TENDER SPECIFICATION
BHEL: PSSR: SCT: 1852

FOR

Erection, Testing & Assistance for Commissioning and Trial Operation of Boiler & Auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, Fans, Bowl Mills, Rotating Equipments etc. of Unit 1, Auxiliary Boiler & Auxiliaries, Application of Refractory and Insulation, Supply and Application of Final Painting including Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection

at

2x800 MW Uppur Supercritical Thermal Power Project,
Ramanathapuram 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

- **Volume - I**
  - **Book-I**
    - **Notice Inviting Tender**
    - **Volume-IA : Technical Conditions of Contract**
      - **Part I**
      - **Part II**
  - **Book-II**
    - **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 dated 1st October 2015
- **Volume – II: Price Bid**

NOTICE INVITING TENDER

Bharat Heavy Electricals Limited

Ref: BHEL: PSSR: SCT: 1852 **Date: September 06, 2019**

NOTICE INVITING TENDER (NIT)

Submission only through E-Procurement Portal

https://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://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: 1852**	
ii)	**Broad Scope of job**	Erection, Testing & Assistance for Commissioning and Trial Operation of Boiler & Auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, Fans, Bowl Mills, Rotating Equipments etc. of Unit 1, Auxiliary Boiler & Auxiliaries, Application of Refractory and Insulation, Supply and Application of Final Painting including Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection for Unit 1 at 2x800 MW Uppur Super Critical Thermal Power Project, Ramanathapuram Dist., 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, Rev 01 dated 1st June 2012, Amendment 01 dated October 01, 2015	Applicable

C	Volume-IC	General conditions of Contract Rev 01 dated 1st June 2012, Amendment 03 dated October 01, 2015	Applicable
D	Volume-ID	Forms & Procedures Rev 01 dated 1st June 2012 Amendment 01 dated October 01,2015	Applicable
E	Volume-II	Price Schedule (Absolute value).	Applicable
iv)	Issue of Tender Documents	1. This is an E-tender floated online through our E-Procurement Portal https://bhel.abcprocure.com 2. **Sale Start : 07.09.2019** Close: Tender documents can be downloaded till closing time for offer submission. 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 : 27.09.2019, Time :15.00 Hrs** The bidder should submit their offer online in e-Procurement portal at https://bhel.abcprocure.com only. Bidders are requested to upload their offer well in advance in order to avoid last minute congestion at this website. Hard copy bid or bids through email/ fax shall not be accepted.	Applicable
vi)	Opening of Tender	**Date : 27.09.2019, 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 record their presence online, during tender opening. However this being an e-tender it shall be opened online.	Applicable
vii)	EMD Amount	**Rs. 66,20,000/-** (Rupees Sixty Six Lakhs Twenty Thousand only). - Refer Vol-1A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I, Book-I) for mode of payment of EMD. - Exemption of Cost of Tender for MSEs is not applicable for this tender. - One Time EMD is not applicable for this Tender.	Applicable

viii)	Cost of Tender	**Rs.2,000/-** (Rupees Two Thousand Only) - Cost of tender shall be remitted through, Electronic Fund Transfer credited in BHEL account or Banker's cheque or Pay order or Demand draft, in favour of BHEL. - Exemption of Cost of Tender for MSEs is not applicable for this tender.	Applicable
ix)	Last Date For Seeking Clarification	Bidders may submit their queries in https://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:**16.09.2019** Time **11.00AM** at BHEL PSSR, Chennai-35	Applicable
xi)	Integrity Pact & Details of Independent External Monitor (IEM)	a. Integrity Pact (IP) is a tool to ensure that activities and transactions between the company and its Bidders / Contractors are handled in a fair, transparent and corruption free manner. A panel of Independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL. The IP as per format given at Volume 1D Formats (refer Volume I Book II) of this tender is to be submitted (duly signed and stamped by the authorized signatory who signs in the offer) along with Techno Commercial Bid. Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this pact would be a preliminary qualification. **Details of IEM for this tender is furnished below**: 1) Shri. Arun Chandra Verma, IPS (Retd.) Flat No. C-1204, C Tower, Amrapali, Platinum Complex, Sector 119, Noida (U. P) Email: acverma1@gmail.com 2) Shri. Virendra Bahadur Singh, IPS (Retd.) H. No. B-5/ 64, Vineet Khand, Gomti Nagar, Lucknow- 226010 Email: vbsinghips@gmail.com	**Applicable**

b. Please refer section- 8 of the IP (refer the format given at Volume 1D Formats of this tender) for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender.

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. All such clarification / issued shall be addressed directly to the tender issuing (Procurement) department.

For all clarifications/ issues related to the Tender, please contact:

1) Sreenath N G,
Dy. Manager
Subcontracts department
BHEL PSSR,
No. 690, Anna Salai
Nandanam, Chennai- 35
Phone: 044-24330209, 044-28286763
Email: sreenath.ng@bhel.in

2) Vinod Jaseja
Dy. General Manager
Subcontracts department
BHEL PSSR,
No. 690, Anna Salai
Nandanam, Chennai- 35
Phone: 044-28286734
Email: jaseja@bhel.in

3) Sandipan Biswas
AGM/ SCT & Purchase
BHEL PSSR,
No. 690, Anna Salai
Nandanam, Chennai-35
Phone: 044-28286757
Email: bsandipan@bhel.in

xii)	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com → Tender Notifications) & portal https://bhel.abcprocure.com. **These will not be published in the newspapers**. Bidders to keep themselves updated with all such information. This also form part of tender hence the same shall be enclosed with their offer.	

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 in E- Procurement website, shall not be entertained.**

3.0 Bidder shall remit cost of tender through Electronic Fund Transfer credited in BHEL account or Banker's cheque or Pay order or Demand draft, in favour of BHEL.

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) under the heading 'Mode of Payment of EMD'. Please note that 'One Time EMD' shall not be considered. **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://bhel.abcprocure.com. The bidder should respond by submitting their offer online only in our e-Procurement portal at https://bhel.abcprocure.com. Hard copy bid or bids through email/ fax shall not be accepted.

I. Pre-requisite for Offer Submission:-

Digital Certificate: To participate in an e-Tender, you need to have a Class-II/III Digital Signature Certificate (DSC) for Signing & Encryption (Required both digital signature certificate: Signing & Encryption) of bids issued by any of the valid Certifying Authorities (approved by Controller of Certifying Authorities) in India. Valid Digital Signature Certificate (DSC) must be installed in a computer system from where you want to access the website.

MINIMUM REQUIREMENT: (Mandatory)

- Computer with good Internet Connection.
- Operating System should be Windows Vista / Windows 7 and above.
- Web Browsers: Internet Explorer 9.0 (32-bit Browser only) & above.

At first time login, to verity and approve your login profile & DSC, you are requested to contact e-Procurement Service Provider.

Also please Refer "Bidder Manual for BHEL Bidders" and "Minimum System Requirements and Settings Document for BHEL user & Bidders" available at https://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-II/III Digital Signature Certificate (DSC) for Signing & Encryption.

i) The Requirement:

a. A PC with Internet connectivity &
b. DSC (Digital Signature Certificate) Class – II/ III Digital Signature Certificate (DSC) for Signing & Encryption)

III. E-procurement service Provider-:

e-Procurement Technologies Limited (abcProcure),

Head Office: B-704/705, Wall Street - II, Opp. Orient Club,

Nr. Gujarat College, Ellis Bridge, Ahmedabad - 380 006, Gujarat (India)

Timing:

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

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

The contact details of the service provider are given below:

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://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 tender (preferably in pdf format):

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

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 seller manual available on https://bhel.abcprocure.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.

6.0 DOCUMENTS TO BE UPLOADED & MODALITY OF UPLOADING in E-PROCUREMENT PORTAL https://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. Refer "Bidder Manual for BHEL Bidders" available at **https://bhel.abcprocure.com**
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.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at **https://bhel.abcprocure.com**
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	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at

	by clients shall distinctly bear the name of organization, contact phone no, FAX no, E-mail ID, etc.	**https://bhel.abcprocure.com**
iv.	All Amendments / Correspondences / Corrigenda / Clarifications / Changes / Errata etc pertinent to this NIT.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at **https://bhel.abcprocure.com**
v.	Integrity Pact Agreement (Duly signed by the authorized signatory) (As applicable)	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at **https://bhel.abcprocure.com**
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification / NIT	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at **https://bhel.abcprocure.com**
vii.	Notice inviting Tender (NIT)	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at
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	

		https://bhel.abcprocure.com
ix.	Volume – I B : Special Conditions of Contract (SCC)	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at https://bhel.abcprocure.com
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at https://bhel.abcprocure.com
xiii.	Any other details preferred by bidder with proper indexing.	To be uploaded under the form Techno-commercial Bid. Refer "Bidder Manual for BHEL Bidders" available at https://bhel.abcprocure.com

Caution to Bidders: -
The duly signed & stamped copies of Volume – 1 Book 1 & Volume 1 Book 2 are to be attached as a part of your offer, in their respective sections. Also for any further queries, please refer "Bidder Manual for BHEL Bidders" available at https://bhel.abcprocure.com

	PRICE BID consisting of the following shall be attached as mentioned below	
i	**Price/ Total Amount corresponding to the total works as specified in "Part C: Bill of Quantities" available in "Volume II – PRICE BID (latest Revision) shall be quoted in the Price Bid Form available in e-Procurement portal.**	To be uploaded under the form Price Bid. Refer "Bidder Manual for BHEL Bidders" available at

	Bidders to note that documents uploaded under the Price Bid Form shall be considered for commercial evaluation of offer.	**https://bhel.abcprocure.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.**

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

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

9.0 Assessment of Capacity of Bidders:

Bidder's capacity for executing the job under 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 upto 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 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 (six) months period upto 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:

a) P_1, P_2, P_3, P_4, P_5, …. 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 = $\mathbf{P_T}$ (ie $P_T = P_1 + P_2 + P_3 + P_4 + .. P_N$)

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 '$\mathbf{T_T}$' for total similar Packages '$\mathbf{P_T}$' for all Regions (i.e $\mathbf{T_T} = T_1 + T_2 + T_3 + T_4 + .. T_N$)

c) Sum 'S_1 'of 'Monthly Performance Evaluation' Scores ($S_{1\text{-}1}$, $S_{1\text{-}2}$, $S_{1\text{-}3}$, $S_{1\text{-}4}$, $S_{1\text{-}5}$,…. $S_{1\text{-}T1}$) for similar package P_1, for the 'period of assessment' 'T_1' (i.e $S_1 = S_{1\text{-}1} + S_{1\text{-}2} + S_{1\text{-}3} + S_{1\text{-}4} + S_{1\text{-}5} + \ldots S_{1\text{-}T1}$). 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 '$\mathbf{P_T}$' for all Regions (i.e 'S_T '$= S_1 + S_2 + S_3 + S_4 + S_5 + \ldots S_N$.)

d) **Overall Performance Rating 'R_{BHEL}' for the similar Package / Packages (**under execution / executed during the 'Period of

Assessment') in all the Power Sector Regions of BHEL)**:**

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

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

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

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

Sl no	**Item Description**	**Details for all Regions**							**Total**
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
1	Similar Packages for all Regions → (under execution/ executed during period of assessment)	P_1	P_2	P_3	P_4	P_5	…	P_N	Total No of similar packages for all Regions = **P_T** ie Sum (Σ) of columns (iii) to (ix)
2	Number of Months for which 'Monthly Performance Evaluation' as per relevant formats should have been done in the 'period of assessment for corresponding similar Package (as in row 1)	T_1	T_2	T_3	T_4	T_5	…	T_N	Sum (Σ) of columns (iii) to (ix) = **T_T**
3	Monthly performance scores for the corresponding period (as in Row 2)	S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, … S_{1-T1}	S_{2-1}, S_{2-2}, S_{2-3}, S_{2-4},… S_{2-T2}	S_{3-1}, S_{3-2}, S_{3-3}, S_{3-4}, … S_{3-T3}	S_{4-1}, S_{4-2}, S_{4-3}, S_{4-4}, … S_{4-T4}	S_{5-1}, S_{5-2}, S_{5-3}, S_{5-4}, … S_{5-T5}	.. … … … …	S_{N-1}, S_{N-2}, S_{N-3}, S_{N-4}, … S_{N-TN}	---

Sl no	Item Description	Details for all Regions							Total
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
4	Sum of Monthly Performance scores of the corresponding Package for the corresponding period (as in row-3)	S_1	S_2	S_3	S_4	S_5	…	S_N	Sum (Σ) of columns (iii) to (ix) = **S_T**

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

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

a) 'Period of Assessment' i.e. 6 months preceding and including the cut-off month.
b) 12 months preceding and including the cut-off month
c) 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:

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

The Bidder shall be considered 'Qualified' as per 'Assessment of Capacity of Bidder' for the subject Tender if $P \leq P_{Max}$
(where P is calculated as per clause 'I' above)

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

IV. **Explanatory note**:

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 (ie., Boiler, ESP and Power Cycle Piping) and finally the Bidder's capacity to execute the tendered scope is assessed in line with III above.

ii) Identified Packages (Unit wise)

Table-1

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

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

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

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

The "FIRST TIMER" tag shall remain till completion of all the contracts against which vendor has been tagged as First Timer or availability of 6 evaluation scores within last 36 months preceding and including the Cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions.

