS-635-600-C001

VOLUME -

SECTION - D SUBSECTION - D18

REV.NO. 0 DATE 13/02/2018

SHEET 14 OF 17

When a structure of the same type is selected for a check test, it shall be subjected, in addition to its actual dead load, to a superimposed test load, equal to 1.5 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.

4.01.04

Repair for subsequent test and use after strength tests

An actual structure which has passed the "Strength Test" as specified in Sub-clause 4.1.2 hereinbefore and is subsequently to be erected for use, shall be considered satisfactory for use after it has been strengthened by replacing any distorted members and has subsequently satisfied the 'Stiffness Test' as specified in Sub-clause 4.01.01 hereinbefore.

4.02.00

Tolerances

Some variation is to be expected in the finished dimensions of structural steel frames. Unless otherwise specified, such variations are deemed to be within the limits of good practice when they are not in excess of the cumulative effect of detailed erection clearances, fabricating tolerances for the finished parts and the rolling tolerances for the profile dimensions permitted under the Specifications for fabrication of structural steel work applicable to this Project and as specified below: The specified tolerance is mainly for welded erection. In case of bolted erection, no tolerance is desired so that all prefabricated bolt holes are matched on erection.

I. For Buildings Containing Cranes

Component	Description	Variation Allowed
1.	2.	3.
Main columns	a) shifting of column axis at foundation level with respect to building line	
	i) In longitudinal direction	i) ± 3.0 mm
	ii) In lateral direction	ii) ± 3.0 mm
	b) Deviation of both major column axis from vertical between foundation and	

 Maharatna Company	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001			
	TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	VOLUME -			
		SECTION - D		SUBSECTION – D18	
		REV.NO.	0	DATE	13/02/2018
		SHEET	15	OF	17
other member connection levels:					
	i) For a column upto and including 10M height	i) ± 3.5 mm from true vertical			
	ii) For a column greater than 10M but less than 40M height	ii) ± 3.5 mm from true vertical for any 10 M length measured between connection levels, but not more than ± 7 mm per 30m length.			
	c) For adjacent pairs of columns across the width of the building prior to placing of truss	± 9.0 mm on true span.			
	d) For any individual column deviation of any bearing or resting level from levels shown on drawings.	± 3.0 mm			
	e) For adjacent pairs of columns either across the width of building or longitudinally level difference allowed between bearing or seating	3.0 mm			
Trusses	a) Deviation at centre of span of upper chord member from vertical plane running through least.	1/1500 of the span or greater than 10mm whichever is the			
	centre of bottom chord.				
Trusses	b) Lateral displacement of top chord at center of span from vertical plane running through center of supports.	1/250 of depth of truss or 20 mm which ever is the - least.			
Crane Cirders	a) Difference in levels of crane rail measured between adjacent columns.	2.0 mm.			
	b) Deviation to crane rail-gauge	± 3.0 mm			

 BHEL Maharatna Company	TITLE: TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	SPECIFICATION NO. PE-TS-635-600-C001
		VOLUME -
		SECTION - D SUBSECTION – D18
		REV.NO. 0 DATE 13/02/2018
		SHEET 16 OF 17
	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 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.	1.0 mm. ± 3.5 mm
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.	

	TITLE:	SPECIFICATION NO. PE-TS-635-600-C001	
	TECHNICAL SPECIFICATION FOR ERECTION OF STRUCTURAL STEELWORK	VOLUME -	
		SECTION - D	SUBSECTION - D18
		REV.NO. 0	DATE 13/02/2018
		SHEET 17	OF 17

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

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.



SECTION 5.6

STEEL STRUCTURES

TABLE OF CONTENTS

CLAUSE NO.	DESCRIPTION	PAGE NO.
5.6.1	GENERAL	2
5.6.2	MATERIALS	2
5.6.3	FRAMING	3
5.6.4	DESIGN METHODOLOGY	4
5.6.5	PERMISSIBLE DEFLECTIONS	5
5.6.5.1	Vertical Deflection	5
5.6.5.2	Horizontal deflections	6
5.6.6	MINIMUM THICKNESS AND SIZES OF STEEL ELEMENTS	6
5.6.6.1	Minimum Thickness	6
5.6.6.2	Minimum sizes	7
5.6.7	SLENDERNESS AND DEPTH RATIO	7
5.6.8	JOINTS / CONNECTIONS IN STEEL STRUCTURES	7
5.6.9	FABRICATION AND ERECTION	10
5.6.10	INSPECTION OF WELDING	11
5.6.11	REQUIREMENTS FOR SPECIFIC STRUCTURES	14
5.6.12	PAINTING	16
5.6.13	DELIVERY, STORAGE, HANDLING AND CONSTRUCTION	16



5.6 STEEL STRUCTURES

5.6.1 GENERAL

Design of structural steel work shall include generally but not be limited to the steel constructions listed below :

- a. Steel building structure and open structures.

This shall include beams, columns, bracings, supporting structure for floors, roof slabs, cladding etc.

- b. Crane gantry girders, monorails, etc.
- c. Coal bunkers
- d. Large diameter oil tanks
- e. Platforms and walkways
- f. Ladders, staircases, handrails etc
- g. Pipe racks and cable racks.
- h. Coal conveyor galleries and trestles
- i. Steel flues for R.C.C. Chimneys
- j. Galvanised latticed structures for switchyard

Wherever possible, without compromising system requirements, prefabricated structural steel construction shall be adopted.

Wherever possible, without compromising system requirements, RCC floors and roofs in structural steel buildings may be constructed over metal decking sheet.

5.6.2 MATERIALS

Structural steel shall conform to Grade A of IS: 2062 for rolled steel members or plates up to 20 mm thickness. For plates above 20 mm thickness or welded construction, steel conforming to Grade B (Killed) of IS: 2062 shall be used except for crane girders where Grade C (IS: 2062) steel shall be used.

All sections for structural steel shall be rolled sections only. Pipe / tubular sections also may be used, if meeting functional and design requirements.

Pipes for handrail shall be medium grade as per IS: 1161.

Crane rails shall conform to IS: 3443.

Foundation bolt material shall be of mild steel (property class 4.6) and shall conform to IS: 1367 – Part 3 (2002) and IS: 5624 (1993), material grade shall conform to IS: 2062 grade A unless noted otherwise in the drawing.

Steel shall be procured from SAIL or any other approved main producers.

Plates above 25 mm thickness shall be subject to ultrasonic test as per ASTM A435 or equivalent



to check the presence of lamination.

Washers shall conform to IS:2016, IS:5369, IS:5372, IS: 5374, IS: 6610 and IS: 6649 as applicable. Spring washers shall be provided for those parts, which carry dynamic loads and where black bolts for connection are permitted. Welding Consumables Mild steel electrodes shall conform to IS: 814. The electrodes used for welding shall be of suitable type and size depending upon specification of parent material, method of welding, position of welding and quality of welds desired. The Contractor shall furnish a certificate issued by the manufacturer to the effect that the electrodes supplied are in accordance with the above specifications.

Grating

All gratings shall be pressure locked type (preferably Electro-forged) manufactured in accordance with applicable Indian Standard. All removable grating shall be bolted or clipped to supports. Sizes of grating shall be such as to allow easy handling. Grating units at all penetrations shall be made up in split section All gratings shall be arranged such that bars in either direction are in line. All gratings and accessories shall be hot dip galvanised.

It may be of rectangular pattern of parallel bearing bars of 40 mm depth and 5 mm thickness and cross bars of 25 mm depth and 3 mm thickness. Bearing bars shall be at 30 / 40 mm c/c with cross bars at 100 mm c/c.

In Boiler area, all gratings fabricated from MS flats shall meet minimum requirements as bearing bars of 32x5 thick spaced at 30 mm c/c and cross bar of twisted square bar (6 mm diagonal) at 100 mm c/c

Chequered Plates

Removable chequered plates shall be provided with two lifting holes and the size of plates shall be such as to allow easy handling. All edges of plates shall be smooth and straight with 3 mm clearance between plates. All chequered plates shall rest flat on their supports without rocking. All chequered plates shall be hot dip galvanised. Chequered plates shall conform to IS: 3502.

Galvanising

Hot dip galvanised coatings on iron and steel articles shall be carried out in accordance with IS:4759 and other relevant IS standards. Galvanising shall be checked and tested in accordance with IS:2629. The coating shall be smooth, continuous and free from flux stains.

Small areas of galvanised coating damaged by welding, cutting, or during transport shall be repaired by applying at least two coats of zinc-rich paint. All structural steel works, which are not galvanised, shall be painted.

The minimum average coating weight of galvanizing shall be 610 gm / sq.m.

5.6.3 FRAMING

All steel framed structures shall be either "rigid frame" or "simple space frames" or a combination of two. Column base shall be considered fixed or hinged.

Lateral forces shall be resisted by stiff jointed moment connections in rigid frame design. The column bases shall generally be fixed to concrete foundation pedestal by providing moment resistant base detail.

Simple space frame design utilises single-span beam systems, vertical diagonal bracing at main column lines and horizontal bracing at the roof and major floor levels. The most of plant steel buildings shall be designed as simple space frame structures.



The Steam Turbine Building design shall be a combination of rigid frame in transverse direction and braced frame in longitudinal direction.

Pipe rack shall consist of rigid main frame in transverse direction spaced longitudinally as required. In longitudinal direction, pipe rack shall be divided into sections of suitable length with an anchor bay. The main transverse frames shall be connected with longitudinal beams which shall transmit horizontal forces to braced anchor bays. The pipe and cable rack bridge structure shall be adequately rigid to carry the forces from pipelines at anchor points without undue deflection so that pipelines are really anchored at the anchor points.

Concrete floors (with shear connectors from top flange of steel beams) shall be considered to provide continuous lateral support to the top (compression) flange of the support beams. However, wherever large cut outs are provided in the floor slabs horizontal floor bracing shall be provided. Grating/chequered plate floor shall neither be considered to provide lateral support to the top flange of supporting beams nor to provide a shear diaphragm. Adequate lateral support and horizontal bracing shall be provided as required.

Floors for vibrating machines of all kind together with supporting framework shall be adequately braced in both horizontal and vertical planes. Floors or structure supporting mechanical equipment shall be designed to minimise vibration, avoid resonance and maintain alignment and level.

Columns may be designed to support the load combination that produces the maximum interaction ratio. Exterior columns shall be designed to resist wind moments between braced elevation as appropriate. Columns shall also be designed to resist moments caused by discontinuous vertical bracing or non-concentric bracing work points.

5.6.4 DESIGN METHODOLOGY

The design of steel structures shall be done in accordance with the provisions of IS: 800 and other relevant IS codes as applicable to specific structures.

Main columns, bracings, ties and main grid beams of Power House Building, Control Room Building and Bunker building may be sized with a maximum interaction ratio of 0.90 during initial design stages to take care of changes in equipment layout / loads and unforeseen future loads.

All buildings/structures shall be framed structure. Basic consideration for structural framing shall be stability, rigidity, building uses, ease of fabrication / erection and overall economy. Additional bracings/moment connections shall be used to assure stability of structures. Structure shall be designed such that the surfaces of all parts shall be accessible for inspection, cleaning, painting and maintenance.

Crane gantry girders shall be single web plate girder or welded construction with bearing and intermediate stiffeners. Crane girder shall be designed as simply supported and of single span length. Chequered plate shall be used for gantry girder walkway flooring. For lifting / monorail beams ISMB sections shall be preferred and the bottom flange of all beams shall be checked separately for distortion and reinforced suitably if required.

Permissible stresses for different members shall be allowed to exceed up to 33.33% only under normal loads along with wind and seismic conditions. The members which are designed primarily to resist wind load such as bracing members, no increase in permissible stress shall be permitted. However, permissible stresses in bolts and welds shall be allowed to exceed up to 25% only under wind and seismic conditions.

For design which requires the use of the minimum column load (such as, uplift on anchor bolts, column axial tension, etc.) the following criteria shall be used in determining minimum load.

- Use 90% of the column dead load.



- No live load is used.
- Uplift forces from vertical bracing are included where applicable.
- Wind uplift on the roof is included where applicable.

Base plates shall be placed on foundation pedestal with grouting. For large base plates necessary grout holes shall be provided. All anchor bolts for fastening steel columns on foundation shall be embedded in foundation during concreting itself. No anchor pockets in foundation shall be allowed. Design of base plates shall be based on design pressure on foundation, which shall not exceed the allowable stresses as per Clause 34.4, IS 456.

The total horizontal shear force at the base of column is transferred to the column pedestals through friction between the base plate and the grout. A coefficient of friction of 0.30 shall be used in conjunction with the minimum column load as defined above. If the horizontal shear force exceeds the frictional resistance force or if the column is subjected to a net uplift load, the total force shall then be transmitted through shear bars / shear keys welded to the base plate. Anchor bolts are not assumed to resist any horizontal shear force. Necessary recesses shall be kept in the foundation concrete for shear lugs.

All column base plate at braced bay shall be provided with shear key to transfer lateral load to the pedestals.

The following criteria shall be followed for indicating loads on the design drawings.

For vertical beam reactions, the load shall be indicated whenever the value exceeds the maximum allowable uniformly distributed load.

For axial loads in floor beams, the actual horizontal load which the beam end connection must resist shall be indicated for each end of the beam. Note that this value may be different for opposite end of the same beam. For truss members, only one member force shall be noted for each member.

Angle sections shall not be used as flexural members except for roof trusses, purlins, side girt and walkway runners only.

Lateral forces along the length of the building will be resisted by bracings in horizontal and vertical frames. The transverse lateral load will be resisted by stiff jointed frame action. Additional bracing or moment connection will be used to assure stability of the structures.

All structural steel members subjected to tension shall be connected to pedestals with holding down bolts. Anchor plates of bolts shall be fillet welded to bolts with 8mm (minimum) weld. Anchorage shall be determined based on bond stress developed between embedded bolt and concrete.

5.6.5 PERMISSIBLE DEFLECTIONS

The permissible deflection of various steel members under normal loading conditions shall be as specified below. For calculation of deflections in structures and individual members dynamic effects shall not be considered, unless specified otherwise. Also, no increase in deflection limits shall be allowed when wind or seismic loads are acting concurrent with normal loading conditions.

5.6.5.1 Vertical Deflection

- a. For beams supporting dynamic equipment - Span / 500
- b. For beams supporting floors / masonry - Span / 325
- c. For beams supporting pipes (pipe rack) - Span / 400



- d. For roofing and cladding components - Span / 250
- e. For gratings and chequered plates - Span / 200 subject to a maximum of 6 mm
- f. Coal conveyor gallery bridges - Span / 450

For crane gantries or any member subjected to working loads, the maximum deflection under dead load and live load excluding impact shall not exceed the following values

- a. For manually operated cranes & monorails - Span / 500
- b. For electric overhead cranes
 - i. Up to 50 t capacity - Span / 750
 - ii. Over 50 t capacity - Span / 1000

5.6.5.2 Horizontal deflections

The permissible horizontal deflections shall be as per following unless specified otherwise :

- a. Single storey building (without crane load) - Height / 325
- b. Multistoried building (without crane load) - Height / 500
- c. Pipe rack columns - Height / 200
- d. Open structures - Height / 200
- e. Crane gantry girder due to surge - Span / 2000 limited to Maximum of 15mm
- f. Building main columns at crane rail level due to action of crane surge load only - Height / 2500 limited to Maximum of 10 mm
- g. Open gantry columns at crane rail level due to action of crane surge load only - Height / 4000 limited to Maximum of 10 mm
- h. Coal handling trestles - Height / 1000

5.6.5.3 Provisions of IS: 800 and relevant IS codes shall be followed for limiting deflections of structural elements not listed above.