A Bidder shall not be eligible for the next job as long as the Bidder is tagged as "FIRST TIMER" excepting for the Tenders which have

been opened on or before the date of the bidder being tagged as 'FIRST TIMER'.

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 Evaluation 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 ('RBHEL') ≥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, 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 ('RBHEL') ≥60, (b)- First timer" bidders having average of available performance scores ≥60 upto and including the Cut Off month, (c)- "First timer" bidders for whom no performance score is available in the system upto and including the Cut Off month, shall be considered qualified against criteria of 'Assessment of Capacity of Bidders' for further processing of tender.

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

(a) Up to execution of 90% of anticipated Contract Value in case of Civil, MM, Structural and Turbo Blower Packages

(b) Up to Steam Blowing in case of Boiler/ESP/Piping Packages

(c) Up to Synchronization in all Balance Packages

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

vi) Contractor shall provide the latest contact details i.e. mail-ID and Correspondence Address to SCT Department, so that same can be entered in the Contractor Performance Evaluation System, and in case of any change/discrepancy same shall be informed immediately. Login Details for viewing scores in Contractor Performance Evaluation System shall be provided to the Contractor by SCT Department.

vii) Performance Evaluation for Activity Month shall be completed in Evaluation Month (i.e. month next to Activity Month) or in rare cases in Post Evaluation Month (i.e. month next to Evaluation Month) after approval from Competent Authority. In case scores are not acceptable, Contractor can submit Review Request to GM Site/ GM Project latest by 25th of Evaluation Month or 3 days after approval of score, whichever is later. However, acceptance/rejection of 'Review Request' solely depends on the discretion of GM Site/GM Project. After acceptance of Review Request, evaluation score shall be reviewed at site and the score after completion of review process shall be acceptable and binding on the contractor.

viii) Project on Hold due to reasons not attributable to bidder -

a. **Short hold:** Evaluation shall not be applicable for this period, however loading will be considered.

b. **Long hold:** Short hold for continuous six months and beyond or hold on account of Force Majeure shall be considered as Long Hold. Evaluation as well as Loading shall not be considered for this period.

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 clarification provision available in procurement portal https://bhel.abcprocure.com or 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.

15.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.

16.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), if applicable, along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. The Integrity Pact is to be submitted by Prime Bidder & Consortium/ Technical Tie up partner jointly in case Consortium bidding is permitted, otherwise by the sole bidder. **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 authorized 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 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 "www.bhel.com → tender notification".

28.0 It may be noted that guidelines / rules in respect of 'Suspension of Business dealings' available on BHEL website "www.bhel.com → Supplier Registration", 'Vendor evaluation format', Quality, Safey & HSE guidelines', etc may undergo change from time to time and the latest one shall be followed.

29.0 Void

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

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

31.1 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.

31.2 Commitment by Bidder / Supplier / Contractor:

31.2.1 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.

31.2.2 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.

31.2.3 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.

31.3 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 www.bhel.com and / or under applicable legal provisions.

32.0 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.

33.0 For this procurement, Public Procurement (Preference to Make in India), Order 2017 dated 15.06.2017 & 28.05.2018 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.

34.0 "The offer, if submitted by the awardee of Boiler and Bunker works of Unit 2 of 2x800 MW Uppur Thermal Power Station shall be rejected as per the provisions of clause no. 33 of 'Notice Inviting Tender' of Tender Specification: BHEL PSSR SCT 1802".

35.0 Order of Precedence:

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

a. Amendments / Clarifications / Corrigenda / Errata etc. issued in respect of the tender documents by BHEL
b. Notice Inviting Tender (NIT)
c. Price Bid
d. Technical Conditions of Contract (TCC)—Volume-1A
e. Special Conditions of Contract (SCC) —Volume-1B
   Rev. 01 Dt. 01 Jun 2012; Amendment: 01 Dt. 1st October 2015
f. General Conditions of Contract (GCC) —Volume-1C
   Rev. 01 Dt. 01 Jun 2012; Amendment: 03 Dt. 1st October 2015
g. Forms and Procedures —Volume-1D
   Rev. 01 Dt. 01 Jun 2012; Amendment: 01 Dt. 1st October 2015

For and on behalf of BHARAT HEAVY ELECTRICALS LTD

Additional General Manager / SCT & Purchase

Enclosure

1. Annexure-1: Pre Qualifying criteria.
2. Annexure-2: Check List.
3. Annexure-3 Void
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.

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	Erection, Testing & Assistance for Commissioning and Trial Operation of Boiler & Auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, Fans, Bowl Mills, Rotating Equipments, Auxiliary Boiler & Auxiliaries etc. of Unit 1, Application of Refractory and Insulation, Supply and Application of Final Painting including Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection, at 2x800 MW Uppur Super Critical Thermal Power Project, Ramanathapuram Dist., Tamil Nadu
Tender No.	**BHEL: PSSR: SCT: 1852**

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 jointly in case Consortium bidding is permitted, otherwise by the sole bidder)	Applicable	
B	**TECHNICAL** 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	**FINANCIAL** **Turnover** Bidders must have achieved an average annual financial turnover (Audited) of Rs.16,86,00,000/- (Rs. Sixteen Crores Eighty Six Lakhs only) 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	**Networth** (only in case of Companies) Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive.	Applicable	To be filled in Annexure-4
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.	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	To be filled in Annexure-4
D	Assessment of Capacity of Bidder to execute the work as per Sl. No 9 of NIT (if applicable)	Applicable	By BHEL
E	**Approval of Customer (if applicable)** **Note:** Names of bidders (including consortium / Technical Tie up partners in case consortium bidding is permitted) who stand qualified after compliance of criteria A to D shall be forwarded to customer for their approval.	Applicable	BY BHEL
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	

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

1. Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as indicated against C-1 above along with all annexures.
2. In case audited financial statements have not been submitted for all the three years as indicated against C-1 above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i.e. total divided by three.
3. If Financial Statements are not required to be audited statutorily, then instead of audited financial statements, financial statements are required to be certified by Chartered Accountant.
4. C-2:-NETWORTH: Shall be calculated based on the latest Audited Accounts as furnished for C-1 above. Net worth = Paid up share capital* + Reserves. (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)
5. C-3:- PROFIT : shall be PBT earned during any one of the three financial years as in C-1 above
6. For evaluation of PQR, the credentials of the Bidder alone, and not that of the Group Company shall be considered.
7. Time period for achievement of the 'Technical' criteria of PQR (as in 'B' above) will be the last 7 years ending on the 'latest date of Bid submission' of Tender.
8. Boiler means HRSG or WHRB or any other types of Steam Generator
9. Power Cycle piping means Main Steam, Hot Reheat, Cold Reheat, HP Bypass, LP Bypass lines
10. For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5TPH where ever rating of HRSG/BOILER is mentioned in MW. Similarly, where ever rating of Gas Turbine is mentioned in terms of Frame size, ISO rating in terms of MW shall be considered for evaluation.

    Also refer foot note mentioned in Annuxure-3 of Notice Inviting Tender.
11. Scope for capital overhaul of STG shall cover Bearing Inspection work and overhauling of all cylinders of the Turbine unless otherwise specifically indicated in the PQR.
12. In case the experience / PO / WO certificate enclosed by bidders do not have separate break up prices for the E&C portion of Electrical and CI Works, (i.e. the certificates enclosed are for composite order for supply and erection of Electrical & CI and other works if any), then value of Erection and Commissioning for the Electrical & CI portion shall be considered as

	15% of the supply & erection of Electrical & CI, unless otherwise specifically indicated in the PQR.

Note:

(i) 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.

(ii) 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.

(iii) **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.

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 Vol 1A, Part-2, Chapter-1 of Technical Conditions of Contract Volume-I Book-I)	Mode of Remittance: Ref No: Date : Amount:		
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

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 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)

Annexure- 3

- VOID -

ANNEXURE - 4

Additional Format to be submitted by Bidders in an additional separate cover superscribed "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)	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	Rem-arks
1	**Technical B:**	**Technical** 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".					

Sl. No.	PQR Ref	PQR (Reproduced from Annexure – 1)	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	Rem-arks
2	**Financial C1**	**TURNOVER** Bidders must have achieved an average annual financial turnover (Audited) of Rs.16,86,00,000/- (Rs. Sixteen Crores Eighty Six Lakhs only) or more over last three Financial Years (FY) i.e 2015-16, 2016-17 and 2017-18.					
3	**Financial C2**	**NETWORTH** (only in case of Companies) Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive					
4	**Financial C3**	**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	**Financial C4**	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.					

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

ANNEXURE-5

Tender Schedule

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

Note:

1. Bidders to note that the above schedule should be adhered to and no further extension will be given. To adhere to the schedule indicated below, Bidders should ensure the adequacy of the documents submitted in their offer, with proper validation.
2. Bidders who have not been working with Power Sector Regions of BHEL in the last twelve months should enclose the duly filled in certificates for performance as per the format (Annexure-5) provided in Notice Inviting Tender of this book.

Annexure 6

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

CONTENTS

VOLUME - IA PART – I CHAPTER – I

PROJECT INFORMATION

1.1	Project Title	:	2 x 800 MW Uppur Super critical Thermal Power Project
1.2	Plant capacity	:	2x 800 MW
1.3	Type of project	:	Green Field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	Uppur, Valamavoor and Thiruppalaikudi villages of Thiruvadanai Taluk, Ramanathapuram District.
1.6	Location co-ordinates	:	9.780647 N, 78.921417 E
1.7	Nearest Village	:	Uppur Village
1.8	Nearest Town & City	:	Ramanathapuram at 28 KM
1.9	State Capital	:	Chennai (481 Km)
1.10	Nearest Railway Station	:	Ramanathapuram at 28 KM
1.11	Nearest Airport	:	Domestic airport at Madurai (140 KM)
1.12	Nearest Seaport	:	Tuticorin Port (130 KM)
1.13	Nearest Road access	:	ECR Connecting Ramanathapuram and Pattukottai
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	:	(+) 4.5 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	37.8°C
b.	Annual Minimum Mean Temperature	:	22.3°C
c.	DRY BULB TEMPERATURE (DBT) FOR DESIGN PURPOSE	:	30 ± 10°C 50°C (for electrical equipment)

2.4	RELATIVE HUMIDITY FOR DESIGN PURPOSE		75 ± 15%
2.5	Annual Rainfall		
	Average	:	827 mm (avg.)
2.6	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)
2.7	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
2.7	Seismic zone	:	Zone: III as defined in IS:1893-2002

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:

Erection, Testing & Assistance for commissioning and Trial Operation of Boiler & auxiliaries, Air Pre Heaters, Ducts & Dampers, Boiler Integral Piping, structure for bunker, Fans, Bowl mills, Rotating Equipment etc. of Unit 1, Auxiliary boiler and auxiliaries etc., application of refractory and insulation, supply and application of final Painting including Handling of Materials at BHEL / Client's Stores / Storage Yard and transportation to site of Erection at 2x800 MW Uppur Supercritical Thermal Power Project, Ramanathapuram 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, carrying out air 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 Equipment, 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 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, 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 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's constituting terminal points, whether the terminal equipment's 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, is within 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's, etc., in this 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 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.

Note:

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

VOLUME IA 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 equipments, 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 equipments 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
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	

Sl No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.1	Distribution from single point including supply of materials and service		Yes	
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	

Sl No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
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	
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 equipments 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	
1.3.2	**PART II**			
1.3.2.1	**ERECTION FACILITIES**			
1.3.2.1.0	Engineering works for construction	Yes		In consultation with BHEL
1.3.2.1.1	Providing the erection drawings for all the equipments covered under this scope	Yes		
1.3.2.1.2	Drawings for construction methods		Yes	
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 erection schedules and other input requirements		Yes	

Sl No.	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.2.1.6	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	In consultation with BHEL
1.3.2.1.7	Weekly erection schedules based on Sl No 1.3.2.1.5		Yes	
1.3.2.1.8	Daily erection / work plan based on Sl No 1.3.2.1.7		Yes	
1.3.2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
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 **LAND FOR SITE OFFICE AND LABOUR COLONY:**

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 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.

1.3.3.3 Location and area requirement for office/storage sheds/ fabrication yard shall be discussed and mutually agreed to.

1.3.3.4 Any development of fabrication yard, storage area, etc shall be done by the contractor within the quoted rates of the contract.

1.3.4 **ELECTRICITY**:

1.3.4.1 Electricity for construction purpose (415 V) shall be provided by BHEL 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 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 will be arranged by the contractor, installed and taken care by the contractor.

1.3.4.3 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.

1.3.4.4 Provision of distribution of electrical power from the given single central common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.

1.3.4.5 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.

1.3.4.6 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. Contractor shall make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets with consumables at their cost during the power breakdown / failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.