5.6.6 MINIMUM THICKNESS AND SIZES OF STEEL ELEMENTS

5.6.6.1 Minimum Thickness

The minimum thickness of various components of a structure and hot rolled sections shall be as follows. The minimum thickness of rolled shapes shall mean flange thickness regardless of web thickness. Structural steel members exposed to marked corrosive environment shall be increased suitably in thickness or suitably protected otherwise as per good practice and sound engineering judgment in each instance.

- a. Trusses, purlins, girts and bracing : 6 mm
- b. Columns and beams : 8 mm



- c. Gussets : 8 mm
- d. Stiffeners : 8 mm
- e. Base plates : 10 mm & above
- f. Chequered plates : 6 mm o/p & above
- g. Grating flats : 5 mm

Minimum thickness of structural members, other than gratings and chequered plate, directly exposed to weather and inaccessible for painting and maintenance shall be 8 mm.

For axially loaded members in framework, minimum angle section to be used shall be ISA 50x50x6.

5.6.6.2 Minimum Sizes

The flange width of purlins supporting light weight concrete slab shall not be less than 65 mm, and for those supporting roof sheeting and wall cladding it shall not be less than 50 mm.

Width of steel rolled section connected to other member shall be at least 50 mm.

The depth of beams for platform of all structures shall not be less than 125 mm.

5.6.7 SLENDERNESS AND DEPTH RATIO

The slenderness ratio of main members in tension, compression or bending shall be in accordance with IS: 800.

The following limiting ratios of depth to span shall be considered as general guide.

- a. Truss - 1/10
- b. Rolled beams and girders for ordinary floors and rafters - 1/24
- c. Supporting floor beams for vibrating machinery / equipments - 1/15
- d. Roof purlins and girts - 1/45
- e. Gable columns - 1/30

5.6.8 JOINTS / CONNECTIONS IN STEEL STRUCTURES

Steel structures shall be detailed and connection and joints provided as per the provisions of IS:800, IS:816, IS:9595, IS:1367, and IS:9178 and as per following requirements.

- a. Connection of vertical bracings with connection members and diagonals of truss members shall be designed for full tensile capacity of the bracings unless actual loads are indicated on the drawings.
- b. Size of fillet weld for flange to web connection for built up section shall be as follows:
 - i) For box section weld size shall be designed for 60% of full shear capacity or actual



- shear whichever is more. Where fillet weld is not possible, full penetration butt weld shall be provided.
- ii) For built up I-section, weld size shall be designed for 80% of full shear capacity or actual shear, (if indicated, in drawings) whichever is more. However, weld size shall not be less than 0.5 times the web thickness. Weld shall be double fillet.
 - iii) All welds shall be continuous unless otherwise specifically approved. The minimum size of the fillet weld shall be 6mm.
- c. Shear connections shall be designed for 75% of section strength for rolled sections and 80% of section strength for built up section or rolled section with cover plates. However, if load is more than above, the connection shall be designed for actual load.
 - d. Moment connections between beam and column shall be designed for 100% of moment capacity of the beam section. This can be achieved either by direct butt welding of the top flange of beam with column flange or by providing top moment plate with suitable notch for additional weld length.
 - e. Welding shall be used for shop fabrication and joints. All butt welds shall be full penetration butt welds. IS: 816 and IS: 9595 shall be followed for welding of structures.
 - f. The connection between top flange and web of crane girder shall be full penetration butt weld. Bottom flange, connection with web can be fillet weld or butt weld as directed by Owner/Engineer.
 - g. Connection of base plate and associated stiffeners with the columns shall be designed considering the total load transferred through welds. However, minimum weld size (double fillet) shall not be less than 0.6 times the thickness of stiffeners
 - h. Splicing: All splicing work shall be of full strength. Field splicing shall be done with web and flange cover plates for full strength. Shop splicing for all sections other than rolled shall be carried out by full penetration butt welds with no cover plates. Splicing for all rolled sections shall be carried out using web and flange cover plate.
 - i. For site connections, high strength friction grip (HSFG) type bolts shall be used, except in few cases for shear connections of lighter members or removable beam connections where bolted joints using permanent mild steel bolts may be adopted e.g. purlins, side girts etc. For high strength friction grip bolt connections IS: 4000 shall be followed. High strength friction grip bolts shall be of property class 6.6 or 8.8 and shall conform to IS: 3757. High strength bolts shall be installed as bearing type joint except where loads are reversible.
 - j. A minimum of two bolts per connection shall be used.
 - k. All bolted connections shall have bolts of minimum 16 mm dia. The connections of stairs and hand railing shall be made with 20 mm diameter threaded fasteners conforming to IS:1363. Erection bolts shall be black bolts of minimum 12 mm dia.
 - l. All bolts and nuts have property class compatible to each other. For bolts carrying dynamic or fluctuating loads and those in direct tension shall be provided with an additional double coil helical spring washer conforming to IS: 6755. The threaded portion of the bolt shall project through the nut at least by one thread.
 - m. Where a steel beam or member is to be connected on RCC structure, it shall be connected using an insert plate and preferably through shear connection.
 - n. For crane girders, welding between web and flange plates shall be carried out by submerged arc welding process. Full penetration of weld between web plate and top flange shall be



ensured. Intermediate stiffeners shall be connected with top flange plate by full penetration butt weld. Welding across tension flange shall not be permitted. Bearing edges of crane girders shall be machined.

- o. The work point of the bracing connection shall be the centre of column and girder to which it connects, where practical. The connections of gusset plates to column and girders shall be made to include provisions for eccentricity in connection. Double angle bracings (back to back or star) can be used. The double angle back-to-back with gusset plates in between shall not be used in dust-laden areas. Where double angles are not adequate, beam sections with web in the plane of bracing are used.
- p. Horizontal bracings shall be angle / tee section connected to the bottom portion of the top flange of framing beams. Field welding of bracing at the underside of beam as required to meet slenderness requirement of bracing member shall be indicated on the drawings. Horizontal bracing shall be arranged to avoid framing into the beams at columns locations.
- q. For Major columns of main building, column splices shall be designed to resist the greater of the design axial tension load and moments in either the major or minor axis, whichever produces the greatest number of bolts. For horizontal bracings to act as torsion bracing the bracing shall not be connected to the bottom flange. Splicing of columns shall be 1.05 times the capacity of the section.
- r. Minimum size of fillet weld shall be 6 mm. Main structural elements shall be welded continuously. Intermittent weld shall be used only on secondary members, which are not exposed to weather or other corrosive influence. Overhead welding shall not be permitted. However if it is un-avoidable welding shall be carried with 4G with approved WPS.
- s. Efficiency of site welds to be considered shall be as follows:
 - i) Fillet weld above 25 m from ground 50%
 - ii) Others 80%

Shop connections shall be all welded and field connections shall generally be bolted unless otherwise if specifically indicated by owner. Field bolts, wherever provided shall be high tensile of 20 mm dia or of higher diameter and of property class 8.8 (minimum) as per IS: 1367 (latest) for all major connections. All bolts, nuts and washers shall be procured from the manufacturers as approved by Owner. The bolted joints shall be designed for friction type connection and the HT bolts shall be tightened to develop the required pretension during their installation. However, the nominal connections in the field like purlins, stairs, wall beams shall be carried out by using MS black bolts not less than 16 mm dia (minimum property class 4.6) conforming to IS:1363 (latest) unless specified otherwise. All removable type connections shall be with bearing type HT bolts of grade 8.8 (minimum).

Welding shall be in accordance with the recommendation of IS:816 (latest) Code of Practice for arc of metal arc welding for general construction in mild steel and IS:9595 (latest) recommendation for metal arc welding of carbon and carbon manganese steels. Built-up members will be fabricated using submerged arc welding procedure. All electrodes, flux, bare wire etc shall be procured by the contractor only from manufacturers approved by owner. All butt-welds in beams, girders & columns will be of full penetration. All butt-welds will be radiographically or ultrasonically tested as per IS-822 and standard practice.

The bare wire electrodes for submerged arc welding shall conform to IS:7280 (latest). The combination of wire and flux for submerged arc welding shall be as follows:

Filler wire shall be of classification AWS-A-5.17-EH14 and flux shall be of agglomerated type of classification AWS-A-5.17F7 A2-EH14.



Low hydrogen electrodes as approved by the Owner shall invariably be used in the following cases:-

- a) For welding of all important joints such as butt-joints in columns (flange or web), butt-joints in main frame beams (flange or web) etc.
- b) For welding steel members having thickness more than 20 mm.

In case of fillet weld between two components, the thickness of the thinner part shall be considered.

Minimum preheat & interpass temperature for welding over 40 mm to 63 mm (thickness of the thicker part at the point of welding) shall be 66°C and for over 63 mm, it shall be 110°C. However, higher preheat & interpass temperature may be required due to joint restraint etc and shall be followed as per approved welding procedure.

5.6.9 FABRICATION AND ERECTION

Contractor shall prepare detailed fabrication drawings and erection scheme based on the design drawings approved by Owner. Fabrication drawings are not to be submitted to Owner for approval as the responsibility for correct detailing rests exclusively on the Contractor. However these drawings shall be furnished to Owner for their reference to effect payment and information.

Fabrication shall in general follow the provisions of IS:800, 816, 9595, 1367, 9178 and good engineering practice where provisions of IS:800 are not clear.

Tolerance in fabricated steel work shall be as per IS:7215.

Erection of fabricated steel components shall be as per erection drawings prepared by Contractor and approved by his Owner

Tolerance for erected steel structures shall be as per IS:12843.

The workshop shall be equipped with sufficient and satisfactory facilities with qualified and competent workmen and welders. The Contractor shall submit to the Owner all detailed drawings of structural steel to be fabricated in the workshop. The fabrication works shall commence only after obtaining approval of the Owner for these drawings. The Owner reserves the right to be present during any or all of the fabrication and assembly of the structural steel.

At the stages of fabrication, structural steel members shall be identified by a suitable marking scheme. Cutting, holing, assembly, welding and bolting shall be carried out in accordance with appropriate IS Standards. Tolerances in fabrication of structures shall be in accordance with IS:7215.

The structural steel shall be pre-assembled in the workshop to such an extent as to ensure proper site erection.

Levelling of base plates shall be carried out by levelling screws or shims subject to the Owner's approval. The structural steel erector shall verify the positions of the anchor bolts of the base plates before the concreting of the foundations. The base plates shall be set at a minimum of 35mm above the concrete foundations in order to allow for the grouting. The deviation for plumbing of columns shall not exceed 1 to 1000 of the total height of the column. The position in plan of the column base shall not deviate more than 10 mm along either of the setting out axes. The positioning in plan of the column base shall be carried out by non-shrink grout subject to the Owner's approval.

Unless otherwise specified the erection of the steel structures shall comply with IS:800 and other relevant IS standards. Deviations / tolerances in erection of structures shall be limited to the stipulations of IS:12843.



Steel packing plates shall be provided where necessary to ensure that the total remaining gap between the connected parts does not exceed 2 mm.

All non-matching holes or holes required for new connections shall be formed by drilling and in no case will burning of holes be permitted.

All bolts shall project through the corresponding nuts and check nuts, but such projection shall not exceed three threads. Where connections have to be made by high strength friction bolts, the mating surfaces must be clean from any oil, grease, and any type of paint or primer. All fixing bolts, screws, nuts, clips, and washers shall have approved anticorrosive finishes. Any temporary bracing or temporary restraint shall be left in position until such time as erection is sufficiently advanced so as to allow for its safe removal.

5.6.10 INSPECTION OF WELDING

Welding

All shop welding as well as site welding shall be carried out by qualified welders. The test certificates for welder's qualification shall not date back more than six months prior to the execution of the welding works. For site welding, all welders shall be obliged to pass qualification tests to determine their ability to perform such type of work. The sample welds shall be carried out on specimens of equal shape, thickness, and chemical analysis as of the material to be welded. The testing of welders shall be carried out in accordance with IS:817.

The Contractor shall submit detailed method statements for both shop and site welding, including the following:

1. Material to be welded
2. Weld edge preparation
3. Welding process
4. Type of electrodes
5. Welding position
6. Welding sequence
7. Number of weld passes
8. Quality control for shop and site welding

The contractor shall not proceed with the welding works until his method statement is approved by the owner.

The contractor shall carry out testing as per IS. The contractor shall get the specimen tested in a laboratory approved by the Engineer and test results shall be submitted to the Engineer in triplicate within 3 days after completion of the test. All electrodes shall be procured with test certificates. The correct grade and size of electrodes not deteriorated in storage shall only be used. The testing of welding shall be performed as under with quantum of minimum non-destructive tests to be conducted during fabrication and after erection as below:

- i) Ultrasonic test should be performed on the columns; girders; Built-up beam fabricated with plates.
- ii) Fillet welds at junction of flange & web of built-up beams, columns, all shear connections of main beams and all butt welds shall be 100% ultra sonic tested
- iii) 100% radiographic test shall be performed for butt weld joints of crane girder & its supporting columns, deaerator supporting beams and columns. The minimum percentage of Radiographic test to be carried out at other locations shall be 25 percent.



- iv) Dye penetration test, Ultrasonic test, Radiographic test shall be carried out at any other location also, if required as per Engineer's approval.

In cases, the test results shows deficiency, the Engineer shall have option to reject or instruct any remedial measures to be carried out by the contractor.

The extent of quality control in respect of welds for structural elements shall be as follows.

5.6.10.1 Visual Examination

All welds shall be 100% visually inspected to check the following:

- (i) Presence of undercuts
- (ii) Surface cracks in both welds and base metals.
- (iii) Unfilled craters
- (iv) Improper weld profile and size
- (v) Excessive reinforcement in weld
- (vi) Surface porosity

Before inspection, the surface of weld metal shall be cleaned of all slag, spatter matter, scales etc. by using wire brush or chisel.

5.6.10.2 Dye Penetration Test (DPT)

This shall be carried out for all important fillet welds and butt welds to check the following.

- a. Surface cracks
- b. Surface porosities

Fillet Weld : 5% of the total length, dye-penetration test shall be carried out to the root run.

Butt Weld : 10% of the total length, dye-penetration test shall be carried out to the root run after back gouging.

Dye Penetration Test shall be carried out in accordance with American National Standard ASTM E165.

5.6.10.3 Ultrasonic testing

Ultrasonic test shall be conducted for all groove welds and heat affected zone in dynamically loaded structures and for other important load bearing butt welds in statically loaded structures as desired by Owner to detect the following:

- (i) Cracks
- (ii) Lack of fusion
- (iii) Slag inclusions
- (iv) Gas porosity

Ultrasonic testing shall be carried out in accordance with American National Standard ANSI / AWS D1-92 Chapter 6 : Part C.

Before Ultrasonic test is carried out, any surface irregularity like undercuts, sharp ridges etc. shall be rectified. Material surface to be used for scanning by probes must allow free movement of probes. For this purpose, surface shall be prepared to make it suitable for carrying out ultrasonic examination.



5.6.10.4 Radiographic Testing (X – ray and Gamma – ray Examination)

This test shall be limited to 2% of length of welds for welds made by manual or semi-automatic welding and 1% of length of weld if made by automatic welding machines. The location and extent of weld to be tested by this method shall be decided by OWNER to detect the following defects:

- i) Gas porosity
- ii) Slag inclusions
- iii) Lack of penetration
- iv) Lack of fusion
- v) Cracks

Radiographic testing shall be conducted in accordance with American National Standard ANSI / AWS D1.1-92.

Any surface irregularity like undercuts, craters, pits etc shall be removed before conducting radiographic test. The length of weld to be tested shall not be more than $0.75 \times$ focal distance. The width of the radiographic film shall be width of the welded joint plus 20 mm on either side of the weld.

Contractor shall provide testing equipment for conducting non-destructive tests for confirming the integrity of welding wherever necessary as directed by the Owner.

Generally, splicing shall not be provided in tension flange of bunker girder. Spot radiography shall be carried out on 100% joints in tension zone and 10% joints in compression zone. Minimum 300 mm length shall be spot radiographed. When radiograph is not possible, ultrasonic test shall be carried out after grinding the surface with prior approval of Owner.