1.3.5 **CONSTRUCTION WATER**

1.3.5.1 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 the contractor, due to delay/ failure for providing water supply.

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

1.3.6 **DRINKING WATER**

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

1.3.7 **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.

1.3.8 **CONSUMABLES:**

1.3.8.1 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.

1.3.8.2 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.

1.3.8.3 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.

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

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.

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

1.3.9 **MATERIAL SUPPLY:**

1.3.9.1 BHEL will supply the materials/ equipments 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 equipments and chemicals required for chemical cleaning of equipments will be supplied free of cost by BHEL.

1.3.10 **LIGHTING FACILITY:**

1.3.10.1 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.

1.3.11 **GASES:**

1.3.11.1 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.

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

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

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

1.3.12 **ELECTRODES SUPPLY AND STORAGE**

1.3.12.1 The bidder shall use the BHEL / Customer approved quality welding electrodes only.

1.3.12.2 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.

1.3.12.3 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.

1.3.12.4 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.

1.3.12.5 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.

1.3.12.6 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.

1.3.12.7 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.

1.3.13 **OTHER FACILITIES**

1.3.13.1 Adequate water less urinals [at least 2 nos. per level] and toilets [atleast 2 nos.] shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, with proper disposal arrangement.

1.3.14 **BID DRAWINGS**

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

VOLUME-IA PART-I CHAPTER – IV

T&Ps and MMEs TO BE DEPLOYED BY CONTRACTOR

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
1	150 MT Crawler crane This crane should be made available at site from 2nd month of commencement of Main Boiler erection till completion of all physical works which require this capacity as decided by Engineer Incharge	1 No.
2	75 MT Crawler crane First crane to be made available at site from the commencement of column erection of Boiler till completion of all physical works which require this capacity crane, as decided by Engineer Incharge Second crane to be made available from 3rd month from commencement of column erection of Boiler till the completion of all the physical works which require this capacity crane, as decided by Engineer Incharge	2 Nos.
3	40 T Crawler Crane The crane shall be made available at site from commencement of column erection of Boiler till completion of all physical works which require this capacity crane, as decided by Engineer Incharge	1 No.
4	Pick and carry crane (10 MT-14MT)	As required (minimum 3 nos.)
5	Tractor Trailer- 30T and 60T	As required (Minimum 1 no. each of 30T and 60T)
6	DG set-250 KVA (Stand by for P91 welding)	1 No.
7	Tube Expander	1 No.

Sl No.	Description	Quantity
8	Boiler furnace inside maintenance platform (Sky climber make or equivalent)	2 Nos.
10	Ultrasonic Hardness Testing Machine (Ultrasonic Contact Impedance)	1 No.
11	Resistance Heating Based Local PWHT Equipment with Flexible Ceramic Pad	Min 7 Sets for T-91 and T-92 welding
12	Passenger cum Goods lift - Minimum 1 T capacity	1 No.

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.

1.4.2 T&P shown in the above mentioned list 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&P/ equipment's to ensure completion of entire work within schedule/ target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation & 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.

1.4.3 In the event of non-mobilization of any T&P by the successful bidder and as a result progress of work suffered, BHEL reserves the right to engage required T&P in line with Special Conditions of Contract.

1.4.4 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 analyzing the production capacity and suitability of both the T&Ps.

1.4.5 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

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 enclosed in chapter 10 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).

1.4.6 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.

1.4.7 For loading and transportation, all necessary T&P such as Trailors, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor.

1.4.8 For transportation, material handling, loading & unloading of heavier components / equipments 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 operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

1.4.11 The contractor shall arrange crane operator, diesel, petrol and other consumables required for the tools and plants, equipments 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.

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

1.4.12.1 Clause no 1.3.7 on SCMS in chapter III

1.4.12.2 Clause no 1.5.5 on steel plates for crane movement in chapter V

1.4.12.3 Clause no 1.5.8 on replacement of spares for BHEL’s T & P in chapter V

1.4.12.4 Clause no 1.5.16 on Facility to be provided by BHEL for P91 welding in chapter V

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

1.4.13 Supply of Bed materials such as Beam, Channel, Angles & flats for Pre-Fabrication shall be under the scope of the contractor.

1.4.14 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 from pre-fabrication amongst the contractors. Approach road from Pre-Assembly yard to the erection area will be under the scope of the contractor.

1.4.15 **FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P91 WELDING**

1.4.15.1 Required no of operators/ Technicians/ Electrician for installation, commissioning & operating continuously.

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

1.4.15.3 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.

1.4.15.4 GE or Kraut Kramer or Microdur make or reputed branded ultrasonic hardness testing machine (Ultrasonic Contact Impedance(UCI)).

1.4.15.5 MPI/LPI Kits with required consumables.

1.4.15.6 Consumables

1.4.15.6.1 Glass fibre cloth – 1mm x 1000mm – Temp rating – 1260 ^{o}C.

1.4.15.6.2 Glass fibre cord – Dia 3mm (twisted) Temp rating – 1260 ^{o}C.

1.4.15.6.3 Ceramic fibre Blanket – RT Grade, density 96Kg/M3 - Temp rating – 1260 ^{o}C.

1.4.15.6.4 Ceramic fibre rope – Fibre Glass braided, Dia 12mm - Temp rating – 1260 ^{o}C.

1.4.15.6.5 K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated.

1.4.15.6.6 Heavy duty TC connectors for - K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated.

1.4.15.6.7 All other consumables/ equipments required to carry out the work.

Note: 1) Also refer clause 1.5.8 regarding annealing cables and clause 1.5.16 regarding Facility to be provided by BHEL for P91 welding.

2) The induction heating equipments and other equipments 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.

3) The contractor shall provide electrical cables & switches required for extending power supply to the induction heating equipments. All the equipments shall be protected by providing covers or sheds at site by the contractor with in the quoted rate.

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	Qty
1	BHEL will provide additional cranes of capacity above 150T to the contractor as per site requirement on sharing basis free of hire charges	As decided by BHEL
2	Hydraulic Pressure Testing Pump with accessories	As Required
3	Chemical Cleaning Pumps with Motor	As Required
4	Boiler fill pump	As Required
5	Air Blower for Air Leak Test of Boiler	As Required
6	Induction Heating Machine	As Required

1.5.2 BHEL will provide cranes only for materials whose weight cannot be lifted with 150T crane at the required height.

1.5.3 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.

1.5.4 Besides the T & P mentioned above, which is being made available to the contractor on free of hire charges, any additional crane and other T & P which may be required for successful and timely execution of the work covered within the scope of this tender shall be arranged and provided at site by the contractor at his cost. In case if the contractor fails to provide such equipments, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary even during contract period.

1.5.5 Levelled area in Boiler area will be provided by BHEL for the cranes. Consolidation of the ground, if required, and preparation (including civil work with material) 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.**

1.5.6 BHEL may provide either owned cranes or hired cranes at the discretion of BHEL as below:

1.5.6.1 In the event of providing BHEL Cranes:

1.5.6.1.1 For all BHEL's own cranes of capacity greater than 150T, BHEL shall provide operators, free of charges. Fuel, lubricants and consumables for BHEL's own cranes of capacity greater than 150T, are to be arranged by the contractor within the quoted rate.

1.5.6.1.2 Tentative List of consumables required to be provided by contractor is as below:

i) Engine Oil 15 W 40
ii) Fuel Filters
iii) Air Filters
iv) Hydraulic Filters
v) Hydraulic Oil –Servo 68
vi) Gear Oil- Servo 90
vii) Engine oil Filter
viii) Oil Separator Filter
ix) Rope- CRG 100 Grease
x) Grease- Servo Multi-Purpose Grease

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

1.5.6.2 In the event of providing hired cranes:

i) Crane Operators for hired cranes will be provided by BHEL, on free of charges.

ii) The fuel for the cranes is to be arranged by the Contractor within the quoted rate.

1.5.7 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.

1.5.8 The day-to-day and routine maintenance including replacement of spares for the BHEL T&Ps (except 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.

1.5.9 Only one set of annealing cable shall be provided irrespective of the number of induction machines provided by BHEL, ie even if more than one Induction Heating Machine provided by BHEL, only one set of annealing cable shall be

provided. Additional annealing cables required, if any, till total work completion, shall be procured by the contractor, at his cost.

1.5.10 Any loss / damage of tools by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.

1.5.11 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.

1.5.12 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.

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

1.5.14 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.

1.5.15 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.

1.5.16 **FACILITY TO BE PROVIDED BY BHEL FOR P91 Welding.**

1.5.16.1 Induction Heating machine with accessories as indicated in Clause 1.5.1 above.

1.5.16.2 Welding Electrodes for P91 welding.

1.5.16.3 Spot Welding Machine for fixing thermocouple.

1.5.16.4 The following consumables:

1.5.16.4.1 Only one set of annealing cable shall be provided irrespective of the number of induction machines provided by BHEL, ie even if more than one Induction Heating Machine provided by BHEL, only one set of annealing cable shall be provided. Additional annealing cables required, if any, till total work completion, shall be procured by the contractor, at his cost.

1.5.16.4.2 Compensating Cables.

VOLUME-IA PART-I CHAPTER - VI
TIME SCHEDULE

1.6.1. TIME SCHEDULE

1.6.1.1. The entire work of Boiler and auxiliaries, rotating machines etc. including Supply & Application of Final Painting as detailed in the Tender Specification shall be completed within 28 **(Twenty Eight) 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 F15: Monthly Performance Evaluation of Contractor” for all the instructions to be taken immediately after receipt of LOI. Please note that Form-15 in the Volume 1D- Forms and Procedures is revised. For details please refer Sl No. 18 of Part-II, Chapter-1 of Technical Conditions of Contract (VOLUME-IA PART II) of his booklet.

1.6.2. COMMENCEMENT OF CONTRACT PERIOD

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

1.6.3. MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIOING ETC.,

1.6.3.1. The activities for erection, testing etc shall be started as per directions of Construction manager of BHEL.

1.6.3.2. The contractor has to augment his resources in such a manner that following major milestones of erection & commissioning are achieved on specified schedules:

Milestone Activity	Milestone Month (Tentative)
Start of Erection (Tentative)	September 2019 (First month)
Completion of ceiling girder erection, roof structure, silencer erection and all approach platforms of ceiling girder.	8th Month
Boiler Hydro Test (Drainable)	15th Month
Boiler Light Up	20th Month
Synchronisation (with oil)	22nd Month
Trial Operation	24th Month
Completion of Contractual Obligation	28th Month

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

1.6.4 MAJOR INTERMEDIATE MILESTONES (For each package)

Sl No.	Milestone Description	Scheduled Completion (from date of commencement)	Intermediate Milestone
1	Boiler Drainable Hydro Test	15th Month	M1
2	Boiler Light Up	20th Month	M2

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

1.6.5 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **28 (Twenty Eight) 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

a) the date of handing over of Unit to Customer

or

b) 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).

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

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 1.7.4

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 bunker structure) Pro-rata as per Cl no 1.7.1.1 to 1.7.1.16 of the following table.

Cl. No.	Contract (Main Package) Identification ---->	Boiler			Rot. M/c	Refractory & Insulation
	Rate schedule Identification	Struct-ures	Pr. Parts	Non Pr. Parts	Rot. M/c & Handling Eqpts.	
	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%	-
1.7.1.2	Placement in position	15%	10%	10%	20%	50%
1.7.1.3	Alignment	15%	15%	10%	20%	15%
1.7.1.4	Welding / Bolting / Fixing	15%	20%	15%	20%	20%
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	-	-	-	-	-

Cl. No.	Contract (Main Package) Identification ---->	Boiler			Rot. M/c	Refractory & Insulation
	Rate schedule Identification	**Struct-ures**	**Pr. Parts**	**Non Pr. Parts**	**Rot. M/c & Handling Eqpts.**	
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%	-	-
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	Equipment trial operation	-	-	-	10%	-
1.7.1.15	Hydraulic test or pneumatic test	-	-	-	-	-
1.7.1.16	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%**

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:	**Percentage**
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 sections, Hot and cold end connecting plates	14%
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 Progressive Payment against monthly running bills for bunker structure will be made upto 85 % of the value of the erected tonnage Pro-rata as per Cl no 1.7.3.1 to 1.7.3.6 of the following table.

Cl. No.	**Description- Bunker Structures- PG 34**	**Percentage**
1.7.3.1	On pre-assembly wherever applicable (if not applicable, this portion shall be clubbed with placement in position)	15 %
1.7.3.2	Placement in position	10%
1.7.3.3	Alignment	15%
1.7.3.4	Welding / bolting / fixing	30%
1.7.3.5	Completion of non-destructive examination & stress relieving/ heat treatment (if not applicable, then this portion to be paid along with welding)	10%
1.7.3.6	Hangers & supports etc, Readiness of floors for concrete pouring as applicable	5%
	TOTAL FOR PRO RATA PAYMENTS (TOTAL 85%)	**85%**

1.7.4 Further 15% payment on pro-rata basis common to all PGs of Boiler shall be released on achievement of the following stage/ milestone events (as per Clause No. 1.7.41. to 1.7.4.19)

Sl. No.	Contract (Main Package) Identification --->	Boiler				Rotating Machine	Refractory & Insulation	Bunker Structure
	Rate schedule Identification	Struc-tures	Pr. Parts	Non Pr. Parts	Air Pre Heater	RM & Handling Eqpts		
	Stage / Milestone Payments (15%)							
	Air & Gas Tightness Test	-	-	5%	-	-	-	
1.7.4.1	Completion of Air & Gas Tightness Test for Furnace		2%				-	
1.7.4.2	Boiler Hydraulic Test (Drainable)		2%					
	Boiler Hydraulic Test (Non Drainable)		1%					
1.7.4.3	Reheater Coils Hydraulic Test		2%					
1.7.4.4	Clean Air Flow test					1%		
1.7.4.5	Boiler Light Up		1%		2%	1%	1%	
1.7.4.6	ABO / Chemical cleaning		1%	1%	2%	1%	1%	
1.7.4.7	Steam Blowing			2%	1%	1%	1%	
1.7.4.8	Safety Valve Floating	-	2%	-	2%	-	1%	
1.7.4.9	Readiness for feeding coal							2%
1.7.4.10	Coal Firing	-	-	2%	2%	2%	1%	2%
1.7.4.11	Full Load	-	-	-	-	1%	1%	
1.7.4.12	Trial Operation of Unit	-	-	-	-	2%	2%	

Sl. No.	Contract (Main Package) Identification --->	Boiler				Rotating Machine	Refractory & Insulation	Bunker Structure
	Rate schedule Identification	**Struc-tures**	**Pr. Parts**	**Non Pr. Parts**	**Air Pre Heater**	**RM & Handling Eqpts**		
1.7.4.13	Completion of sheet covering for Boiler roof, burner roof, lift shaft cladding, completion of gutters	3%	-	-	-	-		
1.7.4.14	Painting	6%		1%	1%	2%		6%
1.7.4.15	Area cleaning, temporary structures cutting / removal and return of scrap	1%	1%	1%	1%	1%	3%	1%
1.7.4.16	Punch List points / pending points liquidation	2%	1%	1%	2%	1%	1%	2%
1.7.4.17	Submission of 'As Built Drawings'	-	-	-	-	-		
1.7.4.18	Material Reconciliation	2%	1%	1%	1%	1%	2%	1%
1.7.4.19	Completion of Contractual Obligation	1%	1%	1%	1%	1%	1%	1%
	Total for stage / milestone payments	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**
	TOTAL of clause 1.7.1 to 1.7.4	**100%**	**100%**	**100 %**	**100%**	**100%**	**100%**	**100%**

Note to Terms of Payment:

For PVC, ORC, RA Bill Payment, 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)

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- PSSR SITE OFFICE,
2X800 Uppur Thermal Power Plant
Valamavoor & Thirupalaikudi
Thiruvadanai Taluk
Ramanathapuram District

1.8.1.4 TAMILNADU–623531GST 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. 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, which is defined in relevant clauses elsewhere in the tender specification) 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.

VOLUME-IA PART-I CHAPTER IX
BILL OF QUANTITY

1.9.1 Weight Schedule – Summary: -

Description	UOM	Weight (MT)	Rate Schedule Ref No.
Boiler- Structures	MT	17,085	1.1
Boiler- Pressure Parts	MT	14,688	1.2
Boiler- Non- Pressure Parts	MT	5,562	1.3
Rotating Equipments	MT	1,667	1.4
Rotating Machines Handling Equipments	MT	78	1.5
Insulation- Castable and Pourable Refractory	MT	324	1.6
Insulation- Mineral wool mattress including acoustic insulation	MT	1,569	1.7
Insulation- Fixing (Iron) components / steel enclosures etc.	MT	213	1.8
Insulation- Aluminium Sheets / Sealing compound	MT	52	1.9
TOTAL Weight in MT (Approx.)		**41,238**	

Note to clause 1.9.1 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] 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 these works.

4. The Erection of HT MOTORS 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.
7. **Extra work rates for welding in Boiler and Auxiliary Boiler:**

   The quantum of welding joints indicated in chapter 2 of part II of Technical Conditions of Contract (Volume-I Book-I) 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/T92/P92) and convert them in to equivated joints (Dia 63.5x6.3mm) as per the formula below:

   No of equivated Joints = Dia X Thickness / (63.5 x 6.3)

   = Dia X 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 equated joints exceeds beyond +125% in each category, the quantity exceeding +125% of the tendered quantity of each category will be paid as below:

   a) 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.

1.9.1.1 Detailed (PGMA wise) weight of BOQ for Boiler, Rot. M/c etc:

Boiler- Structures

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
34	100	BUNKER BAY COLUMNS	800	1.1
34	200	BUNKER SUPPORT BEAMS	400	1.1

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
34	300	BUNKER BAY HORIZONTAL BRACINGS	55	1.1
34	390	MISC.STRUCTURES	15	1.1
34	400	BUNKER BAY HORZ.BEAMS	450	1.1
34	500	BUNKER BAY VERTICAL BRACINGS	353	1.1
34	810	FLOOR GRILLS	5	1.1
34	820	STAIRS	5	1.1
34	850	HAND RAILS	5	1.1
35	010	FOUNDATION MATERIALS	30	1.1
35	012	BLR&AUX COL FDN MATL	20	1.1
35	111	MAIN COLUMNS LEFT 1S	500	1.1
35	112	MAIN COLUMNS LERT 2N	500	1.1
35	121	MAINCOLUMNS RIGHT 1S	500	1.1
35	122	MAIN COLUMNS RIGHT 2	500	1.1
35	130	MAIN COLUMNS MIDDLE	350	1.1
35	140	AUXILIARY COLUMNS-LE	400	1.1
35	150	AUXILIARY COLUMNS-RI	400	1.1
35	190	GIRDER PIN CONNECTIO	30	1.1
35	211	CEILING STRUCTUREMAI	570	1.1
35	212	CEILING STRUCTUREMAI	500	1.1
35	213	CEIL STRUCT -CROSS W	193	1.1
35	214	CEIL STRUCT -CROSS W	150	1.1
35	221	CEILING STRUCTURE RO	60	1.1
35	222	CEILING STRUCTURE RO	60	1.1
35	231	CEILING STRUCTURE HO	30	1.1
35	232	CEILING STRUCTURE HO	30	1.1
35	311	HORIZONTAL BRACING I	80	1.1
35	312	HORIZ BRACING II PAS	80	1.1
35	321	HORIZ BRACING I PASS	50	1.1
35	322	HORIZ BRACING II PAS	50	1.1
35	331	HORIZ BRACING I PASS	40	1.1
35	332	HORIZ BRACING II PAS	40	1.1
35	341	HORIZ BRACING I PASS	30	1.1
35	342	HORIZ BRACING II PAS	30	1.1
35	351	HORIZ BRACING I PASS	30	1.1
35	352	HORIZ BRACING II PAS	30	1.1
35	361	HORIZ BRACING I PASS	30	1.1
35	362	HORIZ BRACING II PAS	30	1.1
35	371	Horizontal Bracing@79100 (MBL-7)1st Pass	30	1.1
35	372	Horizontal Bracing @79100(MBL-7)2nd Pass	30	1.1
35	374	Horizontal Bracing@87500(MBL-8) 1st Pass	30	1.1
35	375	Horizontal Bracing@87500(MBL-8) 2nd Pass	30	1.1

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
35	381	Landing & Connecting Platforms Tier-1	60	1.1
35	382	Landing & Connecting Platforms Tier-2	60	1.1
35	383	Landing & Connecting Platforms Tier-3	50	1.1
35	384	Landing & Connecting Platforms Tier-4	50	1.1
35	385	Landing & Connecting Platforms Tier-5	50	1.1
35	386	Landing & Connecting Platforms Tier-6	50	1.1
35	387	Landing & Connecting Platforms Tier-7	60	1.1
35	388	Landing & Connecting Platforms Tier-8	30	1.1
35	390	MISC STRUCTURES	50	1.1
35	441	Horil Beams First Pass-Tier-1	110	1.1
35	442	Horil Beams First Pass-Tier-2	110	1.1
35	443	Horil Beams First Pass-Tier-3	90	1.1
35	444	Horil Beams First Pass-Tier-4	90	1.1
35	445	Horil Beams First Pass-Tier-5	90	1.1
35	446	Horil Beams First Pass-Tier-6	80	1.1
35	447	Horil Beams First Pass-Tier-7	80	1.1
35	448	Horil Beams First Pass-Tier-8	80	1.1
35	451	Hor Beam-Second Pass- Tier-1	90	1.1
35	452	Hor Beam-Second Pass- Tier-2	90	1.1
35	453	Hor Beam-Second Pass- Tier-3	90	1.1
35	454	Hor Beam-Second Pass- Tier-4	90	1.1
35	455	Hor Beam-Second Pass- Tier-5	90	1.1
35	456	Hor Beam-Second Pass- Tier-6	80	1.1
35	457	Hor Beam-Second Pass- Tier-7	80	1.1
35	458	Hor Beam-Second Pass- Tier-8	80	1.1
35	511	Front Bracing-Tier-1	50	1.1
35	512	Front Bracing-Tier-2	50	1.1
35	513	Front Bracing-Tier-3	50	1.1
35	514	Front Bracing-Tier-4	40	1.1
35	515	Front Bracing-Tier-5	40	1.1
35	516	Front Bracing-Tier-6	40	1.1
35	517	Front Bracing-Tier-7	40	1.1
35	518	Front Bracing-Tier-8	40	1.1
35	521	Side Bracing-Tier-1	50	1.1
35	522	Side Bracing-Tier-2	50	1.1
35	523	Side Bracing-Tier-3	50	1.1
35	524	Side Bracing-Tier-4	40	1.1
35	525	Side Bracing-Tier-5	40	1.1
35	526	Side Bracing-Tier-6	40	1.1
35	527	Side Bracing-Tier-7	40	1.1
35	528	Side Bracing-Tier-8	40	1.1
35	531	Rear Bracing-Tier-1	50	1.1

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
35	532	Rear Bracing-Tier-2	50	1.1
35	533	Rear Bracing-Tier-3	50	1.1
35	534	Rear Bracing-Tier-4	40	1.1
35	535	Rear Bracing-Tier-5	40	1.1
35	536	Rear Bracing-Tier-6	40	1.1
35	537	Rear Bracing-Tier-7	40	1.1
35	538	Rear Bracing-Tier-8	40	1.1
35	700	HSFG FASTENERS	40	1.1
35	701	HSFG FASTENERS	20	1.1
35	811	FLOOR GRILLS AND GUARD PLATE	100	1.1
35	812	Edge Strip And Guard Plate	50	1.1
35	821	STAIRS - LOWER	10	1.1
35	822	STAIRS - MIDDLE	10	1.1
35	823	STAIRS - UPPER	10	1.1
35	851	HAND RAILS AND POSTS	30	1.1
35	993	CONSUMABLESANDERECTI	20	1.1
35	995	CHUTE PIPE AND LADDE	30	1.1
36	110	COLUMNS NEAR AIR PRE	350	1.1
36	150	BEAMSANDBRACINGS NEA	200	1.1
36	311	MAIN FLOOR I MBL 1ST	30	1.1
36	312	MAIN FLOOR I MBL 2ND	30	1.1
36	313	NON-MBL FLOOR BETWEE	80	1.1
36	314	NON-MBL FLOOR BETWEE	90	1.1
36	315	NON-MBL FLOOR BETWEE	80	1.1
36	316	NON-MBL FLOOR BETWEE	120	1.1
36	321	MAIN FLOOR II MBL IST	40	1.1
36	322	MAIN FLOOR II MBL 2ND	50	1.1
36	323	NON-MBL FLOOR BETWEE	120	1.1
36	324	NON-MBL FLOOR BETWEE	70	1.1
36	325	NON-MBL FLOOR BETWEE	90	1.1
36	326	NON-MBL FLOOR BETWEE	42	1.1
36	331	MAIN FLOOR III MBL 1	90	1.1
36	332	MAIN FLOOR III MBL 2	90	1.1
36	333	NON-MBL FLOOR BETWEE	90	1.1
36	334	NON-MBL FLOOR BETWEE	80	1.1
36	335	NON-MBL FLOOR BETWEE	50	1.1
36	336	NON-MBL FLOOR BETWEE	50	1.1
36	337	NON-MBL FLOOR BETWEE	50	1.1
36	341	MAIN FLOOR IV MBL 1ST	60	1.1
36	342	MAIN FLOOR IV MBL 2ND	60	1.1
36	343	NON-MBL FLOOR BETWEE	121	1.1
36	344	NON-MBL FLOOR BETWEE	90	1.1