5.6.10.5 Acceptable Limits of defects of weld

Limits of Acceptability of welding defects shall be as follows.

i) Visual inspection & Dye Penetration Test

The limits of acceptability of defects detected during visual inspection and Dye Penetration Test shall be in accordance with clauses 8.15.1 & clauses 9.25.3 of American National Standard ANSI / AWS D1.1-92 respectively, for statically and dynamically loaded structures.

ii) Ultrasonic Testing

The limits of acceptability of defects detected during ultrasonic testing shall be in accordance with clause 8.15.4 & clause 9.25.3 of American National Standard ANSI / AWS D1.1-92 respectively, for statically and dynamically loaded structures.

iii) Radiographic Testing

The limits of acceptability of defects detected during Radiographic testing shall be in accordance with clause 8.15.3 & 9.25.2 of American National Standard ANSI / AWS D1.1-92 respectively for statically and dynamically loaded structures.

5.6.10.6 Rectification of Defects in Welds

In case of detection of defects in welds, the rectification of the same shall be done as follows:

- (i) All craters in the weld and breaks in the weld run shall be thoroughly filled with weld.



- (ii) Undercuts, beyond acceptable limits, shall be repaired with dressing so as to provide smooth transition of weld to parent metal.
- (iii) Welds with cracks and also welds with incomplete penetration, porosity, slag inclusion etc. exceeding permissible limits shall be rectified by removing the length of weld at the location of such defects plus 10 mm from both ends of defective weld and shall be re-welded. Defective weld shall be removed by chipping hammer gouging torch or grinding wheel. Care shall be taken not to damage the adjacent material.

5.6.11 REQUIREMENTS FOR SPECIFIC STRUCTURES

5.6.11.1 Storage tanks

Design, fabrication and erection of the cylindrical welded oil storage tank shall follow the provisions of IS:803. The stresses in the tank shall be computed on the assumption that tank is filled with water. Tension in each course shall be computed at 30 cm above the centreline of lower horizontal joint of the course under consideration.

Wind and internal vacuum loads shall be considered together to check the stability of tank.

Joint efficiency factor shall be taken as 0.85 for butt joints to determine the minimum thickness of shell plates provided all the vertical and horizontal butt welds are spot radiographed. Where welds are not inspected by radiography joint efficiency factor of 0.7 shall be used. However it is recommended that all butt welded joints shall be radiographed.

Minimum thickness of shell plate shall be as given in clause 6.3.3.2 of IS:803 to which corrosion allowance shall be added. Maximum thickness of shell plate shall not exceed 40 mm.

Bottom plate uniformly resting on the substructure shall have a minimum thickness of 8 mm for tanks up to 10 m in diameter and 10 mm for higher diameter. Bottom plate shall project at least 25 mm all-round beyond the outer edge of weld attaching the bottom to the shell plate.

For large diameter oil tanks supported cone roof shall be provided. Arrangement of columns and rafter shall in general be as per fig 9 & 10 of IS:803. Roof plates shall have a minimum thickness of 6 mm and shall not be attached to the supporting member. A kerb angle shall be provided at the top of the shell in line with clause 6.3.6.2 of IS:803. Roof plates shall be attached to the kerb angle with a continuous fillet weld on the top side only. Minimum slope of roof shall be 1 in 16.

Rafter clips for the outer row of rafters shall be welded to the shell. Columns shall not be rigidly attached to the bottom plates guide. Clips shall be welded to the tank bottom to prevent lateral movement.

Roof supporting columns shall be made from structural shapes or pipe or built up section. Suitable base frames or reinforcing pads shall be provided at the column base to distribute loads coming on the tank bottom.

Appurtenances and mountings covered under section 7 of IS:803 shall be provided in addition to any other appurtenance which may be required for the safe and smooth operation of the fuel oil storage and oil handling system.

After erection and inspection of the tank, the tanks shall be tested as per clause 12 of IS:803. Leakage if any noticed shall be repaired to the satisfaction of the OWNER and the tank retested to satisfy acceptance criteria.

Tanks shall be provided with two coats of epoxy coating for internal surfaces over two coats of compatible primer.

The design of tanks for seismic and slosh condition shall be as per API 650.



5.6.11.2 Coal handling system structures

Toe guards shall be provided on sides of conveyor gallery, toe guard shall have a minimum size of 100 x 6 mm.

In case the inclination of the conveyor is more than 10°, walkway shall be given steps.

For the design of conveyor gallery, load due to cables, light fittings and pipes as well as effect of gravity take up loads shall also be considered, in addition to dead load, wind load and imposed load.

Lattice girders supporting the conveyor shall be suitably braced at top and bottom chord levels to transmit the wind load to the end portals connected to trestles. Roof purlins and walkway runners shall also be suitably braced at both ends.

In the case of galleries, temperature expansion joint shall be introduced at intervals less than 180 m to divide the galleries into temperature block. In each block at least one number four legged rigid support guaranteeing stability of structure in the longitudinal direction shall be provided. This shall also take care of all longitudinal forces in the given block. Effect of wind load acting on 2-legged trestle shall also be considered while designing the 4-legged trestle.

Base plates for trestles shall be designed as gusseted bases with shear lugs to transfer horizontal forces. Anchor bolts shall be designed only for uplift forces.

Conveyor galleries and trestles having two conveyors belt shall be designed for both conveyors working together.

Chute loads on floors of houses shall be considered plugged with material for the entire height of the chute.

In case chequered plates are used as floor covering the thickness of plate o/p shall be 8 mm. Suitable plan bracings shall be provided 75 mm from top of steel to transfer all the horizontal forces

Anchor fasteners shall not be used for supporting equipment imparting dynamic forces.

Bracing patterns and locations shall be so planned such that they do not hinder movement of personnel and movement of equipment during maintenance. When floor beam form part of vertical bracing system, additional loads from the floor beams transferred to the bracing shall be taken into account.

Angle section shall not be used as flexural members except for purlins, side girts and walkway runners. Minimum angle size used shall be L50x50x6.

All foundation bolts shall be provided with double nuts.

End connection for rolled beams and channels shall be designed for a minimum of 60% of their shear capacity and built up beams for 80% of their shear capacity in addition to axial load.

Dynamic analysis shall be carried out for beams supporting screens, vibrating feeder, rotating equipments and conveyor supporting beam in conveyor gallery.

To admit proper light into the conveyor gallery perspex sheet shall be provided at the rate of 0.1 square metre per metre length of gallery on the roof and 0.2 square metre per metre length of gallery per side on the sides of conveyor gallery.

**5.6.12 PAINTING**

All steel structures shall receive two primer coats and two finish coats of painting.

First coat of primer shall be given in shop after fabrication, before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection.

Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted to Sa-2½ finish as per SIS05-5900. Primer paint shall be zinc silicate of approved make.

Finish paint shall be 2 coats of High built epoxy finish of approved brand. Dry film thickness of each finish coat shall be 90 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 300 microns. All paints shall be of approved brand and shade as per the OWNER's requirement.

Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

5.6.13 DELIVERY, STORAGE AND HANDLING

All structural steel works shall be protected from damage during handling, transporting, unloading, and storage. Particular attention shall be given to stiffen free ends and to prevent any permanent distortion. All bolts, nuts, washers, and small articles shall be suitably packed and identified. All structural steel shall be stored on thick timbers to prevent any dirt or accumulation of water under the steel.

Safety

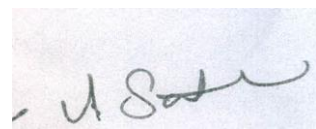
The safety precautions to be applied during the erection of the steel structures shall be in accordance with IS: 7205 and other appropriate IS standards.

Inspection at Site

After erection of the structures, the Contractor shall carry out inspections and checks in the presence of owner in order to demonstrate completeness of the works and correctness of the assembly. The Contractor, subject to owner's approval shall propose the inspections and checks to be carried out. In order to facilitate inspections as well as future maintenance, the structures shall be provided with steps, ladders, handrails, and other facilities in approved positions. The Contractor shall provide for the owner's use all equipment and instruments for inspection.



**TANGEDCO UDANGUDI SUPERCRITICAL THERMAL POWER
PROJECT, 2X660MW STAGE-I, THOOTHUKUDI DIST, TAMILNADU
CUSTOMER NO: U6/1729 & 1730, UNIT – I & II
PAINTING SCHEDULE**

Prepared by	K. Srinivasan Senior Engineer/ Plant Lab		Document No: PL: C3 - PS/ 1729
Reviewed by	D. Vijayakumar Senior Manager /PE/FB		Revision No: 00 Dated: 25-05-2018
Approved by	A. Santhakumari AGM / Plant Lab		Sheet No. 01 of 12

m:\ chem. \ contracts 15\ UDANGUDI-TANGEDCO 2X660 MW STPP\psword_00.doc

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	25-05-2018	New	Prepared in line with bid resolutions between TANGEDCO/ FICHTNER & BHEL on BID spec No. SE/C/ UP / EE/E/OT N0.01/2015-16, Ref: Annexure - 3, Try-Quality, 2x660MW UDANGUDI TPS, STAGE-I.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1 PS1AC	<u>Collector & Separator Vessels (Except Internals), Supports</u> 04 –321,323,547;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	International orange shade No:592 of IS 5	70
2 PS5B	<u>Collector & Separator Vessels internals and Dd items (threaded and machined surfaces only)</u> 04-347;07-302,331,361,362,393; 08-911,912,913;09-303,304;12-306,314; 12-317,324,327,328,344,348,354,393; 17-304,306,319;19-306,307;21-602,605,700; 24-352,700,803,818,827,842; 28-700;32-700;35-190,700,701;36-700; 39-700;41-710;42-700,710;43-710; 45-710;47-710;48-019,700; 65-710;67-710; <u>Foundation materials:</u> 35-010, 39-012	SSPC – SP3 Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=20 μm per coat	2	--	--	--	--	--	40
3 PS19C4	<u>Buck stays</u> 07-509;08-001,003,006,007,111,380,501, 08-503,901,910; <u>Boiler supporting structures, Columns, Girders, Bracings</u> 34-100,200,300,390,400,500; 35-111,112,121,122,130,140,150,211, 212, 35-213,214,221,222,231,232,311,312,321, 35-322,331,332,341,342,351,352,361,362, 35- 381 to 387, 390, 35-441 to 447, 451 to 457, 511 to 517 35-521 to 527;35-531 to 537, 993,995;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 μm	Inorganic Ethyl Zinc Silicate Primer DFT=75 μm per coat	1	Epoxy Based MIO Pigmented Intermediate Coat DFT=100 μm per coat	2	#Aliphatic acrylic Polyurethane paint to DFT 50 μm	#1	Dark admiralty Grey Shade No: 632 of IS5	325

To be applied at site

S. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
3 PS19C4 (Contd.)	<u>Galleries, Stair-ways & inter connecting Walkways</u> 36-110,130,150,311,312,313,314,315,316, 36-321,322,323,324,325,326,331,332,333, 36-334,335,336,337,338,341,342,343,344, 36-345,346,351,352,353,354,355,356,361, 36-362,363,364,365,366; 36-391 to 395 36-610,613,620,740; 38-210,299,310,381,410,510,610,611,710; <u>ID system structures.</u> 39-101,102,141,142,150,299,300,301, 39-304,305,306,993; <u>Duct supports</u> 48-015,115,145, 205,225,235,265,385, 48-435,465,485,495,665;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 μm	Inorganic Ethyl Zinc Silicate Primer DFT=75 μm per coat	1	Epoxy Based MIO Pigmented Intermediate Coat DFT=100 μm per coat	2	#Aliphatic acrylic Polyurethane paint to DFT 50 μm	#1	Dark admiralty Grey Shade No: 632 of IS5	325
4 PS3	<u>Components >95° C Insulated other than components in Sl.No.7 &9</u> Ring Headers, Down Comers, Hot air Headers outside the gas path etc. 05-155,227,231,251,327,330,350; 07-110,125,223,231,232,317; 10-174,178,191,195,274,278,283, 10-284,285, 10-291,295; 12-178,850,852,900; 15-136,178,236,278; 17-476;18-001,002,010,701; 19-701,702,903;21-600;24-811,824,828; 24-836,837;42-020,030,128,150,158;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	--	--	Red oxide	60
# To be applied at site										

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
4 PS3 (Contd.)	Hot Air: 48-018,202,204,207,208,212,214; 48-222,224,232,234,262,264,662,664,667; Flue Gas: 48-372,382,384,386, 432,434; 48-462,464,482, 484 ,492,494;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	--	--	Red oxide	60
5 PS 9B1	<u>Components >95° C uninsulated other than components coming in gas path.</u> Temp: >95°C & <400°C 20-511; 24-807,820,860,865,867; 42-200,300,358; Instrument tappings, doors 48-200,915;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 μm	Inorganic Ethyl Zinc Silicate Primer DFT=75 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.II DFT=20 μm per coat	2	Aluminum	115
6 PS 10	<u>Components uninsulated other than components coming in gas path.</u> Temp: >400°C & <600°C 09-003,004,005,503; 28-220;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT=20 μm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. I 20 μm per coat	1	Aluminum	40
7 PS2	<u>Loose tubes, SH, RH & Eco. coils</u> 11-074,078,095,374,378,406,416,467,469; 11-487,491,494,606,684,694,716,718; 11-767,769,787,791,967; 11-969,991;12-179,184,187,368,395,403,405,495; 12-514,524,544, 548,554,568; 12-800,803,805,903,914,917,924,927,928,944,948; 12-954,968; 16-079,201,202,203,270,379; 19-814,824,853,914,924;	SSPC – SP2 or SSPC – SP3 Hand tool / Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35 μm per coat	1*	--	--	--	--	Red Oxide	35

*-In lieu of dip painting, 2 coats of brush painting of Red oxide Zinc Phosphate primer to a coating thickness of 60 μ is also permitted in line with Sr.No.9.

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
8 PS1A	Miscellaneous and casing sheets 07-409,431,460,461,462,502,503,531,560,561; 12-906,907; 17-919; 21-601,604,606; 24-350,351,354,800,801,804,805,806,808,809; 24-810,815,817,825,826,835,840,841,855; 24-950,955,960;30-233,234;35-995; 36-611,621; 39-302; 04-147; Fuel firing: 41-350,390,500; Steam blowing piping 42-001,002,005,010,046,065,070,120,152,154; 42-157; 43-004,104,105,200; 45-200,801,802,804,805,858; 47- 261,263,858; Duct plates, expansion joints 48-911,912; Coal Feeding 65-736; 67-204,272,276,283,801,802,803; 95-088,089,091,485;96-186;97-585,591,592; Impulse lines: 24-800; Seal air ducting: 43-005, 105; Cold Air duct:48-012,014,112,114,141; Tempering Air: 48-142,144;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	Smoke Grey Shade No: 692 of IS5	70

Sl. No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
9 PS3	<u>Components >95° C coming in the gas path, Headers, Commissioning Spares & erection Materials etc.,</u> 05-137,147;06-400,401,431,434,437,441,444; 06-447,451,453,455,500,501,731,732; 06-734,735,737,741,744,745,747,751,752,753; 06-755, 759; 07-309,315,316,318,423,993; 10-182,183,184,185; 11-474; 12-993;17-174,474,504,506,900,903; 19-704,753,763,783,793,802,850,851; 20-988,998; 21-987; 24-822,823, 987,989, 993; 30-105,211,215,219,223,224,235; 31-010,104; 32-010,210,810; 37-010;42-858;48-993; 65-200; 67-200;96-193; 97-282,590; 99-501; 41-988; 42-988;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	--	--	Red oxide	60
10 PS6	<u>Hand rails and posts, ladders / rungs</u> 34-810,820,850; 35-821,822,823,851; 36-820,851,852,853; 38-820,850;39-820,850; <u>Floor Grills, Step treads</u> 35 – 811,812;36-811,812,813,814; 38 – 810;39 – 810;	Hot dip Galvanizing to a coating weight of 610 g/m ² (minimum) and to a coating thickness of 85.0 microns (minimum). Refer Notes given below **								

Notes **: The Guard plates, Hood Ladders and Stringer channels shall be painted as per painting scheme prescribed in Sl. No: 03

PAINTING SCHEME FOR VALVES

Sl.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
11 PS 10	<u>Cast carbon steel valves (Conventional)</u> <u>Cast alloy steel valves (Conventional)</u> <u>All API valves, QCNRV, SV & SRV Silencers,</u> 21-800,825, 24-885; Safety valves & ERV 21-850; 24-880,881;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. I	1	Aluminum	40
	Forged valves	Chemical cleaning	Phosphating to a coating weight of 1500 mg per Sq.ft.	--	--	--	--	--	--	--
1AS1	<u>Soot Blower components</u> 20-051,054,201,204,794,962;	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 μm per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	Verdigris Green Shade No. 280 of IS5	90
	HP / LP system	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	--	40

Sl.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
12 PS15	<u>For CLH & VLH*</u> PGs 07,08,12,17,19,21,24,47,48 &80 07-402,403,405,505;12-517,528; 17-519,904,906 19-506,507,904,905, 906,907; 24-353; 48-206,395;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 μm	Epoxy zinc rich primer To IS 14589 Gr. II %VS=35, (min) DFT=40 microns per coat	1	--	--	Aliphatic acrylic Poly-urethane paint %VS=40.0 (min) DFT=30.0 microns per coat	1	Phirozi Blue Shade No. 176 of IS5	70
13 PS33A	<u>Components > 95°C, un-insulated Fuel pipes</u> 47-269;	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 μm	Inorganic Ethyl Zinc Silicate Primer DFT=75 μm per coat	1	Heat Resistant Aluminium Paint to IS 13183 Gr.II DFT=25 μm per coat	2	Heat Resistant Aluminium Paint to IS 13183 Gr.II DFT=20 μm per coat	1	Aluminum	145
14 PS 5B	All Columns below '0' level (embedded in concrete) PGs 34,35,36,38 39	SSPC-SP3/ Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=20 μm per coat	2	--	--	--	--	--	40

*- For components other than CLH & VLH, painting scheme shall be as given in Sl. No. 8.

NOTES:

1. Rust Preventive Coating should be given on HSFG Bolt and nut threads.
2. Machined surfaces and all retainers are to be applied with a coating of Temporary Rust Preventive oil.
3. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves, 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.
4. Ground shade/ Colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per doc. No. Vol-II Section 2-25 Painting_R0.
5. PGMA's under Sub-Vendor items are not indicated. For all bought-out and sub-vendors items including PGMA's mentioned above falling under the scope of BHEL the same scheme as for main equipment as covered in this document shall be followed.
6. This painting Schemes is valid for only Customer No: U6/1729 & 1730, TANGEDCO UDANGUDI STPP - 2X660 MW.
7. No painting is required for Stainless Steel, non-ferrous & galvanized components.
08. Wherever inside surfaces of components under PGMA 48 – XXX & others, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.
09. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be visually inspected for good adherence. If the coating is intact, direct coating of alkyd based red oxide paints over the coating is permitted. In case, the coating has peeled off over a large area, then the coating is to be removed by suitable solvents / heating to 350 –400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).
10. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods of <25mm/tubes/drain pipes are used, power tool / hand tool cleaning to SSPC – SP3 / SP2 shall be followed and the painting shall be done as described in Sl.No.8.
11. For all commissioning components-erection materials (xx-993) two coats of Red oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.
12. Touch-up paintings, making good any damaged shop painting and completing any unfinished portion of the shop coat shall be carried out as per clause applicable painting scheme.
13. All components covered under different PGMA's are to be painted. In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.
14. For very small components like clamps etc. Sl.No.8 shall be followed.

15. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer. Structural members having welded connections at site, relevant area can be painted with primer paint instead of Weldable primer.
16. Painting scheme for all temporary structures like 04-196, 35-391,392,393 shall be PS 1AE i.e. 1 coat of Red oxide Zinc Phosphate primer (Alkyd Base) to IS 12744-DFT-30 μ and 2 coats of Synthetic Enamel paint (Long Oil Alkyd) to IS 2932-DFT-2X20 μ Shade Yellow –Shade No. 356 of IS 5- Total DFT 70 μ . These are to be cut & removed at site after erection. (It excludes components covered under Sr. No. 3 & 10 of description table).
17. For internal protection of Pipes, tubes, headers and other pressure parts, Volatile Corrosion Inhibitor (VCI) pellets shall be put (after sponge testing/ draining/ or drying) and subsequently end capped. The dosage of VCI pellets shall be approximately 100 g/ Cu.m. For tubes typically 4 – 5 tablets per end are to be put. For C & I items the dosage of self-indicating Silica Gel (colourless) shall be 250 g/ cu.m. (About 2 to 3 bags weighing approximately 100 grams each). VCI pellets shall not be used for stainless steel components and its composite associates.
18. All threaded components of spring assemblies and turnbuckles shall be galvanized and achromatized to 15 microns minimum thickness.
19. Soot blower components i.e Valve head assembly having high surface temperature (> 200 and <600 deg. C) shall be applied with protective coating as per PS9 (up to 400 deg.C) and PS10 (up to 600 deg.C)
20. Corner plate, sheet channel and fixing pins of PGMA 32-210 shall be painted as per scheme PS3 to total DFT of 60 microns.
21. It is mandatory that for finish coat each layer shall have a permanent DFT and free from any paint defects like sags, wrinkles etc. Total DFT of a component correspond to respective painting scheme has to be ensured and recorded by inspection agency as per QP.
22. For chequered plates having thickness ≤ 5 mm, surface preparation can be power tool cleaning to St3 and painting shall be in line with Sl. No. 8.
23. Handrails, step treads of PGMA under Sl. No. 3 need to be galvanized in line with scheme for handrails (i.e. Sl. No. 10).
24. Inside surfaces of fabricated structure (e.g. Box type column) shall be painted with two coats of red oxide primer paint during fit up stage.
25. Painting of bunker structures to be in line with painting scheme of supporting structures (Sl. No. 3).
26. Faying surfaces of bolted connection (Friction Grip, Slip- Critical) shall be masked to prevent application of coating. Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly, where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint, the surfaces shall receive the paint as specified.

Painting Scheme – Details for procurement & application purposes

Sl. No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns per coat (approx.)	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Epoxy Zinc rich primer to IS14589 Gr.II (latest)	8	2	35	40	Grey	--	Spray	24
2	Aliphatic acrylic polyurethane paint to IS 13213 (latest)	13	2	40	30-50	Phirozi – Blue/ Dark admiralty grey	176/ 632	Spray	24
3	Heat resistant Aluminium paint to IS 13183 Grade I/II (latest)	10	1	-	20	--	--	Brush / Spray	24
4	Red oxide zinc phosphate primer paint to IS 12744 (latest)	10	1	--	30	-	--	Brush / Spray	12
5	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	35	--	---	Dip	12
6	Long oil alkyd synthetic enamel finish paint to IS2932 (latest)	17	1	--	20	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
7	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	25	--	--	--	12
8	General purpose Aluminium paint to IS 2339 (latest)	10	2	--	20	Aluminum	--	Brush	12
9	HB Chlorinated Rubber Based Zinc Phosphate Primer-Colour Grey	8	1	40	50	Grey	--	Brush / Spray	12
10	Epoxy based polyamide cured MIO pigmented intermediate coat.	8	2	60	100	Brown	--	Spray	24
11	Inorganic ethyl zinc silicate primer to IS 14946 (%Zn on dry film= 75min)	8	2	60	75	Grey	--	Spray only	16

Brush painting is accepted, if recommended by the paint suppliers. The covering capacity of paints specified is only approximate. The paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. **Values are indicative.

CUSTOMER: 	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED				
CONSULTANT: 	DESEIN PRIVATE LTD.				
PROJECT:	2X660 MW UDANGUDI STPP- STAGE I (UNIT#1&2) IN UDANGUDI, TUTICORIN DISTRICT, TAMILNADU				
	BHARAT HEAVY ELECTRICAL LTD BOILER AUXILIARIES PLANT, RANIPET				
COPY RIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICAL LIMITED it must not be used directly or indirectly in any way detrimental to the interest of the company	DEPT CODE		NAME	SIGN	DATE
		PRPD	Rajamanickam.M		16.03.2018
		CHD APPD	R.Arunachalam		16.03.2018
<u>2X660MW UDANGUDI STPP STAGE I (UNIT# 1&2)</u>					
<u>TITLE:</u>		<u>PAINTING SCHEDULE FOR APH, FANS, ESP, Gates & Dampers, Aux. boiler chimney</u>			
DOCUMENT NO: RPT-PS:UDAN:EPC:R678-R679& R4S9		REV: 00		Date: 16.03.2018	
<u>RECORD OF REVISION</u>					
REV No 00	Effective date 16/03/2018	Remarks Original Issue			

	Bharat Heavy Electricals Limited Boiler Auxiliaries Plant Ranipet – 632 406 Vellore Dist. Tamil Nadu	BHEL DOC NO.	RPT-PS:UDAN:EPC:R678-R679&R4S9
		REVISION NO.	00
		DATE	16-03-2018

UDANGUDI TPP (2X660MW)
PAINTING SCHEDULE FOR APH, FAN, ESP, GATE&DAMPER, &CHIMNEY (AUX.BLR)
BHEL RANIPET Customer No(s).: R678 – R679 & R4S9

RECORD OF REVISION

REV NO	EFFECTIVE DATE	DETAILS OF REVISION MADE
00	16.03.2018	Original issue – first submission

Prepared By	Reviewed & Approved By
	
(Rajamanickam.M)	(R. Arunachalam)

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

1-AIR PRE HEATER (APH)

01	Steam Coiled APH (SCAPH)	Power Tool Cleaning to St3 (SSPC-SP3)	Red-oxide Zinc phosphate primer to IS 12744 (Two coats)	60	NIL	NIL	60
02	Rotor Post assembly (Flue gas swept surface)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
03	Pin rack assembly (machined areas of pin & holes)	Power Tool Cleaning to St3 (SSPC-SP3)	Temp rust preventive to PRQA 523	20	NIL	NIL	20
04	Seals		Temporary rust preventive oil to PRQA 523	20	NIL	NIL	20
05	Rotor Housing assembly	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
06	Hot and Cold End Connecting Plate assembly	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
07	Axial seals (Flue gas swept surface)	Power Tool Cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Oil to PRQA 523	20	NIL	NIL	20
08	Bypass seals (Flue gas swept surface)	Power Tool Cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Oil to PRQA 523	20	NIL	NIL	20
09	Washing manifold & deluge assy items (Flue gas swept surface)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL		60
10	Cleaning Device Assy (Tube with Nozzle – Long Retractable Non Rotating type)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL		60
11	Other items of General Details except Access Door Assy	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
12	Access Door Assy (> 95°C - exposed to atmosphere)	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	75	350

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
13	Air seal piping (<95°C- exposed to atmosphere)	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Sky blue (Shade no: 101 of IS 5)				

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

2. FANS

01	Foundation Matl of FD,ID & PA Fans Bolt & Stud Assy & FD Fan (aux.blr)	Power tool cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Fluid as per PR QA 523	20	NIL	NIL	20
02	Foundation Matl of FD, ID & PA Fans – Packer Plates Base Frame for Actuators of FD, ID & PA Fans Seal Air Fan Motor Base Frame / Plate	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900*	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
03	Stairs and Hand Rails-FD/ID/PA FAN – Stair stringer channels, Platform structural items and toe guard plates	Refer SI No 3 under GATES & DAMPERS					
04	FD FAN <95° C Surface Temperature Static Parts - Insulated Surface (Outside) & Ambient Air swept surface (Inside)	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
	Rotating Parts (Inside the Insulated static parts – protection up to erection)	Power tool cleaning to St3 (SSPC-SP3)	Epoxy based Zinc Phosphate Primer (Two Pack system) as per IS:13238 (Two coats) per coat= 30µm &Total DFT = 60 µm min.	60	NIL	NIL	60
05	ID FAN >95° C Surface Temperature Static Parts - Insulated Surface (Outside)	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
	Static Parts – Flue gas swept surface (Inside)						
	Rotating Parts - (Inside the insulated Static Parts – protection up to erection)	Power tool cleaning to St3 (SSPC-SP3)	Epoxy based Zinc Phosphate Primer (Two Pack system) as per IS:13238 (Two coats) per coat= 30µm & Total DFT = 60 µm min.	60	NIL	NIL	60

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

06	PA FAN < 95° C Surface Temperature Static parts – Insulated Surface (out side) & ambient Air swept surface (Inside)	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
	Rotating Parts - (Inside the insulated Static Parts – protection up to erection)	Power tool cleaning to St3 (SSPC-SP3)	Epoxy based Zinc Phosphate Primer (Two Pack system) as per IS:13238 (Two coats) per coat= 30µm & Total DFT = 60 µm min.	60	NIL	NIL	60
07	Coupling and Coupling Guard – For FD, ID & PA FAN, Seal Air FAN & FD FAN (aux.blr)	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
08	Lub Oil System – For FD , ID & PA Fan	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	75	350
09	Silencer for FD & PA FAN & FD FAN (aux.blr.) < 95° C Surface Temperature Insulated Surface	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900	Primer: 1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	75	350
10	Seal Air FAN and FD FAN (aux.blr.) < 95° C Surface Temperature Insulated Surface	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	NIL
11	Commissioning and mandatory spares Tools for FD fan for aux. blr	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

3. GATES & DAMPERS

01	Gates & Dampers > 95° C Insulated Surfaces	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	60
02	Gates & Dampers < 95 ° C Insulated Surfaces	Power tool cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two Coats)	60	NIL	NIL	60
03	Platform & Ladder – Items of Cage for Ladder, Toe Guard Plate Floor Grill, Hand Rails, Hand Rail Post,	Hot Dip Galvanizing to 610 gm per Sq. Metre (minimum) and to a coating thickness of 87 µm (minimum)					
04	Platform & Ladder - Other Structural Items – other than sl.no. 3 of above.	Refer SI No 40 under ESP					
05	Ducts Commissioning Spares	As per respective items mentioned in this Painting Scheme					

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

4. CHIMNEY FOR AUX. BOILER

01	Chimney Foundation Materials		Power Tool Cleaning to st3 (SSPC-SP3	Temp. Rust Preventive Fluid as per PR QA 523	20	NIL	NIL	20
02	Chimney shell	Insulated Side	Power Tool Cleaning to st3 (SSPC-SP3	Two coats of Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coast)	60	NIL	NIL	60
		Flue Gas Swept Surface						
03	Chimney Duct	Insulated Side	Power Tool Cleaning to st3 (SSPC-SP3	Two coats of Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coast)	60	NIL	NIL	60
		Flue Gas Swept Surface						
04	Chimney Base, Painters Trolley (other than SS) and Chimney Strakes		Surface preparation: Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)					
05	Platform Ladder and hand rails post, hand rails and floor grills & step treads		Hot Dip Galvanizing to 610 gm per Sq. Metre (minimum) and to a coating thickness of 87 µm (minimum)					
06	Other than sl.no.05 of platform structural items		Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm	Primer: 1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	75	350