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
36	345	NON-MBL FLOOR BETWEE	80	1.1
36	346	NON-MBL FLOOR BETWEE	30	1.1
36	347	NON-MBL FLOOR BETWEE	66	1.1
36	351	MAIN FLOOR V MBL IST	60	1.1
36	352	MAIN FLOOR V MBL II ND	60	1.1
36	353	NON-MBL FLOOR BETWEE	66	1.1
36	354	NON-MBL FLOOR BETWEE	55	1.1
36	355	NON-MBL FLOOR BETWEE	50	1.1
36	356	NON-MBL FLOOR BETWEE	50	1.1
36	361	MAIN FLOOR VI MBL 1ST	50	1.1
36	362	MAIN FLOOR VI MBL 2ND	50	1.1
36	363	NON_MBL FLOOR ABOVE	50	1.1
36	364	NON MBL FLOOR ABOVE MBL VI	50	1.1
36	365	NON MBL FLOOR ABOVE MBL VI	40	1.1
36	366	NON MBL FLOOR ABOVE MBL VI	40	1.1
36	371	Floor Beams @ 79100 (MBL-7) 1st Pass	50	1.1
36	372	Floor Beams @ 79100 (MBL-7) 2nd Pass	95	1.1
36	373	Floor Beams @ 83400 (Tier-8)	20	1.1
36	374	Floor Beams @ 87500 (MBL-8) 1st Pass	20	1.1
36	375	Floor Beams @ 87500 (MBL-8) 2nd Pass	20	1.1
36	376	Floor Beams @ 90500 (Tier-8)2nd Pass	20	1.1
36	391	MISCELLANEOUS PLATFO	300	1.1
36	392	MISCELLANEOUS PLATFO	150	1.1
36	393	APH, SCAPH, HANDLING	120	1.1
36	394	MISCELLANEOUS PLATFO	50	1.1
36	395	MISCELLANEOUS PLATFO	50	1.1
36	396	Slide Bearing Plates	2	1.1
36	610	BOILER ROOF STRUCTUR	210	1.1
36	611	BOILER ROOF SHEETING	30	1.1
36	613	RAIN WATER PIPES and	25	1.1
36	620	BOILER SIDE CLADDING	90	1.1
36	621	BOILER SIDE CLADDING	10	1.1
36	700	Hsfg Bolts	10	1.1
36	701	Fasterners	2	1.1
36	740	POSTS AND HANGERS	50	1.1
36	811	FLOORGRILLSANDGUARDP	140	1.1
36	812	FLOORGRILLSANDGUARDP	140	1.1
36	813	FLOORGRILLSANDGUARDP	140	1.1
36	814	FLOORGRILLSANDGUARDP	75	1.1
36	820	STAIRS AND LADDERS	15	1.1
36	851	HANDRAILS AND POSTS	15	1.1
36	852	HANDRAILS AND POSTS	20	1.1

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
36	853	HANDRAILS AND POSTS	20	1.1
38	210	INTER CONN PLATFORMS	10	1.1
38	299	MILL HANDLING MONORA	270	1.1
38	310	CONN PLATFORMS TO MI	85	1.1
38	381	ECO HANDLING STRUCTU	108	1.1
38	410	MILL MAINTANANCE PLA	110	1.1
38	510	LIFT BEAMS AND BRACI	80	1.1
38	610	ELEVATOR CLADDING ST	32	1.1
38	611	ELEVATOR CLADDING SH	20	1.1
38	710	LIFT MACHINE ROOM DE	73	1.1
38	810	FLOORGRILLS AND GUAR	125	1.1
38	820	STAIRS AND LADDERS	10	1.1
38	850	HAND RAILS AND HAND	15	1.1
38	993	CONSUMABLES AND EREC	12	1.1
39	301	STRUC AND PLATFORM F	10	1.1
39	302	STRUC FOR MOTOR HOOD	10	1.1
39	304	FAN HANDLING STRUCTU	30	1.1
39	305	FAN HANDLING STRUCTU	30	1.1
39	306	FAN HANDLING STRUCTU	45	1.1
39	700	HSFG FASTENERS FOR P	60	1.1
39	810	FLOOR GRILL	50	1.1
39	820	STAIRS	50	1.1
39	850	HAND RAIL AND HAND R	30	1.1
35	010	Foundation Materials-Boiler	5	1.1
35	110	Main Columns Left	22	1.1
35	410	Column Frames-Front Frame	16	1.1
35	510	Column Bracings-Front Bracing	17	1.1
35	610	Boiler Roof Structure	4	1.1
35	611	Boiler Roof Sheeting	1	1.1
35	810	Temporary Structure For Drum Erection	5	1.1
36	310	Main Floor I Mbl	14	1.1
36	811	Floorgrillsandguardplates-Lower	16	1.1
36	820	Stairs And Ladders	2	1.1
36	850	Handrails And Hand Rail Post	7	1.1
		SUB-TOTAL	17085	