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

5. ELECTROSTATIC PRECIPITATOR (ESP OR EP)

1	Insulator Housing Assy 7X - X06	Power Tool Cleaning to st3 (sspc-sp3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
2	Gas Distribution Assy 7X - X08	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
3	GD Rapping Mechanism 7X - X09	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
4	GD Drive Arrangements (7X - X10) outdoor equipment/external surfaces	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946- DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
5	Gas Screening 7X - X11	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
6	Emitting System suspension 7X - X13	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
7	Emitting Electrode –Hook Part 7X - X15	Rust preventive application on Hook part Only (Electrode Wire is Stainless Steel)					
8	Emitting Electrode Rapping Mechanism 7X - X16	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
9	Drive Arrangement For Emitting System(7X - X17) outdoor equipment/external surfaces	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
10	Suspension Arrangement For Collecting Electrode 7X - X19	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
11	Collecting Electrode, 7X - X20	Rust Preventive Fluid Application					

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
12	Lifting Beam for Collecting Electrode 7X - X20	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	75	350
13	Frame Of Emitting System-Top 7X - X21	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
14	Frame Of Emitting SystemBottom 7X - X22	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coats)	60	NIL	--	60
15	Inspection /Access Door 7X - X23 outdoor equipment/external surfaces	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
16	Shock Bars 7X - X24	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
17	Collecting Electrode (CE) Rapping Mechanism 7X - X25	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
18	Drive Arrangments for CE Raping 7X - X26 outdoor equipment/external surfaces	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
19	ESP Roof Beams 7X - X28	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
20	Frame of Emitting System – Middle 7X - X32	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
21	Outer Roof –EP 7X - X42 outdoor equipment/external surfaces	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946- DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)				
22	Hopper Ridges 7X - X43	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)	
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)		
23	Hopper Upper part(7X - X44)	Insulated side	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Flue Gas Swept Surface		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
24	Hopper Middle & Lower part(7X - X45)	Insulated side	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Flue Gas Swept Surface		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
25	Insulator Support Panel (7X - X46)	Insulated Side	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Flue Gas Swept Surface		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
26	Roof Panel Assy (7X - X47)	Insulated Side	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Flue Gas Swept Surface		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coast)	60	NIL	--	60
27	Casing Structure 7X - X48		Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
28	Casing (Shell, Side Panels, Gables & GD Housing)(7X - X49)	Insulated Side	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Flue Gas Swept Surface		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

29	ESP Funnel Assy 7X - X50	Insulate d Side	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Flue Gas Swept Surface		Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
30	ESP Pent House – Columns and trusses only (7X - X55)	Painting Scheme shall be in line with PGMA 7X – X81 (ESP Supporting Structure) – Refer Sl.no. 40.						
31	ESP Pent House – Other items other than sl.no. 30. (7X - X55)	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	50		325
32	Splitters & Guide Vanes (7X - X57)	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--		60
33	ESP Performance Test Equipment (7X - X61)-outdoor equipment/external surfaces	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5)					
34	Water Washing System (7X - X66)	Power Tool Cleaning to St3 (SSPC-SP3)	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat	75 200	Two pack aliphatic acrylic polyurethane paint to IS 13213 Shade: Dark Admiralty grey (Shade no: 632 of IS 5)	75		350
35	Foundation Materials for ESP (7X - X80)	Surface preparation will be power tool cleaning. All Threaded and other surfaces of foundation bolt and its materials shall be coated with temporary rust preventive fluid. During execution of civil works the dried film of coating will be removed using Organic Solvents.						

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
36	Hand Rail Post, Bend ,ERW Tubes, Floor Grill and Step Tread(7X - X65,89 – 611,89 – 612,89 – 613)	Hot Dip Galvanizing to 610 gm sq. Meter (minimum) and to a coating thickness of 87 µm (minimum)					
37	Commissioning Spares(79 – 988)	As per respective item , as listed in the painting schedule					
38	Tools & Tackles 79 - 996	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	NIL	--

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
39	Approach Platform For Hopper (7X - X65)	Blast Cleaning to Sa 2.5 Near White metal with surface roughness profile to 35-50 µm, SIS 05 5900 *	Primer: 1 coat of Inorganic ethyl zinc silicate to IS 14946 - DFT 75µ. Intermediate coat: Two coats of Polyamide cured Epoxy MIO pigmented Intermediate coat DFT 100 µ per coat- DFT- 200µ Finish: Two pack aliphatic acrylic polyurethane paint to IS 13213, DFT- 75µ Total- 350 µ Shade: Dark Admiralty grey (Shade no: 632 of IS 5) Note: Out of two coats of finish paint of Two pack aliphatic acrylic polyurethane paint to IS 13213 , one coat to DFT- 40 µ will be done at shop or subcontracting works. Second coat of finish paint of Two pack aliphatic acrylic polyurethane paint to IS 13213 will be done at site to DFT- 35µ; Dark Admiralty grey (Shade no: 632 of IS 5) Total DFT- Primer- 75 µ + Intermediate 200 µ+ Finish 75 µ, Total- 350 µ Columns below '0' level, One coat of Rust preventive oil to PRQA 523 to DFT- 40µ shall be applied since this item will be embedded inside the concrete pedestal.				
40	Supporting Structure for ESP (Refer note for surface embedded in concrete) (7X - X81)						
41	Stair stringer Channels, Bracket, Supp Bracket, Frames Loose Channels , Toe Plates, Stiffener Plates and Angles for EP Galleries ,Stair and Walk Way (7X - X65 89 – 610)						

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (μ m min.)
			PAINT	DFT (μ m min.)	PAINT	DFT (μ m min.)	

6. PAINTING OF DAMAGED AREAS

Areas where paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion property and where the steel has got rusted appreciably - these areas are to be repainted as per the following procedure:

SURFACE LOCATION	SURFACE PREPARATION	PRIMER, INTERMEDIATE & FINISH
APH: SI nos. 12,13 Fans: SI nos. 02,07 ESP: SI nos: 04,09,15, 18,21,31,33,39,40,41 Chimney: SI no:04& 06	Hand/ Power tool cleaning to remove the paint and Minimum 6" of surrounding areas with existing coat to be roughened by wire brush & emery paper for best adhesion by patch primer	1. Primer: One coat of Self priming Epoxy Zinc rich primer to IS:14589 Gr.II to DFT of 70 μ m (min.) 2. Intermediate and Finish: As given in respective scheme as above If primer is intact, intermediate and finish to be done as per the respective scheme.
Any other areas other than above sl nos, where paint got damaged	As given in respective scheme (Derusting of all mechanical damages)	Primer and Finish : As given in respective scheme

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (μ m min.)
			PAINT	DFT (μ m min.)	PAINT	DFT (μ m min.)	

GENERAL NOTES

1. Blast cleaning shall not be performed where dust can contaminate surfaces under going such cleaning or during humid weather conditions having humidity exceed 85%.
2. Irrespective of surface preparation, the first coat of primer must be applied immediately within 4 hours of cleaning of surface.
3. No painting is required for Galvanized , non-ferrous & stainless steel items, except as indicated above.
4. Surfaces not easily accessible after shop assembly shall be treated before- hand and protected for life of the equipment as per this painting scheme as applicable for the respective PGMA/Surface location painting scheme.
5. Machined items are to be applied with coat of temporary rust preventive oil
6. PGMAs and its items coming under BOI are not indicated in this painting schedule. However, respective Engg document for all BOIs shall be referred. Whereever it is not specified, it shall be as per painting schedule of applicable PGMA description.
7. In sub-assy, wherever plates / sheets of thickness less than or equal to 5mm and rods are used - Power Tool or Hand Tool Cleaning to SSPC - SP 3 / SP 2 shall be followed.
8. All components covered under different PGMAs are to painted. Incase any component is left out, the same shall deemed to be included under the relevant section.
9. Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted, but may be applied with temporary rust preventive fluid , which may be removed while erection.
10. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves 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.
11. Surface preparation, post treatment and touch up for mechanical damages shall be as per (6) PAINTING OF DAMAGED AREAS.

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	

Painting scheme- Details of procurement & application processes

SL NO	TYPE OF PAINT	SPECIFICATION OF PAINT	NO OF PACK	VOLUME OF SOLIDS (% Min)	MODE OF APPLICATION	OVER COATING INTERVAL	SHADE
01	Epoxy Zinc phosphate primer	IS 13238	2	40	Spray	24	Grey
02	Inorganic Zinc Ethyl silicate primer (% Zn on dry film= 80 (min))	IS 14946	2	60	Spray only	24	Grey
03	Epoxy High solid- Polyamide cured Epoxy based MIO pigmented intermediate coat	--	2	80	Spray	12	Brown
04	Aliphatic acrylic polyurethane paint	IS 13213	2	55	Spray	16	Corresponding shade no
05	Heat resistant aluminium paint	IS 13183 Grade II	1	--	Brush/ Spray	24	--
06	Red oxide Zinc phosphate primer	IS 12744	1	--	Brush/ spray	12	--
07	Temporary rust preventive fluid to PRQA 523	--	1	--	Brush	12	--

SI No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (μ m min.)
			PAINT	DFT (μ m min.)	PAINT	DFT (μ m min.)	

PAINTING REQUIREMENTS AS STIPULATED IN TENDER DOCUMENT

SL NO	AREAS	TENDER DOCUMENT REFERENCE
01	All areas of ESP, Fans, Gates and Damper, APH & chimney	Volume II, Sub section 2.25, Cleaning, Protective coating & Painting
02	Galvanizing of gratings, hand railings and ladders	Volume II, Sub section 2.25, Cleaning, Protective coating & Painting



BHARAT HEAVY ELECTRICALS LIMITED
RAMACHANDRAPURAM: HYDERABAD: 502032
PULVERISERS ENGINEERING

HP 1103 BOWL MILLS (DYNAMIC CLASSIFIER) – 7 NOS. / BOILER

PAINTING SCHEDULE FOR BOWL MILLS

PREPARED BY	RAJESH RANJAN		CUSTOMER: 	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5TH FLOOR WESTERN WING, NPKRR MAALIGAI 144, ANNA SALI, CHENNAI-60002
REVIEWED BY	AMAN SURIN		CONSULTANT 	DESEIN PRIVATE LIMITED DESEIN HOUSE, GREATER KAILASH-II, NEW DELHI
APPROVED BY	SATISH GHATGE		PROJECT 	2X660 MW UDANGUDI (UNIT #1&2) SUPERCRITICAL TPP-STG I BHARAT HEAVY ELECTRICALS LTD HYDERABAD
DOCUMENT NO: BA-PS-UDANDUGI-00	<u>Record of Revisions:</u> Rev 00: Initial Submission			
REV. NO: 00				
DATED: 13.09.2018				

TABLE OF CONTENTS

- SECTION 1: SCOPE
- SECTION 2: ALL INTERIOR SURFACES OF THE MILL
- SECTION 3: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURES GREATER THAN 95 °C
- SECTION 4: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURES LESS THAN 95 °C
- SECTION 5: GENERAL NOTES
- SECTION 6: PAINT SCHEDULE

SECTION 1: SCOPE

This painting specification schedule covers all parts and assemblies of HP 1103 Pulverisers manufactured by BHEL and its sub-vendors including Sister Units for 2x660 MW Udangudi (Unit#1 & 2) STPP-Stg 1 contract of M/s TANGEDCO.

SECTION 2: ALL INTERIOR SURFACES OF THE MILL

Interior surfaces:

Those surfaces inside the pulverizer exposed to the mill airflow and coal. Also included are those surfaces inside the pulverizer and not exposed to mill airflow and coal such as the inside of the Spring Housing.

- A) **Surface preparation:** Commercial Blast SSPC-SP 10 (Swedish Std SA 2.5)
- B) **Primer:** Self curing inorganic zinc silicate primer (solids by volume 60% min) Minimum DFT 75 microns. Shop applied immediately after blast cleaning by airless spray technique.

Note: *No primer application is envisaged on the inside of the Planetary Gearbox and the Journal Housing.*

SECTION 3: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURE GREATER THAN 95°C AND INSULATED

Exterior surfaces:

Those surfaces visible by someone outside the fully assembled pulverizer.

Components with Surfaces Greater Than 95 °C:

Mill Side Housing Assembly (Externally Insulated) and Bowl and Bowl Hub Assembly.

- A) **Primer:** High temperature primer & Aluminium Silicone paint (additional). Total DFT 65-85 microns.

SECTION 4: EXTERIOR SURFACES OF THE MILL WITH SURFACE TEMPERATURES LESS THAN 95 °C

Exterior surfaces:

Those surfaces visible by someone outside the fully assembled pulverizer.

Components with Surfaces Less Than 95 C:

All mill components, except the Mill Side Housing Assembly and Bowl and Bowl Hub Assembly.

- A. **Primer:** Self curing inorganic zinc silicate primer (solids by volume 60% min) Minimum DFT 75 microns. Shop applied immediately after blast cleaning by airless spray technique.
- B) **Intermediate Coat:** Polyamide cured pigmented titanium dioxide (TiO₂) or Micaceous iron oxide (MIO) epoxy based paint. (solids by volume 60% min) Minimum DFT 75 microns. Paint applied by airless spray technique.
- C) **Finish Coat (Shop):** Polyamide cured color pigment epoxy based paint. (solids by volume 60% min) Minimum DFT 75 microns.
- D) **Finish –Finish Coat (After Erection):** of 25 micron DFT (minimum) of Polyurethane based colour pigmented paint (solids by volume minimum 40%).

SECTION 5: GENERAL NOTES

- A. **Grease and Oil Removal:** Special care shall be taken to remove grease and oil by means of suitable solvents.
- B. **Brush Off Blast Swedish Std Sa 2.5 preparation:** Brush Off Blast (SSPC-SP10): All oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very light streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating. At least 95% of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to light discolorations mentioned above. Work to the Sa 2.5 requirements.
- C. **Machined surfaces are not painted.**
- D. Bought-out & other miscellaneous items shall be as per BHEL standard painting. This painting scheme shall be applicable for Mills components as mentioned.

SECTION 6: PAINT SCHEDULE

Sl No	Surface Location	Surface Preparation	Primer		Intermediate		Finish Coat			Total DFT
			Paint	No. of Coats	Paint	No. of Coats	Paint	No. of Coats	Shade	µm min
01	Interior Surfaces of Mill (All surfaces, including surfaces above 95°C and surfaces below 95°C.) Ref Section-2.	Commercial blast Swedish Std SA 2.5	Inorganic Zinc Silicate	2 coats 75 µm min DFT total	NA	-	NA	-	-	75 µm min.
02	Exterior Surfaces of Mill above 95°C (Mill Side Assembly and Bowl and Bowl Hub Assembly) Exterior Surface of the Mill Side Assembly is insulated.	Commercial blast Swedish Std SA 2.5	Inorganic Zinc Silicate (High temperature primer)	1-2 coats 40 µm-50 µm DFT Total	Aluminum Silicone (High temperature paint)	2 coats 25-35 µm DFT Total	NA		Gray RAL 9002	65-85 µm DFT

03	Exterior Surfaces of Mill below 95 °C (All surfaces except the Mill Side Assembly and Bowl and Bowl Hub Assembly) Includes: Separator Body Assembly, Journal Opening Cover, Spring Assembly, Separator Top, Dynamic Classifier Assembly, Discharge Valve Components, Outlet Pipes, Seal Air Piping, Planetary Gearbox, Pulveriser Top Platform, Lube Oil System)	Commercial blast Swedish Std SA 2.5	Inorganic Zinc Silicate	2 coats 75 µm min DFT total	Polyamide cured pigmented titanium dioxide (TiO₂) or Micaceous iron oxide (MIO) epoxy based paint	1-2 coats 75 µm min DFT total	Finish (Shop)	1-2 coats 75 µm min DFT Total	Grey RAL 9002	225 µm DFT min.
							----- Finish (after erection) Polyurethane based color Pigment paint (solids by volume 40% min)	1 coat 25 µm min DFT		

BHARAT HEAVY ELECTRICALS LIMITED

HPVP UNIT - VISAKHAPATNAM - 530012

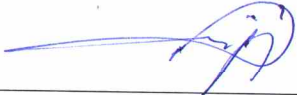


**TSGENCO, M/S. 2x600 MW SUPER CRITICAL THERMAL POWER PROJECT
STAGE-I, UDANGUDI**

1x60TPH - AUXILLIARY BOILER PACKAGE

CUSTOMER NO: HPVP S.O. No. 7842

PAINTING SCHEDULE

Prepared by	S Sankara Rao Sr Engineer (Cryo-Engg.)		Document No: HPVP S.O. No. 7842
Reviewed by	S Vijay Manager (HT-Engg.)		
Approved by	L RAJASEKHAR DGM (HT-Engg.)		
			Sheet No. 01 of 11.

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	16.11.2018	New	

SL.No	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1	Drum (Except Internals), Drum suspension 04-114, 144, 210	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μm per coat	2	International-Orange Shade No: 592 of IS 5	70
2	<u>Drum Internals, foundation materials & Dd items</u> 04-114, 210 35-010; 21-602; 24-352,603,627,642. 81-318	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=20 μm per coat	2	--	--	--	--	--	20
3	<u>Boiler supporting structures, Columns, Girders, Bracings</u> 35 – 110, 410, 510, 610 <u>Galleries, Stair-ways & inter connecting walkways</u> 36– 310 <u>ID system structures</u> 48 - 200, 335 <u>Uninsulated piping components (Spray water/condensate lines/Tanks & Vessels.</u> 80-366,473,600, 601, 612, 616, 650, 81-127, 128	Blast cleaning to SA21/2 (Near white metal) with surface profile 35-50 μm	Inorganic Ethyl zinc silicate primer DFT=75 μm /Coat	1	Epoxy based MIO Pigmented Intermediate Coat DFT=100 μm /Coat --	--	#Aliphatic acrylic Polyurethane paint to DFT=50 μm	#1	Dark admiral Grey Shade no:632 of IS5	325

To be applied at site.

SL.No.	PGMA / Description	Surface Preparation &- Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
4	<u>Components >95° C Insulated other than components in SL.No.6 &8</u> <u>Ring Headers, Down Comers, Hot air Headers outside the gas path etc.</u> 07-200,211,214; 10-170,270; 12-850, 900;18-001; 21-600, 603, 604; 24-600, 620, 624, 628; 48-207,332, 334 80-300, 345,417,420,421,446,450, 451, 453, 81-005,81-026	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30 μm per coat	2	--	--	--	--	Red oxide	60
5	<u>Components >95° C uninsulated other than components coming in gas path.</u> 09- 001,002,003; 21-800; 24-660,665,680,685; 28-220; 42-200, 300; 48-915;	Blast cleaning to SA21/2 (Near white metal) with surface profile 35-50 μm	Inorganic Ethyl Zinc Silicate Primer DFT=75 μm per Coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr II DFT=20 μm /Coat	2	Aluminium	115

SL.No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
6	Loose tubes, SH, RH & Eco.coils, 11-170 12- 901	SSPC – SP2 or SSPC – SP3 Hand tool / Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35μm per coat	1 *	--	--	--	--	Red Oxide	35
7	Components < 95° C (insulated/uninsulated) –Other than components in Sl.No.3. 07-601; 24-350, 601, 604, 625, 626, 635, 640, 641; 41- 200, 500 42-002,005,010, 152; 48-082,084,911; 95-088, 091; 97-592	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30μm per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20μm per coat	2	Smoke Grey Shade No: 692 of IS5	70

*-In lieu of dip painting, 2 coats of brush painting of Red Oxide Zinc Phosphate primer to a coating thickness of 60μ is also permitted in line with Sr.No.8.

SL. No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coat s	Shade	
8	Components >95° C coming in the gas path ,Headers, Commissioning Spares & erection Materials etc., 04-988; 06-609,614,616, 657 07-993; 12-993; 19-850; 20-988, 998; 24-987,988,989, 993; 30-215; 31-010,301; 32-010; 37-010, 810; 48-993; 97-590	SSPC- SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30μm per coat	2	--	--	--	--	Red Oxide	60
9	Hand rails and posts, ladders / rungs 36 – 820, 850 81-034 Floor Grills, Step treads 36-811	SSPC- SP8/ Pickling	Hot dip Galvanizing to a coating weight of 610 g/m ² and to a coating thickness of 87 microns. Refer Notes given below **							

Notes **: The Guard plates, Hood Ladders and Stringer channels shall be painted as per painting scheme prescribed in SI.No: 03.

PAINTING SCHEME FOR VALVES

SL.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μ m (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
10	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I DFT=20 μ m per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr 1 DFT=20 μ m per coat	1	Aluminium	40
	Forged valves	Phosphating	To a coating weight of 1500 mg per sq.ft.	--	--	--	--	--	--	--
	Soot Blower components 20-301,304,801	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50 μ m per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20 μ m per coat	2	Verdigris Green Shade No. 280 of IS5	90
	HP / LP system	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	Aluminium	40

SL.No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
11	For CLH & VLH*** PGs 07,08,12,17,19,21,24,47,48 &80 24-351,353; 80-921, 80-922, 936	Abrasive blast cleaning to Sa 2 ½ 35- 50 microns	Epoxy zinc rich primer To IS 14589 Gr. II %VS=35, (min) DFT=40 microns per coat	2	--	--	Aliphatic acrylic Poly-urethane paint %VS=40.0 (min) DFT=30.0 microns per coat	2	Phirozi Blue Shade No. 176 of IS5	140

***For components other than CLH & VLH, Painting Scheme given in Sl. No. 7 shall be followed.

NOTES:

01. Rust Preventive Coating should be given on HSFG Bolt and nut threads.
02. Machined surfaces and Retainers A & C types are to be applied with a coating of Temporary Rust Preventive oil.
03. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves 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.
04. Ground shade/colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per tender.
05. PGMAs under Sub-Vendor items are not indicated. For all bought-out and sub-vendors items including PGMAs mentioned above falling under the scope of BHEL the same scheme as for main equipment as covered in this document shall be followed.
06. The Painting Scheme is valid for only Customer No: HPVP SO:7842 of Yadadri- 1X60TPH auxiliary boiler.
07. No painting is required for Stainless Steel, Non-ferrous & galvanized components.
08. Wherever inside surfaces of components under PGMA 48 – XXX & other PGs, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.
09. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be removed by suitable solvents / heating to 350 –400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).
10. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods of <25mm/tubes/drain pipes are used, power tool / hand tool cleaning to SSPC- SP3 / SP2 shall be followed and the painting shall be done as described in Sl. No: 08.
11. For all commissioning components-erection materials (xx-993) two coats of Red Oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.
12. Touch-up painting of damaged areas shall be carried out as per clause applicable painting scheme.
13. All components covered under different PGMA's are to be painted In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.
14. For very small components like clamps etc. Sl. no.8 shall be followed.
15. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer.
16. All temporary/ transport structures (PGMAs:35-391, 392, 393), are to be painted with one coat of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 30 µ/coat and 2 coats of Synthetic Enamel finish paint to IS 2932 –**Shade Yellow**-to a DFT of 20 µ/coat, Shade: Yellow-Shade no:356 of IS-5. The total DFT shall be 70 µ and these are to be cut & removed at site after erection. (It excludes components covered under Sr.No. 3 & 7 of description table)
17. For internal protection of Pipes, tubes, headers and other pressure parts, Volatile Corrosion Inhibitor (VCI) pellets shall be put (after sponge testing/draining/ or drying) and subsequently end capped. The dosage of VCI pellets shall be approximately 100 g/cu.m. For tubes typically 4 – 5 tablets per end are to be put. For C & I items the dosage of self-indicating Silica Gel (colourless) shall be 250 g/ cu.m. (About 2 to 3 bags weighing approximately 100 grams each). VCI pellets shall not be used for stainless steel components and its composite associates.
18. All threaded components of spring assemblies and turnbuckles shall be galvanized and achromatized to 15 microns' minimum thickness.
19. Hand Rails, step threads of PGMA under SL NO:3 need to be galvanised in line with the scheme for Hand Rails (ie SL No:9).
20. In side surface of fabricated structure (Eg: Box type column) shall be Painted with two coats of Red oxide zinc Phosphate Primer Paint during fit up stage.

Painting Scheme – Details for procurement & application purposes

Sl.No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns (min) per coat	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Aliphatic acrylic polyurethane paint to IS 13213	10	2	40	30	Phirozi – Blue.	176	Spray	24
2	Heat resistant Aluminium paint to IS 13183 Grade I/II	10	1	-	20	--	--	Brush / Spray	24
3	Red oxide zinc phosphate primer paint to IS 12744	10	1	As per IS 12744	30	Red Oxide	--	Brush / Spray	12
4	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	--	Red Oxide	---	Dip	12
5	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	As per IS 2932	15-20	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
6	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	--	Amber	--	--	12
7	Epoxy Zinc rich primer to IS14589 Gr.II	8	2	35	40	Grey	--	Spray	24
8	De Oxaluminat weldable primer – colour Aluminum	10	1	--	--	Aluminum	--	Brush/ spray	24
9	HB Chlorinated Rubber Based Zinc Phosphate Primer-Colour Grey	8	1	40	50	Grey	--	Brush / Spray	12

Brush painting is accepted, if recommended by the Paint suppliers. The covering capacity of paints specified is only approximate. The paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. ** Values are indicative.

Painting of Damaged Areas

(Areas where the paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion and where the steel has rusted appreciably, should be repainted as follows)

Sl.No.	Components	Surface Preparation	Primer coat		Intermediate coat		Finish coat			Total DFT μm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
2	Paint damaged components fall under Sl.no: 12	Power tool cleaning to bare metal	One coat of Epoxy zinc rich primer to IS 14589 Grade II to a DFT of 40 microns	2	--	--	As given in scheme	2	As given in scheme	140
3	Paint damaged components fall under Sl.no: 1, 2,3,4,5,6,7,8,11.	Power tool cleaning to bare metal	As given in scheme	As given in scheme	--	--	As given in scheme	As given in scheme	As given in scheme	As given in scheme



PSSR

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page 1 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART- A: PLAN/ REVIEW OF WORK FOR THE MONTH OF

Date of Plan/ Review.....

SN.	Description of Work	Unit of Measur- ement	Unit Rate	Planned		Cumulative Shortfall attributable to contractor upto last month (Refer Note 1)		Achieved		Shortfall attributable to BHEL w.r.t Plan (as per Col. 3 of Part- D)		Cumulative Shortfall attributable to Contractor upto & including this month		REMARKS (Reasons for Shortfall attributable to Contractor. Supporting documents to be kept as record.)
				(QTY Planned for the month as per Part –C of last month)										
(a)	(b)	(c)	(d)	A		B		C		D		E=A+B-C-D		
				Phy.	Financial	Phy	Financial	Phy.	Financial	Phy.	Financial	Phy.	Financial	
	Value of Other Items not mentioned above but planned to be executed in this month													
Total					ΣA		ΣB		ΣC		ΣD		ΣE	

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

 PSSR	MONTHLY PLAN & REVIEW WITH CONTRACTOR	Page 2 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART- A: Contd.....

Note 1: In addition to the work planned as per Col. 'A', Contractor shall also make full efforts to minimize the 'Cumulative shortfall attributable to contractor upto the month' as mentioned in Col. 'B' by enhancing its resources, so as to achieve the completion of activities as per agreed schedule. In case contractor is not able to execute the entire shortfall, then BHEL 'Engineer in-charge', shall decide the priority of work to be executed and it shall be binding on the contractor.

Note 2: Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month = $[(\Sigma E - \Sigma B) / (\Sigma A - \Sigma D)] \times 100$
 In case, $(\Sigma E - \Sigma B)$ is negative, then it shall be treated as zero percent."

Note 3: Form 14 should include all items being planned in the current month, and all items against which shortfall was attributable to contractor till previous month. However, for practical reason, if it is not possible to mention some of the items in Form-14 being planned to be executed in this month, then also value of such items shall necessarily be included in calculation of Total Value.

Note 4: In case reason for shortfall attributable to contractor is w.r.t. T&P and Manpower, it should be in conformity with Part B1 and B2.

BHEL
 (Sign with name, designation and date)

CONTRACTOR
 (Sign with name, designation and date)



PSSR

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page 3 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – B-1: PLAN/REVIEW OF DEPLOYMENT OF MAJOR T&Ps FOR THE MONTH OF

Date of Plan/ Review.....

CONTRACTOR'S SCOPE: -

SN.	PLAN				DEPLOYMENT STATUS			
	Major T&P to be deployed as per work planned for the month	QTY	Deployment Period (in days)	Weightage assigned to planned T&P (in fraction such that $\Sigma C = 1$)	Actual Deployed Quantity	Actual Deployment Period (in days)	Weighted T&P Deployed	REMARKS (Works affected due to non-deployment of T&Ps)
		A	B	C	D	E	$F = (C \times D \times E) / (A \times B)$	

Note: In case, $E > B$, it shall be considered as $E = B$. Similarly, in case $D > A$, it shall be considered as $D = A$.Percentage of T&P Deployed = $\Sigma F \times 100$ **BHEL SCOPE: -**

SN.	PLAN			DEPLOYMENT STATUS			
	Major T&P to be deployed as per work planned for the month	QTY	Deployment Period (in days)	Actual Deployed Quantity	Actual Deployment Period (in days)	REMARKS (Works affected due to non-deployment of T&Ps)	

BHEL

(Sign with name, designation and date)

CONTRACTOR

(Sign with name, designation and date)



PSSR

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page 4 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – B-2: PLAN/ REVIEW OF DEPLOYMENT OF MANPOWER FOR THE MONTH OF

Date of Plan/ Review.....

CONTRACTOR'S SCOPE: -

SN.	Area of Work	Category of Labour	No. of Labour required as per category	Deployment Period (in days)	No. of Labour actually deployed	Actual Deployment Period (in days)	REMARKS (Works affected due to non-availability of labour)
			A	B	C	D	

$$\text{Percentage of Manpower Deployed} = 100 \times \frac{\sum(C \times D)}{\sum(A \times B)}$$

BHEL

(Sign with name, designation and date)

CONTRACTOR

(Sign with name, designation and date)



PSSR

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page 5 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – C: PLAN(PHYSICAL) FOR THE NEXT MONTH i.e.

Date of Plan

SN.	Description of work	Original Planned Quantity	Planned Quantity (excluding shortfalls attributable to contractor till date)	Unit of Measurement	T&Ps Required				Manpower Required		REMARKS (Reasons for difference in Original Planned Quantity w.r.t. Planned quantity to be given)
					Contractor Scope		BHEL Scope		Category of Labour	No. of Labour required as per Category	
					Major T&P to be deployed as per work planned for the month	Quantity	Major T&P to be deployed as per work planned for the month	Quantity			

Note 1: Planned quantity should be based on available/ expected fronts/ inputs in the next month

Note 2: “Original Planned Quantity” shall be as per latest jointly agreed programme between BHEL and Contractor before commencement of work or at the time of latest Time Extension, as the case may be.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)



PSSR

MONTHLY PLAN & REVIEW WITH CONTRACTOR

Page 6 of 6

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – D: REASONS FOR SHORTFALL ATTRIBUTABLE TO BHEL IN RESPECT OF PLAN FOR THE MONTH.....

SN.	Description of Work (from Part-A)	Quantities Affected		Reasons for Shortfall attributable to BHEL	Agency responsible for reasons for Shortfall	Remarks (Supporting Documents in respect of agency responsible)
		(Physical Quantity)	Unit of Measu- rement			
1	2	3	4	5	6	7

Note1: Reasons for shortfall shall include non-availability of fronts/ drawings/ materials/ T&P (BHEL Scope)/ clearances etc. and other hindrances for which contractor is not responsible.

Note2: Agency responsible may be BHEL Site/ MUs/ Design Centre/ BHEL Customer/ other Contractors etc.