Boiler- Pressure Parts

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
04	147	Supprts for Collectr & Separatr Vessel	22.00	1.2
04	321	VERTICAL SEPARATOR	33.00	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
04	323	STORAGE TANK	57.50	1.2
04	347	Seperator/Collecting Vessel Supp DD	0.30	1.2
04	547	Seperator/Collecting Vessel Supp Shop	2.20	1.2
05	137	EVAPORATOR INLET HDR - FRNT	18.00	1.2
05	147	FUR LWR REAR INLET HDR	18.00	1.2
05	155	FUR LWR SIDE INLET HDRS	13.00	1.2
05	227	FUR UPPER REAR OUTLET HDR	14.00	1.2
05	231	FUR UPPER FRNT OUTLET HDR	12.00	1.2
05	251	FUR UPPER SIDE OUTLET HDRS	21.00	1.2
05	327	FUR INTERMEDIATE REAR HDR	14.00	1.2
05	330	FUR INTERMEDIATE FRNT HDR	14.00	1.2
05	350	FUR INTERMEDIATE SIDE HDRS	26.00	1.2
06	400	FUR BURNER PANELS	60.00	1.2
06	431	Front Upper Ww Panel Attachment	0.25	1.2
06	434	Front Intermediate WW Panel -OS	110.00	1.2
06	437	Front WW Lower Panel-OS	35.80	1.2
06	441	Rear Upper WW Panel -OS	0.05	1.2
06	447	Rear Lower WW Panel -OS	35.80	1.2
06	451	Side Upper Ww Panel Attachment	0.20	1.2
06	453	Side Intermediate WW Panel -OS	68.50	1.2
06	455	Side Lower WW Panel -OS	13.00	1.2
06	500	FUR SOFA PANELS	18.00	1.2
06	501	Sofa Panels -OS	0.20	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	40.00	1.2
06	734	FUR UPPER FRNT SPIRAL PANEL	100.00	1.2
06	735	FUR FRNT SPIRAL TO VERTICAL TRANS. PANEL	13.00	1.2
06	737	FUR LWR FRNT SPRL PNL WITH I/T TERM TUBE	68.00	1.2
06	741	FUR REAR ARCH PANELS	50.00	1.2
06	744	FUR UPPER REAR SPIRAL PANEL	100.00	1.2
06	745	FUR REAR SPIRAL TO vert TRANSITION PANEL	8.00	1.2
06	747	FUR LWR RR SPRL PNL WITH I/T TERM TUBES	68.00	1.2
06	751	FUR VERTICAL WALL PANELS - SIDE	98.00	1.2
06	752	FUR LWR VERTICAL WALL PANELS - SIDE	80.00	1.2
06	753	FUR UPPER SIDE SPIRAL PANELS	188.00	1.2
06	755	FUR LWR SIDE SPIRAL PANELS	60.00	1.2
06	759	FUR SIDE SPIRAL TO VERT TRANSITION PANEL	17.00	1.2
07	102	LINKS FROM SEPARATOR TO STORAGE TANK	41.00	1.2
07	110	DOWNCOMER TO CONNECTING SPHERE	6.50	1.2
07	125	Connecting Sphere	3.50	1.2
07	223	FUR SCREEN AND HANGER ASSEMBLY	86.00	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
07	231	FUR SPIRAL WALL OUTLET TERM TUBES	3.00	1.2
07	232	FUR VERTICAL WALL INLET TERM TUBES	11.00	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	39.00	1.2
07	316	FUR REAR RISERS	24.00	1.2
07	317	FURN STORAGE TANK VENT LINK	5.50	1.2
07	318	FUR FRNT RISERS	7.30	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	0.06	1.2
07	402	WW FRT HDR SUSPN	3.00	1.2
07	403	WW SIDE HDR SUSPN	1.10	1.2
07	405	WW SCR.HDR SUSPN.	27.00	1.2
07	409	Furnace wall Supports front	32.00	1.2
07	423	Furnace Screen Tubes Attachment	1.00	1.2
07	431	RISER TUBE SUPPORT	3.20	1.2
07	460	Furnace Spiral Wall supports Misc items	19.00	1.2
07	461	Furnace wall Supports rear	20.00	1.2
07	462	Furnace wall Supports Sides L & R	23.00	1.2
07	502	Ww Front Header Suspn Shop Item	1.05	1.2
07	503	Ww Side Header Suspension Shop Item	0.60	1.2
07	531	Riser Tube Support Shop Item	0.60	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
08	001	FURN UPR BKSTYS-F&R	95.00	1.2
08	003	FURN UPR BKSTYS-SIDE	166.70	1.2
08	006	FURN INT BKSTYS	440.00	1.2
08	007	FURN LWR BKSTYS	58.00	1.2
08	111	FURN REAR ARCH BKSTYS	24.00	1.2
08	380	FURN BOT SUPRTS	210.00	1.2
08	382	FURN BOT SUPRTS-REAR	210.00	1.2
08	501	FURN B P BKSTYS-F&R	258.90	1.2
08	503	FURN B P BKSTYS-SIDE	265.00	1.2
08	901	FURN KEY BKSTYS-UPR	20.40	1.2
08	907	FURN KEY BKSTYS-LWR	0.90	1.2
08	910	EX.MOVT MEAS COMP	1.10	1.2
08	911	Bulk Bps Items-Upper	0.24	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
08	912	Bulk Bps Items-Inter	1.50	1.2
08	913	Bulk Bps Items-Lower	2.80	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
10	135	FUR ARCH SUPPPORT INLET HDR	16.00	1.2
10	174	FINISH SH INLET HDR	19.00	1.2
10	178	SH PLATEN INLET HDR	28.00	1.2
10	182	BP LWR REAR HDR	14.00	1.2
10	183	BP UPPER SIDE INLET HDR	24.50	1.2
10	184	BP EXTENDED SIDE INLET HDR	13.60	1.2
10	185	BP LWR FRNT HDR	15.90	1.2
10	191	SH FUR ROOF INLET HDR	16.00	1.2
10	195	SH DIVN PANEL IN HDR	16.00	1.2
10	235	FUR ARCH SUPPPORT OUTLET HDR	16.00	1.2
10	274	FINISH SH OUTLET HDR	42.70	1.2
10	278	SH PLATEN OUTLET HDR	32.00	1.2
10	283	BP LWR SIDE HDRS	19.00	1.2
10	284	BP EXT FLOOR OUTLET HDR WITH TERM TUBES	12.00	1.2
10	285	BP FRNT OUTLET HDR	17.20	1.2
10	291	SH FUR ROOF OUTLET HDR	39.40	1.2
10	295	SH DIVN PANEL OUTHDR	22.00	1.2
10	315	SH REAR INTER HEADER	27.00	1.2
10	687	SH BP Junction header	13.70	1.2
11	074	FINISH SH FRNT ASSY WITH I/T TERM & COT	505.50	1.2
11	078	SH PLATEN ASSY WITH TERM TUBES - LEFT	229.00	1.2
11	095	SH DIVN PANEL LEFT	61.00	1.2
11	374	FINISH SH REAR ASSY WITH O/T TERM & COT	523.50	1.2
11	378	SH PLATEN ASSY WITH TERM TUBES - RIGHT	78.00	1.2
11	395	SH DIVN PANEL RIGHT	55.00	1.2
11	406	SH Frnt Upper Pnl Attachment	0.50	1.2
11	467	SH Sc Side Pnl Upper Left Attachment	0.10	1.2
11	469	SH Sw Panels Lower Front (L&R)-OS	0.08	1.2
11	474	SH Vertical Spaced Coil Attachment	0.50	1.2
11	487	BP LTRH Hanger Tube Attchment	0.50	1.2
11	491	SH Radient Roof Tubes (Left)-OS	0.50	1.2
11	494	SH Extended Bottom Panels-OS	0.02	1.2
11	606	BP FRNT WALL PANELS	39.00	1.2
11	608	BP FRNT WALL PANEL - LWR	34.00	1.2
11	684	BP EXTENDED SIDE FIN WELDED PANEL	24.00	1.2
11	694	BP EXTENDED SIDE FLOOR FIN WELDED PANEL	21.00	1.2
11	716	BP UPPER REAR PANEL	19.00	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
11	717	SH REAR WALL PANEL INTER(LEFT)	18.00	1.2
11	718	BP LWR REAR PANEL	20.00	1.2
11	767	BP UPPER SIDE PANEL-LEFT	48.40	1.2
11	768	SH SIDE WALL PANELS INTER (FRONT)	28.00	1.2
11	769	BP LWR SIDE PANEL - LEFT	39.50	1.2
11	787	BP REAR ROOF PANELS	25.00	1.2
11	791	SH FUR ROOF FIN WELDED PANEL	22.00	1.2
11	916	SH REAR WALL PANELS UPPER (RIGHT)	19.00	1.2
11	917	SH REAR WALL PANEL INTER (RIGHT)	18.00	1.2
11	918	SHSC RR WL PNL LR RT	20.00	1.2
11	967	BP UPPER SIDE PANEL-RIGHT	48.40	1.2
11	968	SH SIDE WALL PANELS INTER (REAR)	28.00	1.2
11	969	BP LWR SIDE PANEL - RIGHT	39.50	1.2
11	987	SHSC RR ROOF PNL RT	25.00	1.2
11	991	SH FUR ROOF TUBES	34.00	1.2
12	178	LINK TO SH DESUPERHEATER	25.00	1.2
12	179	LINK TO FINISH SH INLET HDR	40.00	1.2
12	181	FUR ARCH SUPPORT LINKS	12.50	1.2
12	184	BP EXTENDED SIDE CONNECTION LINK	55.00	1.2
12	187	SH BYPASS PIPES	36.00	1.2
12	314	Suspn of SH R.Roof Headers DD Item	0.02	1.2
12	317	Suspn 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	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	0.03	1.2
12	393	SH Misc Components DD Item	0.20	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	20.00	1.2
12	514	Suspn of SH R.Roof Hdrs Shop Item	3.50	1.2
12	515	BP STEAM COOLED HANGER TUBES	290.00	1.2
12	517	Suspn of R.Roof Headers Shop Item	0.95	1.2
12	524	Suspension of SH Rear Wall Shop Item	1.90	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	1.30	1.2
12	554	Suspn of Vert. Spaced Assy Shop Item	2.35	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
12	568	RH Vert Platen Frnt Coil Left Shop Item	0.15	1.2
12	619	BP LTRH I/T AND ECO O/T HDR SPT TUBES	55.00	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	53.00	1.2
12	850	SH CONNECTING PIPE	22.00	1.2
12	852	LINKS TO SH PLATEN INLET HDR	39.00	1.2
12	900	SH DESUPERHEATER	8.00	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	30.00	1.2
12	927	SUSPN OF REAR ROOF	12.00	1.2
12	928	SUSPN - SH REAR WALL	60.16	1.2
12	944	SUSPN-SH PLATEN HDRS	4.00	1.2
12	948	SUSP-VERT SPACD ASSY	61.85	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	992	Welding Electrodes	1.90	1.2
12	993	EREC MATLS, CONSUMES	6.15	1.2
12	994	PORT IN FOR THK MSMT	0.05	1.2
15	136	LTRH INLET HDR	12.00	1.2
15	178	FINISH RH INLET HDR	15.00	1.2
15	236	LTRH OUTLET HDR	16.00	1.2
15	278	FINISH RH OUTLET HDR	36.00	1.2
16	079	RH VERPLN FR COIL LT	256.50	1.2
16	201	LTRH UPPER ASSEMBLY	283.00	1.2
16	202	LTRH INTERMEDIATE ASSEMBLY	538.80	1.2
16	203	LTRH LWR ASSEMBLY WITH INLET TERM TUBES	399.20	1.2
16	270	LTRH PENDANT ASSY WITH O/T TERM TUBES	301.50	1.2
16	379	RH VERPLN FR COIL RT	60.00	1.2
17	174	LINK TO RH DESUPERHEATER	45.00	1.2
17	304	RH Spprts For Lines And Links DD Item	0.04	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	0.10	1.2
17	504	RH Suprts For Lines And Links Shop Item	2.25	1.2
17	506	RH Suprt For Lines And Links Shop Item	0.17	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
17	519	RH Frnt Suspension Shop Item	2.00	1.2
17	900	RH DESUPERHEATER	6.00	1.2
17	903	RH MISCL COMPONENTS	72.00	1.2
17	904	RH HDR SUPRT AB ROOF	9.75	1.2
17	906	RH SUPRT LINES & LIN	2.00	1.2
17	919	RH FRONT SUSPENSION	30.00	1.2
17	991	Welding Electrodes-Part-1	1.00	1.2
17	992	Welding Electrodes	1.13	1.2
18	001	FUR ROOF SKIN CASING	19.44	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
19	092	ECO OUTLET TERM TUBES	22.30	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	19.70	1.2
19	702	ECO OUTLET HDR	28.00	1.2
19	814	ECO UPPER ASSY - LEFT	360.00	1.2
19	824	ECO LWR ASSY -LEFT	320.00	1.2
19	850	ECO INLET LINKS	136.90	1.2
19	851	LINKS FROM ECO OUT. HDR TO ECO MIX LINE	36.32	1.2
19	852	ECO MIXING LINE	16.60	1.2
19	853	LINKS FROM ECO MIX LINE TO FURN I/T HDRS	34.20	1.2
19	903	ECO.MISCL COMP	150.00	1.2
19	906	ECO LINE&LINK SUPORT	29.45	1.2
19	907	ECO,FEEDPIPE SUPPORT	15.00	1.2
19	914	ECO UPPER ASSY - RIGHT	360.00	1.2
19	924	ECO LWR ASSY-RIGHT	320.00	1.2
19	991	Welding Electrodes-Part-1	0.03	1.2
19	992	Welding Electrodes	0.10	1.2
21	600	S.B. PPG & FITTINGS	22.00	1.2
21	601	S.B PIPING SUPPORTS	2.18	1.2
21	602	Sb Piping - DD Items	2.18	1.2
21	603	Sb Piping - BOI Items	0.02	1.2
21	604	SB Piping Supports - OS items	8.65	1.2
21	605	SB Piping Supports - DD Items	0.01	1.2
21	606	SB Piping Supports - BOI Items	0.01	1.2
21	700	BULKED BPS COMP	0.53	1.2
21	800	SB VALVES (BHEL)	3.98	1.2
21	825	SB VALVES (SUBDELY)	0.88	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
21	850	SB SAFETY VALVE BHEL	0.06	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	0.05	1.2
24	350	BLR FILLING PIPING	3.10	1.2
24	351	H&S BLR FILLING PPG	0.28	1.2
24	352	Boiler Fill Piping - DD Items	0.18	1.2
24	353	H&S For Boiler Fill Piping - OS Items	0.77	1.2
24	354	BOI Items for Blr Trim Piping	0.00	1.2
24	700	BULKED BPS COMP	0.50	1.2
24	800	BOILER TRIM PIPING	48.00	1.2
24	801	SUPPORTS-TRIM PIPING	5.46	1.2
24	803	Boiler Trim Piping - DD Items	0.35	1.2
24	804	Supports - Blr Trim Piping - OS Items	41.33	1.2
24	805	LINK TO BOILER RECIRCU SYSTEM	45.10	1.2
24	806	MIXING VESSEL	7.82	1.2
24	807	RECIRCU PUMP SUCTION LINE	37.70	1.2
24	808	RECIRCU PUMP DISCHARGE LINE	14.34	1.2
24	809	BOILR RECIR LINK FROM BF LINE	13.75	1.2
24	810	H and S FOR STARTUP SYSTEM	28.32	1.2
24	811	Fur Link to Flash tank HWL1&2	113.20	1.2
24	813	Supports - Blr Trim Piping - DD Items	0.01	1.2
24	815	SPRAY WATER SYSTEM	60.87	1.2
24	817	H&S For Start-Up System - OS Items	15.40	1.2
24	818	H&S For Start-Up System - DD Items	0.30	1.2
24	819	H&S For Start-Up System - BOI Items	0.01	1.2
24	820	EXHAUS PIPE SAFETY VLV	47.95	1.2
24	822	De-Superheater Pipes - OS Items	32.68	1.2
24	823	De-Superheater Pipes - DD Items	0.19	1.2
24	824	Exhaust Pipe For Sv - OS Items	10.74	1.2
24	825	SILENCER SUPPORTS	0.08	1.2
24	826	Silencer Supp - OS Items	48.30	1.2
24	827	Exhaust Pipe For Sv - DD Items	0.86	1.2
24	828	Exhaust Pipe For Sv - BOI Items	0.02	1.2
24	835	STARTUP VENT DIFFUSER SILEN SUP	0.90	1.2
24	836	Start-Up Vent, Diffuser, Sil Supp-OS	6.20	1.2
24	837	Start-Up Vent, Diffuser, Sil Supp-DD	0.02	1.2
24	840	SAMPLE COOLER AND SUPPORTS	0.74	1.2
24	841	Sample Cooler & Supports - OS Items	0.15	1.2
24	842	Sample Cooler and Suprts-DD items	0.02	1.2
24	855	RECIRCULATING PUMB COMP	19.86	1.2
24	860	VALVES (BHEL)	87.52	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
24	865	CTL VALVES FOR SPRAY PIPING SD	7.72	1.2
24	867	CTL VAL FOR STARTUP RECIRCU SYS	13.74	1.2
24	880	SAFETY VALVES	6.88	1.2
24	881	SAFETY VALVES AND ERV(BHEL) SD	1.55	1.2
24	883	Safety Valves (Bhel) - Non HT	5.70	1.2
24	885	SILENCERS(BHEL)	50.32	1.2
24	950	SPECIAL TOOLS	0.16	1.2
24	955	LAP TOOL SV&ERV	0.04	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	COMMG SPARES/SD	0.02	1.2
24	989	BHEL VALVE COMG SPAR	0.05	1.2
24	992	WELDING ELECTRODES-TRIM PPG	1.30	1.2
24	993	CONSUME & EREC MATLS	0.18	1.2
24	994	NAME PLATES	0.28	1.2
31	010	COMPS WELDED TO PR	1.10	1.2
31	104	FUR REAR ARCH SKIN	2.50	1.2
31	993	ERECTION MATERIALS	2.00	1.2
32	700	BULKED DD COMPONENT	130.00	1.2
32	810	EQUIPMENT OUTER CASING	310.00	1.2
42	001	PNEUMATIC FITTINGS	0.20	1.2
42	002	STEAM BLOW MATERIALS	1.00	1.2
42	005	INSTRUMENT FITTINGS	0.60	1.2
42	010	LFO PUMP SET	10.5	1.2
42	020	HFO PUMP SET	16.5	1.2
42	030	HFO HEATER SET	35.25	1.2
42	046	DO PUMP-MOTOR ASSY	0.5	1.2
42	065	DRAIN OIL TANK	4	1.2
42	070	BURNER STN SKID ASLY	6.5	1.2
42	120	PIPING,PH FUEL OIL	3.20	1.2
42	128	PIPING,P.HOUSE STM	1.00	1.2
42	150	PIPING, OFLR HFO/TRC	19.00	1.2
42	152	PIPING,OP.FLR LFO	3.00	1.2
42	154	PIPING,OP.FLR DO	2.50	1.2
42	157	PIPING,OP.FLR AIR	4.30	1.2
42	158	PIPING,OP.FLR STM	6.00	1.2
42	200	SUB.DEL FO SYSTEM	3.00	1.2
42	300	BHEL VALVE F.O. SYS	2.20	1.2
42	358	B.VALVE,OP.FLR STM	0.45	1.2
42	700	BULKED BPS COMPONENT	1.00	1.2
42	710	Fuel Oil System - DD Items	4.00	1.2
42	858	Fuel Oil System - Shop items	10.00	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
42	988	O&G SYS COMMG SPARE	0.05	1.2
42	992	IMPORTED ELECTRODES	0.05	1.2
97	590	ERECTION MATERIALS	20.00	1.2
80	300	MS FROM SUPERHEATER TO BOILER STOP VALVE	2	1.2
80	345	AUX STEAM TO DEAERATING HEATER	3.5	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	SUB DELIVERY VALVES FOR LIGHT UP-PIPING	0.3	1.2
80	420	BOILER FEED PUMP SUCTION	0.7	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	0.4	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	0.675	1.2
80	600	HIGH PRESSURE DOSING PIPING	0.15	1.2
80	601	LOW PRESSURE DOSING PIPING	0.095	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	2.1	1.2
80	901	SUB DELIVERY VALVES FOR LIGHT UP-INST.	0.5	1.2
80	920	H AND S FOR HYDRO TEST	2.3	1.2
80	921	H AND S FOR LIGHT UP STEAM LINE	3.1	1.2
80	922	H AND S FOR LIGHT UP - NON STEAM LINES	1.2	1.2
80	936	VLH AND CLH for SG PPG -HERP	1	1.2
80	992	WELDING ELECTRODES-1	0.025	1.2
81	005	INTERMITTENT BLOW DOWN EXPANDER-D1500 MM	2	1.2
81	127	LOW PRESSURE DOSING SYSTEM	1	1.2
81	128	HIGH PRESSURE DOSING SYSTEM	1	1.2
52	000	SPECIAL TOOLS/CONTRA	1.52	1.2
52	010	LARG AH-ROTOR ASSY	1456.59	1.2
52	011	LARG AH-ROTOR POST	52.10	1.2
52	012	LARG AH-ROTORPINRACK	7.20	1.2
52	013	LARG AH-ROTORSEALS	16.41	1.2
52	030	LARG AH-ROTORHOUSING	81.50	1.2
52	041	HOT END CONN PLATE	123.08	1.2
52	042	COLD END CONN PLATE	255.50	1.2
52	054	LARG AH-AXIAL SEAL	1.55	1.2
52	055	LARG AH-BY PASS SEAL	1.64	1.2
52	100	LARGE AH ROTOR DRIVE	14.35	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
52	101	APH-AIR RECEIVER	10.46	1.2
52	211	LARG AH-AIRSEAL PIPE	0.79	1.2
52	220	LARG AH-GENS DETAILS	3.49	1.2
52	261	LARG AH-GUIDE BEARNG	7.95	1.2
52	262	LARG AH-SUPRT BEARNG	21.35	1.2
52	271	OIL PIPING GUIDE BRG	0.56	1.2
52	272	OIL PIPING SUPRT BRG	0.76	1.2
52	274	LUB OIL CIRCULATION UNIT	1.11	1.2
52	275	LARGE AIR HEATER-LUBRICANTS	1.51	1.2
52	301	WASH MANIFLD GAS INL	2.37	1.2
52	302	WASH MANIFLD GAS OUT	2.61	1.2
52	339	LARGE AH-RETRACT CLNG DEV (HE)	1.49	1.2
52	340	LARG AH-CLEANINGEQPT	2.05	1.2
04	114	Upper Drum + Intl Id 49-60	21.96	1.2
04	144	Upper Drum Sspn Id 49-60	0.55	1.2
04	210	Lower Drum + Intl Id Upto 36	10.74	1.2
04	988	Drum-Commisioning Spares	0.02	1.2
05	137	Inlet front lower water wall header	2.50	1.2
05	147	Inlet rear lower water wall header	1.80	1.2
05	231	outlet front upper water wall header	2.50	1.2
05	241	outlet rear upper water wall header	1.80	1.2
06	609	Corner Ww Pnl	3.52	1.2
06	614	D'Pnl Ww Pnl	9.73	1.2
06	616	Baffle Ww Pnl	5.54	1.2
06	630	Front water wall panel	3.60	1.2
06	640	Rear water wall panel	3.60	1.2
06	657	Side Boiler Ww Pnl	6.21	1.2
07	200	Furnace Tubes	1.00	1.2
07	201	Raiser tubes	1.20	1.2
07	202	Supply tubes	1.10	1.2
07	204	SH. GUIDE Tubes	0.03	1.2
07	211	Boiler Bank Tubes	30.15	1.2
07	214	Boiler Side Wall Shield Tubes	3.11	1.2
07	431	Supports for raiser tubes and supply tubes	0.50	1.2
07	601	Pressure Seals	5.12	1.2
07	989	Tools For Tube Expansion	0.13	1.2
07	992	Welding Electrodes	0.00	1.2
07	993	Consumables & Erection Materials	0.51	1.2
09	001	Seal Boxes For Furnace Opening	0.40	1.2
09	002	Seal Boxes For Instrument Inserts	0.20	1.2
09	003	Material For Instrument Inserts	0.40	1.2
10	170	Vertical Sh Inlet Hdr	1.00	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
10	270	Vertical Sh Outlet Header	1.00	1.2
11	170	Sh Vertical Coil Element	10.00	1.2
12	850	Sh Connecting Pipe	5.81	1.2
12	900	Sh Desuperheater	2.20	1.2
12	901	Sh Hngr,Suprts,Guides & Ties	1.10	1.2
12	992	Welding Electrodes	0.02	1.2
12	993	Consumables & Erection Materials	0.88	1.2
19	850	Eco Inlet Links	0.50	1.2
19	992	Welding Electrodes	0.00	1.2
19	993	Consumables & Erection Materials	1.00	1.2
21	600	Soot Blower Piping And Fittings	0.49	1.2
21	602	Soot Blower Piping & Fittings - Dd	0.11	1.2
21	603	Soot Blower Piping & Fittings - Boi	0.00	1.2
21	604	Soot Blower Piping Supports - Os Items	1.14	1.2
21	700	Bulked Bps Components For Sb Piping	0.01	1.2
21	800	Soot Blower Valves (Bhel)	0.24	1.2
21	992	Imported Electrodes	0.00	1.2
24	350	Boiler Filling Piping	0.12	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	0.22	1.2
24	600	Boiler Trim Piping And Fittings	1.29	1.2
24	601	Boiler Trim Piping Supports	0.20	1.2
24	603	Boiler Trim Piping - Dd Items	0.03	1.2
24	604	Supports - Boiler Trim Piping - Os	0.72	1.2
24	620	Safety Valve Esc Pipe&Drain - Pack Blr	1.17	1.2
24	624	Exhaust Pipe For Safety Valve - Os Items	0.54	1.2
24	625	Silencer Support-Safety Valves	1.35	1.2
24	626	Silencer support	1.00	1.2
24	627	Exhaust Pipe For Safety Valve - Dd Items	0.06	1.2
24	628	Exhaust Pipe For Safety Valve - Boi Item	0.00	1.2
24	635	Slncr&Suprt-Starting Vent - Pack Blr	0.34	1.2
24	640	Sample Cooler And Supports	0.37	1.2
24	641	Sample Cooler & Supports	0.14	1.2
24	642	Sample Cooler & Supports - Dd Items	0.00	1.2
24	660	Valves (Bhel) Pack Blr	1.04	1.2
24	665	Valves & Fittings (Sd) Pack Blr	0.09	1.2
24	673	Direct water level gauge/Bi colour LG	0.12	1.2
24	680	Erv And Safety Valves(Bhel)	0.24	1.2
24	685	Safety Valve/Erv Silencers(Bhel)	1.49	1.2
24	700	Bulked Bps Components For Trim Pipes	0.07	1.2
24	955	Lapping Tools For Sv&Erv	0.01	1.2