BHEL

(Sign with name, designation and date)

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 1 of 6

Project	Vendor	Score Obtained	Max Score	Package/Unit	Supporting Documents
Sl. No.	Parameter for Measurement	Classification	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#1.01	Cumulative number of days in the month, the nominated Quality Officer or his authorised nominee was not available	QUALITY	1.5	Quality Officer or his authorised nominee should be available for all the days of working at site	Daily Log Book entry/Incident Registers/letter references
#1.02	Number of instances of non-compliance wrt FQP, Standard Drawings, Specifications, E&C Manuals etc.	QUALITY	1.5	No deviation from FQP, Standard Drawings, Specifications, E&C Manuals etc. is allowed without BHEL Engineer's approval.	Daily Log Book entry/Incident Registers/letter references
#1.03	Percentage submission of test certificates for batches of welding electrodes, cement, sand, aggregate, consumable, Paints etc. as applicable for this month OR In case of MM & MH package, monthly checks for Storage/Preservation of material.	QUALITY	1	Submission of 100% Test certificates for materials as per FQP is mandatory. MM & MH package: Storage/Preservation as per manual/procedure.	Daily Log Book entry/Incident Registers/letter references
#1.04	Number of incidences of improper storage & preservation (not in accordance to the guidelines of BHEL MUs or approved FQP) of materials, consumables (viz. gases, welding electrodes & fluxes, fuel etc.) & bought-out items (paints, fasteners etc.) under the custody of the contractor	QUALITY	1	Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#1.05	Rework/ Rejection instances in a month necessitated due to deviation from Standard Drawings /Specifications /Manuals /E&C procedures /FQPs or due to Poor Workmanship by contractor	QUALITY	2	Reworks/ Rejection should be as minimum as possible. Total number of reworks/ rejections due to reasons attributable to contractor.	Daily Log Book entry/Incident Registers/letter references
#1.06	Delay in preparation & submission of signed protocols / log sheets / site register / NDT test reports as per approved FQP/ Qualified Welder List along with photocopies of Welder ID cards / Welder Performance Evaluation records etc. in the month OR in case of MM / MH package reconciliation statement / verification report.	QUALITY	1	Within 2 days of measurements taken or within first 3 working days of next month, as advised by BHEL Engineer	Daily Log Book entry/Incident Registers/letter references
#1.07	Number of instances for Major equipment/product failure due to negligence/improper work/poor workmanship by contractor	QUALITY	1	No such event should happen	Daily Log Book entry/Incident Registers/letter references
#1.08	Total number of complaints received in the month on the quality of finish / aesthetics	QUALITY	1	Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 2 of 6

Project	Sl. No.	Parameter for Measurement	Vendor Classification	Score		Package/Unit	
				Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#2.01		Cumulative number of days of delay in submission of Plan FOR THE MONTH supported by deployment plan of Major T&Ps and Manpower (as per Form F-14) and relevant construction/layout drawings - like A4 plan / elevation views of plan status for structures / pressure parts/Civil Works, Piping isometrics for piping, Layout / PID / System reference sketch, Unloading / storage plans etc.as applicable.	PERFORMANCE	5		Number of days delayed from second working day of the month	Daily Log Book entry/Incident Registers/letter references
#2.02		Percentage of timely submission of Daily Reports for Progress of work, Resources, Consumables etc.	PERFORMANCE	1.5		Percentage of timely submission of daily reports/ Scheduled date is successive next day for each day	Daily Log Book entry/Incident Registers/letter references
#2.03		Number of days delayed for submission of FQP log sheets / protocols / Monthly Progress Reports for the work executed during the month under measurement	PERFORMANCE	1.5		Number of days delayed/Scheduled date is first 2 working days of next month	Daily Log Book entry/Incident Registers/letter references
#2.04		Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month as per Form-14	PERFORMANCE	35		As per Part-A of Form-14	Progress review formats
#2.05		Number of days delayed in submission of Running bills with complete supporting documents (including updated reconciliation statement of BHEL issued material) for the month	PERFORMANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#2.06		Number of times the Top Management of contractor did not respond to critical issues of site, for the month	PERFORMANCE	1		Total number of instances	Daily Log Book entry/Incident Registers/letter references
#2.07		Cumulative number of days in the month the works were stopped / refused on interpretation of contract clauses/scope due to tendency of taking undue advantage by interpreting contract clauses in their favour	PERFORMANCE	2		Cumulative number of days lost	Daily Log Book entry/Incident Registers/letter references
#2.08		Number of times rework was refused by contractor	PERFORMANCE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references



Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 3 of 6

Project	Vendor	Max Score	Score Obtained	Measurement Key/Scheduled date	Package/Unit	Supporting Documents
Sl. No.	Parameter for Measurement	Classification				
#2.09	Cumulative number of days in the month recording / logging was not done in daily log / history register / hindrance register / soft form in a PC maintained at BHEL Site Office	PERFORMANCE	1	Cumulative number of days recording or logging was not done / all days of the month		Daily Log Book entry/Incident Registers/letter references
#3.01	Percentage of Manpower Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7	As per Part-B2 of Form-14		Daily Log Book entry/Incident Registers/letter references
#3.02	Percentage of T&P Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7	As per Part-B1 of Form-14		Daily Log Book entry/Incident Registers/letter references
#3.03	Cumulative number of major instances in the month hampering / affecting progress of work due to breakdown or non-availability of major T&P and MME for the work, under the scope of Contractor	RESOURCES	3	Cumulative number of instances		Daily Log Book entry/Incident Registers/letter references
#3.04	Cumulative number of major instances in the month hampering / affecting progress of work due to non-availability of Consumables/ use of improper consumables under the scope of contractor	RESOURCES	3	Cumulative number of instances		Daily Log Book entry/Incident Registers/letter references
#4.01	Number of non-compliances during the month for Statutory requirements like validity of Labour Licence, Insurance Policy, Labour Insurance, PF, BOCW Compliance etc. and any other applicable laws/ Regulation, Electrical Licence, T&P fitness certificate, Contractors' All Risk Policy etc. as applicable	SITE INFRASTRUCTURE & SERVICE	1	Total number of non-compliances		Daily Log Book entry/Incident Registers/letter references
#4.02	Cumulative number of days in a month poor illumination is reported at storage area, erection area, pre-assembly area and other designated areas by BHEL site.	SITE INFRASTRUCTURE & SERVICE	0.5	Total number of non-compliances/random checks		Daily Log Book entry/Incident Registers/letter references
#4.03	Cumulative number of days of non-availability of well-maintained toilets facilities for workers (separate for men and women) and non-availability of potable drinking water stations for workers in specified areas.	SITE INFRASTRUCTURE & SERVICE	1	Total number of non-compliances/random checks		Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

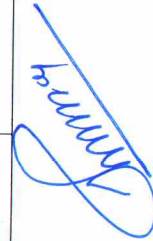
Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 4 of 6

Project	Vendor	Max Score	Score Obtained	Package/Unit	Supporting Documents
Sl. No.	Parameter for Measurement	Classification	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#4.04	Total number of instances in the month, Housekeeping NOT attended to in spite of instructions by BHEL -i.e. removal / disposal of surplus earth / debris / scrap / unused / surplus steel cable drums / other electrical items / surplus steel items / packing materials, thrown out scrap like weld butts, cotton waste etc. from the working area to identified locations	SITE INFRASTRUCTURE & SERVICE	2	Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.05	Total number of instances in a month, Site Office with reasonably good facilities including enough nos. of computers and printers etc. for use by office and supporting staff was not made available/maintained.	SITE INFRASTRUCTURE & SERVICE	0.5	No discrepancy during regular or surprise visits	Photograph and report of the Engineer
#5.01	Number of days delayed in making labour payments for the last month	SITE FINANCE	2	Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#5.02	Number of complaints from labour/ sub supplier/ sub-contractor for non-receipt of payments from contractor	SITE FINANCE	1.5	Total number of complaints or reporting	Daily Log Book entry/Incident Registers/letter references
#5.03	Number of times the site operations were hampered for want of funds at the disposal of site-in-charge.	SITE FINANCE	1.5	Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.01	Cumulative number of days in a month the nominated Safety Officer was not available	HSE & SA	1	Safety Officer should be available for all the days	Daily Log Book entry/Incident Registers/letter references
#6.02	Shortfall in number of weekly safety meetings in the month conducted or attended by the Safety Officer	HSE & SA	0.5	Safety meetings to be held every week	Copy of Minutes of meeting
#6.03	Level of compliance w.r.t decisions taken in previous Safety meetings	HSE & SA	0.5	Number of consolidated issues discussed in Safety meetings	Copy of Minutes of meeting, Non-compliance intimation documents from BHEL site
#6.04	Delay in submission of monthly report on safety (including electrical safety for equipment & personnel etc.) in the prescribed form	HSE & SA	1	Number of days delayed/Scheduled date is third working day of next month	Daily Log Book entry/Incident Registers/letter references
#6.05	Number of days taken for lodging FIRs from date of occurrence/notice of incident of theft / accident etc.	HSE & SA	0.5	Number of days delayed/Scheduled date is within 24 Hrs of occurrence/notice of incidence	Copy of FIR lodged by Contractor



Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 5 of 6

Project Sl. No.	Parameter for Measurement	Vendor Classification	Score		Package/Unit	Supporting Documents
			Max Score	Score Obtained		
#6.06	Number of times written (email, letters etc.) warning issued for non-availability/ use of improper Fall protection and rescue arrangement as lifeline, fall arrestors, safety net, hand-railings, covered floors, man-basket, rescue basket & kit etc. by the contractor	HSE & SA	2		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.07	Number of times punitive fines imposed for unsafe practices as per contract like non-availability/use of PPEs as safety shoes, helmets, goggles, gloves, lifeline, safety belts etc.	HSE & SA	1		Total number of non-compliances	Non-compliance intimation documents from BHEL site
#6.08	Percentage compliance to Emergency preparedness and response plan: Portable Fire-extinguishers, Buckets, Fire-wardens, display of emergency numbers, mock-drills, Hazard Identification and Risk Assessment(HIRA) etc.	HSE & SA	1		Compliance should be 100% as per HSE Plan or as finalized in Safety Meetings	Non-compliance intimation documents from BHEL site
#6.09	Number of times the agency has defaulted on display of safety posters / safety slogans / safety barriers/emergency numbers etc. in identified areas	HSE & SA	0.5		Total number of instances	Non-compliance intimation documents from BHEL site
#6.10	Non compliances observed during HSE and Safety Audit	HSE & SA	0.5		Total number of non-compliances	Non-compliance intimation documents from BHEL site, Audit Reports
#6.11	Cumulative number of days in the month, non-availability of First Aid Kit, First Aider & Emergency Vehicles/Ambulance.	HSE & SA	0.5		Cumulative number of days	Non-compliance intimation documents from BHEL site
#6.12	Number of days taken for submission of Root Cause analysis (RCA) for the accident from the cut-off date intimated by BHEL for submission of RCA	HSE & SA	0.5		Number of days delayed/Scheduled date is cut-off date intimated by BHEL	Daily Log Book entry/Incident Registers/letter references
#6.13	Non conductance of training (induction, job specific, height work etc.), tool box meeting and health check-up as per Contract requirements	HSE & SA	0.5		Number of incidences of non-conductance during the month	Daily Log Book entry/Incident Registers/letter references
Total			100			



Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 6 of 6

Project		Vendor	Package/Unit		Supporting Documents
Sl. No.	Parameter for Measurement	Classification	Max Score	Measurement Key/Scheduled date	
	Less Deduction in Score Due to Major Accidents (Fatal, Permanent Disability or bodily injury by which person injured is prevented to resume to work within 48 hours or more after accident,, Major Damage to Equipment etc.) attributable to the contractor @ 3 points/ accident			Score Obtained	
	Less Deduction in Score Due to Minor Accidents attributable to the contractor @ 1 point/ accident				
	Less Deduction in Score Due to not Maintaining of Labour Colony (if applicable) as per BHEL HSE policy @2 points in a month on verification any day				
Final Score					

Performance Score Summary for the Month	Total Score	Score Obtained
QUALITY	10	
PERFORMANCE	50	
RESOURCES	20	
SITE INFRASTRUCTURE & SERVICE	5	
SITE FINANCE	5	
HSE & SA	10	
OTHERS (deductions if any)	0	
TOTAL	100	

Note:

- 1) It is only indicative and shall be as per the online format issued by BHEL time to time.
- 2) No request will be entertained after specified date of current month w.r.t. changes requested in the scores of immediate previous month.



Name and Signature of BHEL Package In-charge

Name and Signature of Contractor



BHARAT HEAVY ELECTRICALS LIMITED

(A Govt. of India Undertaking)
Power Sector (HQ)- Management Services

Revision of Contractor Performance Evaluation Format (Form F-15 Rev-01)

No.PA.MI.GCC.2018.001
Dated: 31st Aug' 2018

Assessment of Contractor's performance in PS-Regions, is done through online Contractor Performance Evaluation System (CPES) Form F-14 of "Uniform Procedures for Subcontracting of Installation Works at Power Sector Regions" has been revised vide release note dated 28th Aug'2018. To align the existing 'Contractor Performance Evaluation Format' (Form F-15 Rev-01) with revised Form F-14 (Rev-01), changes are proposed in parameters sl. no. 2.04, 3.01 & 3.02 of 'Contractor Performance Evaluation Format' (Form F-15 Rev-01).

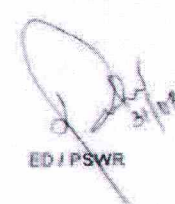
Revised recommended CPES Format parameters sl. no. 2.04, 3.01 & 3.02, signed by all SCT Heads of PS-Regions and PS-MSX, is attached.

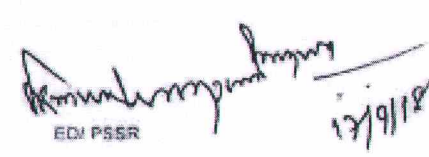
Submitted for approval please.