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
24	960	Lapping Tools For Conventional Val(Bhel)	0.01	1.2
24	987	Commg Spares For Safety Valves/Erv	0.00	1.2
24	988	Commg Spares For Imported Sub-Dely	0.00	1.2
24	989	Commg Spares For Conventional Valves	0.01	1.2
24	992	Imported Electrodes-Trim Piping	0.01	1.2
24	993	Consumables & Erection Materials	0.00	1.2
24	994	Name Plates	0.08	1.2
31	010	Skin Casing Comps Welded To Pressure P	0.53	1.2
31	301	Miscellaneous Casing	2.20	1.2
42	002	Steam Blow Materials	0.32	1.2
42	010	Lfo Pump Set with valves & piping	3.2206	1.2
42	152	Piping,Opr'G Floor Lfo	0.81	1.2
42	200	Subdelivery Fuel Oil System	0.32	1.2
42	300	Bhel Valve F.O. System	0.16	1.2
42	700	Bps Fasteners	0.08	1.2
		SUB-TOTAL	14688.06	

Boiler- Non Pressure Parts

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
20	051	LONG RETRACT SB M11E	88.74	1.3
20	054	WALL BOX NPR LRSB MI	1.63	1.3
20	201	WALL DESLAGGER RW5E	15.96	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
28	220	DOORS	14.00	1.3
28	700	BPS FASTENERS	6.00	1.3
30	103	SEAL PLATE ASSY	5.60	1.3
30	215	MAIN BOILER ENCL	34.00	1.3
30	219	VERT ROOF ENCL	135.00	1.3
30	223	GAS DIST BAFFLES	0.55	1.3
30	224	ANTIVIBRATION BAFFLE	11.95	1.3
30	233	IST PASS DECK SPRT	45.00	1.3
30	234	2ND PASS DECK SPRT	39.00	1.3
30	235	ENCL SUPPORT STEEL	70.00	1.3
41	350	ACOIL GUN ASSY	1.25	1.3
41	390	OIL GUN VICE&RACK	1.75	1.3

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
41	500	HEA IGNITOR	0.90	1.3
41	710	Oil Gun Assembly - DD items	0.01	1.3
41	988	O&G BURN COMMG SPARE	0.00	1.3
43	004	ASSY SCNR&GUN AIR SY	1.80	1.3
43	005	ASSY MILL AIR SYSTEM	15.00	1.3
43	104	M/C SCNR&GUN AIR SYS	20.00	1.3
43	105	M/C MILL AIR SYSTEM	76.00	1.3
43	200	SUBDEL,IGNR,SCNR AIR	6.50	1.3
43	710	Seal Air & Scanner Air System - DD items	0.30	1.3
45	200	Windbox - Sub Delivery	4.00	1.3
45	710	Wind Box & SOFA Assembly - DD items	0.05	1.3
45	801	WINDBOX AND SOFA TUBE ATTACH	43.00	1.3
45	802	WINDBOX ASSEMBLY - 32" WIDTH	255.00	1.3
45	804	WINDBOX - SOFA ASSEMBLY	80.00	1.3
45	805	WINDBOX SUPPT AIR CYL MOUNTG	22.00	1.3
45	858	Wind Box & SOFA Assy - Shop items	53.00	1.3
47	200	Fuel Piping - Sub-delivery	27.00	1.3
47	261	FUEL PIPE SUPPORTS	24.00	1.3
47	263	FUEL PIPE MISC ITEMS	21.00	1.3
47	269	ST PIPE SHOP BEND REST OF MILL	400.00	1.3
47	710	Pulverised Fuel Piping - DD items	3.00	1.3
47	858	Fuel Piping - Shop items	25.00	1.3
48	012	DUCT - -FDFAN TO A.H	131.00	1.3
48	014	EXP.JT - -FDFAN TO A.H	9.80	1.3
48	015	SUPPORT-FDFAN TO A.H	21.00	1.3
48	018	MISC. DUCT&SPRT MATL	25.00	1.3
48	022	DUCT - FDFAN INTRCON	5.00	1.3
48	112	DUCT - -PAFAN-PRI-AH	168.00	1.3
48	114	EXP.JT - -PAFAN-PRI-AH	8.00	1.3
48	115	SUPPORT-PAFAN-PRI-AH	11.00	1.3
48	141	SEAL AIR HAG&ID GATE	3.75	1.3
48	142	DUCT - -COLDAIRBUS	121.00	1.3
48	144	EXP.JT - -COLDAIRBUS	8.30	1.3
48	145	SUPPORT-COLDAIRBUS	1.60	1.3
48	200	INS TAPPINGS ON DUCT	3.70	1.3
48	202	DUCT - AH-WIND BOX	296.00	1.3
48	204	EXPJT - AH-WIND BOX	53.00	1.3
48	205	SUPORT AH-WIND BOX	35.00	1.3
48	206	CLH/VLH -Hot Air	17.50	1.3
48	207	FLOWMTR-SEC AIRFLOW	22.00	1.3
48	208	DUCT-SEC.AIR TO WB	178.00	1.3
48	212	DUCT - WIND BOX CONN	76.00	1.3

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
48	214	EXPJT - WIND BOX CONN	10.50	1.3
48	222	SQ DUCT AH-HOT AIR BUS	205.00	1.3
48	224	EXPN PCS AH-HOT AIR BUS	20.00	1.3
48	225	SUPPORT AH-HOT AIR BUS	2.00	1.3
48	262	Rect Duct Aihtr Toprinozzle And Seca	64.50	1.3
48	264	Expn Piece Aihtr Toprinozzle and Seca	20.00	1.3
48	265	Supports Aihtr Toprinozzle And Seca	6.50	1.3
48	342	SCR Inlet Ducting	213.50	1.3
48	344	EXPJNT-SCR inlet ducting	40.00	1.3
48	345	Supports-SCR Inlet ducting	45.00	1.3
48	352	SCR outlet ducting	213.50	1.3
48	354	EXPJNT-SCR outlet ducting	42.00	1.3
48	355	Supports-SCR outlet ducting	50.00	1.3
48	362	Eco bypass ducting	30.00	1.3
48	364	EXPJNT-Eco bypass ducting	6.00	1.3
48	365	Support-Eco bypass ducting	8.00	1.3
48	372	DUCT - ECO HOPPER TO AH	107.00	1.3
48	382	DUCT - ECO-HOPPER	219.00	1.3
48	384	EXPNJT - ECO-HOPPER	40.40	1.3
48	385	SUPPORT - ECO-HOPPER	47.00	1.3
48	386	DUCT - ECO TO ECO HOPPER	16.50	1.3
48	395	CLH/VLH-FLUE GAS	6.25	1.3
48	432	DUCT - AH-BLROUTFL	49.00	1.3
48	434	EXPJT - AH-BLROUTFL	9.00	1.3
48	435	SUPORT AH-BLROUTFL	6.50	1.3
48	662	CIRCULAR DUCT HOT BUS MILLS	126.00	1.3
48	664	EXPN PCS HOT BUS MILLS	10.00	1.3
48	665	SUPPORTS HOT BUS MILLS	1.50	1.3
48	700	BULKED BPS COMPONENT	8.00	1.3
48	911	Slide Brg Pl & Pac Bellow-Blr	2.00	1.3
48	912	Slide Brg Pl-Id Sys	1.40	1.3
48	915	Man Hole Doors (450X450)	11.00	1.3
48	993	ERECTON-MATERIALS	24.00	1.3
50	510	STEAM COIL A P H	8.70	1.3
57	010	GATE-FD FAN OUTLET	28.79	1.3
57	033	DAMPER-SA SCAPH INLET	15.06	1.3
57	063	DAMPER-SA SCAPH OUTLET	19.08	1.3
57	083	DAMPER-SA SCAPH BYPASS	19.43	1.3
57	143	DAMPER-COLD AIR TO MILL	7.50	1.3
57	160	GATE-COLD AIR TO MILLS	14.09	1.3
57	173	DAMPER-PA APH INLET	12.23	1.3
57	203	DAMPER-SA APH OUTLET	31.25	1.3