P.K. Saxena
GM (PSHQ-MSX)


ED/PSNR


ED/PSER


ED/PSWR


ED/PSSR

13/9/18

Contractor Performance Evaluation System

(Revision in 'Contractor Performance Evaluation Format Rev 01'(F-15) in line with 'Form F-14 Rev 01')

Date 30th Aug 2018

Subsequent to revision of Form F-14, 'Contractor Performance Evaluation Format Rev 01'(F-15) needs to be revised for alignment with F-14. Following changes are proposed in existing 'Contractor Performance Evaluation Format Rev 01':

SL	Parameter for Measurement	Level of achievement					Measurement Key / Scheduled date	Supporting Documents	Score
		0	1	2	3	4	5		
2.04	Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month as per Form-14	>50%	> 40% ≤50%	> 30% ≤ 40%	> 20% ≤ 30%	> 10% ≤ 20%	≤ 10%	As per Part-A of Form-14	35
3.01	Percentage of Manpower Deployed w.r.t. Plan for the month as per Form-14.	< 80%	≥80% < 85%	≥85% < 90%	≥90% < 95%	≥95% < 100%	100%	As per Part-B2 of Form-14	7
3.02	Percentage of T&P Deployed w.r.t. Plan for the month as per Form-14.	< 80%	≥80% < 85%	≥85% < 90%	≥90% < 95%	≥95% < 100%	100%	Daily Log Book entry/Incident Registers/letter references	7

V.K. Gupta
V.K. Gupta
AGM(SCP PSNR)

Subrata Sen
Subrata Sen
AGM(SCT PSER)

P.R. Chawla
P.R. Chawla
AGM(SCT PSWR)

P. K. Saxena
P. K. Saxena
AGM(SCT PSSR)

GM(MSX PSHQ)

Contractor Performance Evaluation System

(Revision in 'Contractor Performance Evaluation Format Rev 01'(F-15) in line with 'Form F-14 Rev 01')

Date 30th Aug 2018

Subsequent to revision of Form F-14, 'Contractor Performance Evaluation Format Rev 01'(F-15) needs to be revised for alignment with F-14. Following changes are proposed in existing 'Contractor Performance Evaluation Format Rev 01':

SL	Parameter for Measurement	Level of achievement					Measurement Key / Scheduled date	Supporting Documents	Score
		0	1	2	3	4	5		
2.04	Percentage Shortfall attributable to contractor w.r.t. 'Plan - Shortfall attributable to BHEL' for the month as per Form-14	>50%	> 40% ≤50%	> 30% ≤ 40%	> 20% ≤ 30%	> 10% ≤ 20%	≤ 10%	Progress review formats	35
3.01	Percentage of Manpower Deployed w.r.t. Plan for the month as per Form-14.	< 80%	≥80% < 85%	≥85% < 90%	≥90% < 95%	≥95% < 100%	100%	Daily Log Book entry/Incident Registers/letter references	7
3.02	Percentage of T&P Deployed w.r.t. Plan for the month as per Form-14.	< 80%	≥80% < 85%	≥85% < 90%	≥90% < 95%	≥95% < 100%	100%		7

Subrata Sen
V.K. Gupta
30/08/18
AGM(SCP PSNR)

Subrata Sen
AGM(SCT PSER)

P.R. Chivarkar
AGM(SCT PSWR)

Sandipan Biswas
31/08/2018
Sandipan Biswas
AGM(SCT PSSR)

P. K. Saxena
GM(MSX PSHQ)

PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS

1. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided herein:
2. The party desirous of resorting to Conciliation shall send an invitation/notice in writing to the other party to conciliate specifying all points of Disputes with details of the amount claimed. The party concerned shall not raise any new issue thereafter. Parties shall also not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till the conclusion of the Conciliation proceedings. If BHEL is to initiate Conciliation, then, the invitation to Conciliate shall be extended to the concerned Stakeholder in **Format 7** hereto. Where the stakeholder is to initiate the Conciliation, the notice for initiation of Conciliation shall be sent in **Format-8** hereto.
3. The party receiving the invitation/notice for Conciliation shall within 30 days of receipt of the notice of Conciliation intimate its consent for Conciliation along with its counter-claims, if any.
4. The Conciliation in a matter involving claim or counter-claim (whichever is higher) up to Rs 5 crores shall be carried out by sole Conciliator nominated by BHEL while in a matter involving claim or counter-claim (whichever is higher) of more than Rs 5 crores Conciliation shall be carried out by 3 Conciliators nominated by BHEL. The appointment of Conciliator(s) shall be completed and communicated by the concerned Department/Group of BHEL Unit/Division/Region/Business Group to the other party and the Conciliator(s) within 30 days from the date of acceptance of the invitation to conciliate by the concerned party in the **Format-9**. The details of the Claim, and counter-claim, if any, shall be intimated to the Conciliator(s) simultaneously in **Format-5**.
5. The Parties shall be represented by only their duly authorized in-house executives/officers and neither Party shall be represented by a Lawyer.
6. The first meeting of the IEC shall be convened by the IEC by sending appropriate communication/notice to both the parties as soon as possible but not later than 30 days from the date of his/their appointment. The hearings in the Conciliation proceeding shall ordinarily be concluded within two (2) months and, in exceptional cases where parties have expressed willingness to settle the matter or there exists possibility of settlement in the matter, the proceedings may be extended by the IEC by a maximum of further 2 months with the consent of the Parties subject to cogent reasons being recorded in writing.
7. The IEC shall thereafter formulate recommendations for settlement of the Disputes supported by reasons at the earliest but in any case within 15 days from the date of conclusion of the last hearing. The recommendations so formulated along with the reasons shall be furnished by the IEC to both the Parties at the

earliest but in any case within 1 month from the date of conclusion of the last hearing.

8. Response/modifications/suggestions of the Parties on the recommendations of the IEC are to be submitted to the IEC within time limit stipulated by the IEC but not more than 15 days from the date of receipt of the recommendations from the IEC.
9. In the event, upon consideration, further review of the recommendations is considered necessary, whether by BHEL or by the other Party, then, the matter can be remitted back to the IEC with request to reconsider the same in light of the issues projected by either/both the Parties and to submit its recommendations thereon within the following 15 days from the date of remitting of the case by either of the Parties.
10. Upon the recommendations by the Parties, with or without modifications, as considered necessary, the IEC shall be called upon to draw up the Draft Settlement Agreement in terms of the recommendations.
11. When a consensus can be arrived at between the parties only in regard to any one or some of the issues referred for Conciliation the draft Settlement Agreement shall be accordingly formulated in regard to the said Issue(s), and the said Settlement Agreement, if signed, by the parties, shall be valid only for the said issues. As regards the balance issues not settled, the parties may seek to resolve them further as per terms and conditions provided in the contract.
12. In case no settlement can be reached between the parties, the IEC shall by a written declaration, pronounce that the Conciliation between the parties has failed and is accordingly terminated.
13. Unless the Conciliation proceedings are terminated in terms of para 22 (b), (c) & (d) herein below, the IEC shall forward his/its recommendations as to possible terms of settlement within one (1) month from the date of last hearing. The date of first hearing of Conciliation shall be the starting date for calculating the period of 2 months.
14. In case of 3 members IEC, 2 members of IEC present will constitute a valid quorum for IEC and meeting can take place to proceed in the matter after seeking consent from the member who is not available. If necessary, videoconferencing may be arranged for facilitating participation of the members. However, the IEC recommendations will be signed by all members. Where there is more than one (1) Conciliator, as a general rule they shall act jointly. In the event of differences between the Members of IEC, the decision/recommendations of the majority of the Members of IEC shall prevail and be construed as the recommendation of the IEC.
15. The Draft Settlement Agreement prepared by the IEC in terms of the consensus arrived at during the Conciliation proceedings between the Parties shall be given

by the IEC to both the parties for putting up for approval of their respective Competent Authority.

16. Before submitting the draft settlement agreement to BHEL's Competent Authority viz. the Board Level Committee on Alternative Dispute Resolution (BLCADR) for approval, concurrence of the other party's Competent Authority to the draft settlement agreement shall be obtained by the other party and informed to BHEL within 15 days of receipt of the final draft settlement agreement by it. Upon approval by the Competent Authority, the Settlement Agreement would thereafter be signed by the authorized representatives of both the Parties and authenticated by the members of the IEC.
17. In case the Draft Settlement Agreement is rejected by the Competent Authority of BHEL or the other Party, the Conciliation proceedings would stand terminated.
18. A Settlement Agreement shall contain a statement to the effect that each of the person(s) signing thereto (i) is fully authorized by the respective Party(ies) he/she represents, (ii) has fully understood the contents of the same and (iii) is signing on the same out of complete freewill and consent, without any pressure, undue influence.
19. The Settlement Agreement shall thereafter have the same legal status and effect as an arbitration award on agreed terms on the substance of the dispute rendered by an arbitral tribunal passed under section 30 of the Arbitration and Conciliation Act, 1996.
20. Acceptance of the Draft Settlement Agreement/recommendations of the Conciliator and/or signing of the Settlement Agreement by BHEL shall however, be subject to withdrawal/closure of any arbitral and/or judicial proceedings initiated by the concerned Party in regard to such settled issues.
21. Unless otherwise provided for in the agreement, contract or the Memorandum of Understanding, as the case may be, in the event of likelihood of prolonged absence of the Conciliator or any member of IEC, for any reason/incapacity, the Competent Authority/Head of Unit/Division/Region/Business Group of BHEL may substitute the Conciliator or such member at any stage of the proceedings. Upon appointment of the substitute Conciliator(s), such reconstituted IEC may, with the consent of the Parties, proceed with further Conciliation into the matter either de-novo or from the stage already reached by the previous IEC before the substitution.
22. The proceedings of Conciliation under this Scheme may be terminated as follows:
 - a. On the date of signing of the Settlement agreement by the Parties; or,
 - b. By a written declaration of the IEC, after consultation with the parties, to the effect that further efforts at conciliation are no longer justified, on the date of the declaration; or,

- c. By a written declaration of the Parties addressed to the IEC to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- d. By a written declaration of a Party to the other Party and the IEC, if appointed, to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- e. On rejection of the Draft Settlement Agreement by the Competent Authority of BHEL or the other Party.

23. The Conciliator(s) shall be entitled to following fees and facilities:

SI No	Particulars	Amount
1	Sitting fees	Each Member shall be paid a Lump Sum fee of Rs 75,000/- for the whole case payable in terms of paragraph No. 27 herein below.
2	Towards drafting of settlement agreement	In cases involving claim and/or counter-claim of up to Rs 5crores. Rs 50,000/- (Sole Conciliator) In cases involving claim and/or counter-claim of exceeding Rs 5 crores but less than Rs 10 crores. Rs 75,000 (per Conciliator) In cases involving claim and/or counter-claim of more than Rs 10 crores. Rs 1,00,000/- (per Conciliator) Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on the, Signing of the Settlement Agreement after approval of the Competent Authority or Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.
3	Secretarial expenses	Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC. Where Conciliation is by multi member Conciliators – Rs 30,000/- (one time)- to be paid to the IEC

SI No	Particulars	Amount
4	Travel and transportation and stay at outstation Retired Senior Officials of other Public Sector Undertakings (pay scale wise equivalent to or more than E-8 level of BHEL)	As per entitlement of the equivalent officer (pay scale wise) in BHEL.
	Others	As per the extant entitlement of whole time Functional Directors in BHEL. Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.
5	Venue for meeting	Unless otherwise agreed in the agreement, contract or the Memorandum of Understanding, as the case may be, the venue/seat of proceedings shall be the location of the concerned Unit / Division / Region / Business Group of BHEL. Without prejudice to the seat/venue of the Conciliation being at the location of concerned BHEL Unit / Division / Region / Business Group, the IEC after consulting the Parties may decide to hold the proceedings at any other place / venue to facilitate the proceedings. Unless, Parties agree to conduct Conciliation at BHEL premises, the venue is to be arranged by either Party alternately.

24. The parties will bear their own costs including cost of presenting their cases/evidence/witness(es)/expert(s) on their behalf. The parties agree to rely upon documentary evidence in support of their claims and not to bring any oral evidence in IEC proceedings.
25. If any witness(es) or expert(s) is/are, with the consent of the parties, called upon to appear at the instance of the IEC in connection with the matter, then, the costs towards such witness(es)/expert(s) shall be determined by the IEC with the consent of the Parties and the cost so determined shall be borne equally by the Parties.
26. The other expenditures/costs in connection with the Conciliation proceedings as well as the IEC's fees and expenses shall be shared by the Parties equally.
27. Out of the lump sum fees of Rs 75,000/- for Sitting Fees, 50% shall be payable after the first meeting of the IEC and the remaining 50% of the Sitting Fees shall

be payable only after termination of the conciliation proceedings in terms of para 22 hereinabove.

28. The travelling, transportation and stay at outstation shall be arranged by concerned Unit as per entitlements as per Serial No. 4 of the Table at para 23 above, and in case such arrangements are not made by the BHEL Unit, the same shall be reimbursed to the IEC on actuals limited to their entitlement as per Serial No. 4 of the Table at Para 23 above against supporting documents. The IEC Member(s) shall submit necessary invoice for claiming the fees/reimbursements.
29. The Parties shall keep confidential all matters relating to the conciliation proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of its implementation and enforcement or as required by or under a law or as per directions of a Court/Governmental authority/ regulatory body, as the case may be.
30. The Parties shall not rely upon or introduce as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the Disputes that is the subject of the Conciliation proceedings:
 - a. Views expressed or suggestions made by the other party in respect of a possible settlement of the Disputes;
 - b. admissions made by the other party in the course of the Conciliator proceedings;
 - c. proposals made by the Conciliator;
 - d. The fact that the other Party had indicated his willingness to accept a proposal for settlement made by the Conciliator.
31. The Parties shall not present the Conciliator(s) as witness in any Alternative Dispute Resolution or Judicial proceedings in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.
32. None of the Conciliators shall act as an arbitrator or as a representative or counsel of a Party in any arbitral or judicial proceeding in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.
33. The Parties shall not initiate, during the Conciliation proceedings, any arbitral or judicial proceedings in respect of a Disputes that is the subject matter of the Conciliation proceedings except that a Party may initiate arbitral or judicial proceedings where, in his opinion, such proceedings are necessary for preserving his rights including for preventing expiry of period of limitation. Unless terminated as per the provisions of this Scheme, the Conciliation proceedings shall continue notwithstanding the commencement of the arbitral or judicial proceedings and the arbitral or judicial proceedings shall be primarily for the purpose of preserving rights including preventing expiry of period of limitation.
34. The official language of Conciliation proceedings under this Scheme shall be English unless the Parties agree to some other language.

**STATEMENT OF CLAIMS/COUNTER CLAIMS TO BE SUBMITTED TO THE IEC
BY BOTH THE PARTIES**

1. Chronology of the Disputes
2. Brief of the Contract/MoU/Agreement/LOI/LOA
3. Brief history of the Disputes:
4. Issues:
5. Details of Claim(s)/Counter Claim(s):

Sl. No.	Description of claim(s)/Counter Claim	Amount (in INR)Or currency applicable in the contract	Relevant contract clause

6. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract)

Note– *The Statement of Claims/Counter Claims may ideally be restricted to maximum limit of 20 pages. Relevant documents may be compiled and submitted along with the statement of Claims/Counter Claims. The statement of Claims/Counter Claims is to be submitted to all IEC members and to the other party by post as well as by email.*

FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY BHEL FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

M/s. (Stakeholder's name)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE CONTRACT BY BHEL**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which arise out of the above- referred Contract/MoU/Agreement/LOI/LOA are reproduced hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/LOA for referring disputes to conciliation.

In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby seek your consent to refer the matter to Conciliation by Independent Experts Committee to be appointed by BHEL. You are invited to provide your consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which you might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA.

Please note that upon receipt of your consent in writing within 30 days of the date of receipt of this letter by you, BHEL shall appoint suitable person(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you

Yours faithfully

Representative of BHEL

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

**FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY A
STAKEHOLDER FOR REFERRING THE DISPUTES TO CONCILIATION
THROUGH IEC**

To,
BHEL (Head of the Unit/Division/Region/Business Group)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE
CONTRACT BY A STAKEHOLDER**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which have arisen out of the above-referred Contract/MoU/Agreement/LOI/LOA are enumerated hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring inter-se disputes of the Parties to conciliation.

We wish to refer the above-said disputes to Conciliation as per the said Clause of the captioned Contract/MoU/Agreement/LOI/ LOA. In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby invite BHEL to provide its consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which it might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA and to appoint suitable person(s) as Conciliator(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you

Yours faithfully

Representative of the Stakeholder

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

FORMAT FOR INTIMATION TO THE STAKEHOLDER ABOUT APPOINTMENT OF CONCILIATOR/IEC

To,

M/s. (Stakeholder's name)

Subject: **INTIMATION BY BHEL TO THE STAKEHOLDER AND CONCILIATOR(S) ABOUT APPOINTMENT OF CONCILIATOR/IEC**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Sir,

This is with reference to letter dated ----- regarding reference of the disputes arising in connection with the subject Contract No/MoU/Agreement/LOI/LOA to conciliation and appointment of Conciliator(s).

In pursuance of the said letter, the said disputes are assigned to conciliation and the following persons are nominated as Conciliator(s) for conciliating and assisting the Parties to amicably resolve the disputes in terms of the Arbitration & Conciliation Act, 1996 and the Procedure ---- to the subject Contract/MoU/Agreement/LOI/LOA, if possible.

Name and contact details of Conciliator(s)

a)

b)

c)

You are requested to submit the Statement of Claims or Counter-Claims (strike off whichever is inapplicable) before the Conciliator(s) in Format 5 (enclosed herewith) as per the time limit as prescribed by the Conciliator(s).

Yours faithfully,

Representative of BHEL

CC: To Conciliator(s)... for Kind Information please.

Encl: As above

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.