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
57	209	MTG BKT FOR CL DAMPER AIR CYL	4.89	1.3
57	223	DAMPER-PA APH OUTLET	12.18	1.3
57	270	GATE-HOT AIR TO MILLS	22.28	1.3
57	273	DAMPER-HOT AIR TO MILL	12.01	1.3
57	623	DAMPER-SCR BYPASS	87.82	1.3
80	370	HP DRAIN FLASH TANK VENT TO ATMOSPHERE	162.7	1.3
81	12	CLEAN DRAIN FLASH TANK - DIA 1500 MM	4.9	1.3
81	12	CLEAN DRAIN FLASH TANK - DIA 1500 MM	0	1.3
81	36	ECW TANK AND ACCESSORIES	7.447	1.3
81	41	CONDENSATE FLASH TANK	4.034	1.3
81	60	FLASH TANK & ACCESSORIES	57	1.3
87	010	CHIMNEY FDN MATERIAL	10.9	1.3
87	100	CHIMNEY SHELL	150.8	1.3
87	150	CHIMNEY STRAKES	5.4	1.3
87	200	PAINTER TROLLEY	0.6	1.3
87	300	PLATFORMS & LADDERS	21.8	1.3
87	930	AVIATION LAMPS	1.0	1.3
99	300	PUMP HANDLING EQUIPT	4.0	1.3
99	400	SCAPH,RAPH HANDLG EQ	7.0	1.3
99	501	QUICK ERECT SCAFFOLD	170.0	1.3
99	502	PRE.PARTS HANDLING E	10.0	1.3
99	514	FURN CRADL-4WALC	4.5	1.3
99	600	FO SYSTEM HANDLG EQU	1.0	1.3
xx	100	Header	47.6	1.3
xx	101	Storage Tank Sec-1	51.9	1.3
xx	102	Storage Tank Sec-2	47.4	1.3
xx	103	Storage Tank Sec-3	50.6	1.3
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	801	LRs 1E Assembly	0.87	1.3
20	803	Wall box Assembly-PR	0.12	1.3
28	220	Doors	2.00	1.3
30	215	Main Boiler	5.00	1.3
41	200	Sv-Burner Assy With Oil Gun	4.81	1.3
41	500	High Energy Arc Ignitor	0.30	1.3
48	082	Duct-Sa Scaph Bypass	9.86	1.3
48	084	Expjt-Sa Scaph Bypass	0.39	1.3
48	200	Instrument Tappings On Ducting	0.32	1.3
48	207	Flowmeters For Secondary Air Flow	1.93	1.3
48	332	Sqduct,Boiler-Chimney	9.00	1.3
48	334	Expansion Joint in Flue Gas Duct	0.90	1.3

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
48	335	Supportsetcfluegas Ducts System	0.97	1.3
48	700	Bulked Bps Components	0.07	1.3
48	911	Slide Brg Plate & Pacific Bellow-Boiler	0.13	1.3
48	915	Man Hole Doors (450x450)	0.39	1.3
48	993	Erection Materials	0.75	1.3
		SUB-TOTAL	5562.13	

Rotating Equipments

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
55	000	AXL FAN TOOL & FIXTU	0.44	1.4
55	011	FD FAN FOUNDATION MATL	1.43	1.4
55	017	FD FAN C&I ITEMS	0.03	1.4
55	021	AXL IDFAN FDN MATL	3.66	1.4
55	024	ID SEALING/COOLING FANS	3.00	1.4
55	027	ID FAN C&I ITEMS	0.04	1.4
55	031	PA FAN FOUNDATION MATL	1.72	1.4
55	037	PA FAN C&I ITEMS	0.04	1.4
55	091	FISRT FILL LUBRICANTS	3.78	1.4
55	216	AXIAL FD FAN ROTOR	4.58	1.4
55	328	AXIAL 2 REACTION ID FAN ROTOR	35.96	1.4
55	335	AXIAL 2 REACTION PA FAN ROTOR	6.03	1.4
55	516	AXIAL FD FAN STATOR	26.17	1.4
55	628	AXIAL ID FAN STATOR	90.12	1.4
55	635	AXIAL PA FAN STATOR	17.02	1.4
55	810	AXIAL FDFAN COUPLING	1.20	1.4
55	820	AXIAL IDFAN COUPLING	3.88	1.4
55	830	AXL PAFAN COUPLING	1.19	1.4
55	910	AXIAL FD FAN LUBE OIL SYSTEM	2.86	1.4
55	911	AXIAL FDFAN SILENCER	62.59	1.4
55	920	AXIAL ID FAN LUBE OIL SYSTEM	5.90	1.4
55	930	AXIAL PA FAN LUBE OIL SYSTEM	3.39	1.4
55	931	PA FAN SILENCER	52.80	1.4
56	000	TOOLS & FIXTURE/CONT	0.17	1.4
56	011	FD FAN FOUNDATION MATL	0.67	1.4
56	017	FD FAN C&I ITEMS	0.01	1.4
56	077	SEAL AIR FAN C&I ITEMS	0.01	1.4
56	113	RADIAL FD FAN ROTOR	1.57	1.4
56	161	RADIAL PENT HOUSE VENTILN FAN	1.02	1.4
56	173	RADIAL SEAL AIR FAN ROTOR	1.63	1.4
56	313	RADIAL FD FAN BEARINGS	0.30	1.4

PG	MA	DESCRIPTION	WEIGHT (MT)	RATE SCHEDULE ID
56	373	RADIAL SEAL AIR FAN BEARINGS	0.21	1.4
56	413	RADIAL FD FAN STATOR	5.03	1.4
56	473	RADIAL SEAL AIR FAN STATOR	6.83	1.4
56	610	RADL FDFAN MOTOR	2.40	1.4
56	670	RADIAL SEAL AIR FAN MOTOR	1.80	1.4
56	810	RADL FDFAN COUPLING	0.06	1.4
56	870	SEAL AIR FAN COUPLING(RADIAL)	0.05	1.4
56	919	RADIAL FD FAN INSULATION	1.20	1.4
61	10	JOURNAL ASSEMBLY & JOURNAL HEAD ASSY	27.60	1.4
61	110	PLANETARY GEAR BOX AND BOWL & BOWL HUB ASSY	264.00	1.4
61	210	MILL SIDE ASSEMBLY	131.00	1.4
61	310	SEP BODY ASSY WITH TRUN SHAFTS & JOURN OPEN CVR	313.00	1.4
61	410	SEPARATOR TOP ASSEMBLY	4.74	1.4
61	411	MDV ASSEMBLY (KNIFE GATVE VALVES)	0.50	1.4
61	710	DYNAMIC CLASSIFIER COMPLETE	11.80	1.4
61	810	LUBRICATING OIL	13.00	1.4
61	910	FOUDATION FASTNER & MOUTING PLATE	66.00	1.4
65	200	Coal Feeder- Sub-Delivey	1.25	1.4
65	710	Coal Feeder - DD items	0.30	1.4
65	736	36GRAVIMETRIC FEEDER	65.60	1.4
67	200	Coal Feeding System- Sub dely.	1.50	1.4
67	204	RAW COAL GATES	4.00	1.4
67	272	BUNKER OUTLET GATE -36" MOTOR	8.70	1.4
67	276	FEEDER INLET GATE- 36" CHAIN	9.00	1.4
67	283	FEEDER OUTLET ISOLATION GATE	11.20	1.4
67	710	Coal Feeding System - DD items	1.00	1.4
67	801	DOWN SPOUT	10.00	1.4
67	802	BUNKER EMPTYINGCHUTE	27.50	1.4
67	803	FEED PIPE TO MILL	20.00	1.4
81	026	TRAY TYPE DEAERATOR BELOW 100 cuM/HR	23.00	1.4
81	104	BOILER FEED PUMP	3.50	1.4
xx	1	ID FAN MOTORS	46.00	1.4
xx	2	FD FAN MOTORS	23.00	1.4
xx	3	PA FAN MOTORS	31.00	1.4
xx	4	MILL MOTORS	52.00	1.4
xx	5	MISC ITEMS	52.00	1.4
xx	6	BFP MOTOR	94.00	1.4
		SUB-TOTAL	**1666.97**	

Rotating Machines Handling Equipments

PG	MA	PGMA_DESC_SHORT	WEIGHT (MT)	RATE SCHEDULE ID
99	100	FAN HANDLING EQUIPT	23	1.5
99	099	MISC CHAIN PULLY BLO	0.1	1.5
61	xxx	MILL HANDLING EQUIPT	55	1.5
		SUB-TOTAL	78.1	

Insulation

PG	MA	PGMA_DESC_SHORT	WEIGHT (MT)	RATE SCHEDULE ID
33	210	MAIN BLR CAST REF GR	180.00	1.6
33	212	Main Blr Castable Refractory Gr C	41.25	1.6
33	230	MAIN BLR POUR INSUL	90.00	1.6
33	201	Main Blr Formed Refractory Is8	13.03	1.6
		SUB-TOTAL	**324.28**	
33	971	MISC EQPTS WW CLOTH	1.50	1.7
33	021	BLR PP MINRL WOOL	1150.00	1.7
33	221	DUCT MINERAL WOOL	360.00	1.7
33	924	MISC EQPTS PCK MATLS	0.58	1.7
55	919	AXIAL FD FAN INSULATION WOOL	3.10	1.7
55	919	AXIAL FD FAN INSULATION WOOL	14.78	1.7
55	939	AXIAL PA FAN INSULATION WOOL	1.86	1.7
55	939	AXIAL PA FAN INSULATION WOOL	9.24	1.7
33	021	Blr Pr Parts Mineral Wool	10.72	1.7
81	325	MINERAL WOOL MATTRESS	1.80	1.7
87	950	CHIMNEY INSULATION	15.768	1.7
		SUB-TOTAL	**1569.35**	
32	010	FICOM BLR PP INSUL	15.00	1.8
33	970	MISC EQPTS EXP METAL	18.00	1.8
32	210	FIX COMP-DUCT INSULN	100.00	1.8
37	810	BLR OUTER CASING	70.00	1.8
32	010	Fixing Comp For Blr Pr Parts Insul	4.00	1.8
37	010	Blr Outer Casing Components	0.83	1.8
37	810	Blr Outer Casing	1.58	1.8
81	318	FIX COM FOR MISCELLANEOUS PPG INSULATION	0.55	1.8
87	960	CHIMN INS FIX COMP	3.21355	1.8
		SUB-TOTAL	**213.17**	
37	010	BLR OUTER CSG COMPS	50.00	1.9
33	975	MISC EQPTS SEAL COMP	0.50	1.9
81	341	SEALING COMPOUND FOR INSL	0.03	1.9
81	350	ALUMINIUM CLADDING FOR INSULATION	1.50	1.9
		SUB-TOTAL	**52.03**	

VOLUME-IA PART-I CHAPTER -X
GENERAL

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

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

1.10.1 Contractors are requested to furnish the following at PSSR-HQ, Chennai immediately after release of Letter of Intent (LOI)

i) Security Deposit and additional Security Deposit.
ii) Unqualified Acceptance for Detailed LOI/ 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) PF Regn No.
ii) Labour License No.
iii) Workmen Insurance Policy No.

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 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 the registration of establishment, fees paid towards registration of Beneficiaries and contribution of Beneficiaries remitted.

1.10.3.1.6 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as 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 extent the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of this letter of intent. In case you are exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of your failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to us by the customer 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/r 25 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 contactor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

1.10.3.3.3 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 contactor, 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 ID 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 in case 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-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 RECOVERY OF COMPENSATION PAID TO VICTIMS BY BHEL IN CASES OF DEATH/ PERMANENT INCAPACITATION OF PERSON DUE TO AN ACCIDENT DURING THE WORKS

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 employees as detailed below.

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

b) 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.

c) Compensation in respect of each of the victims:

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

In the event of other permanent disability: Rs. 7,00,000/- (Rs. Seven Lakh)

d) 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.

1.10.4.2 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The applicable erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any rework on this failure to comply with will be to account of 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 entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs in other projects or for any reason whatsoever.

1.10.4.3 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.

1.10.4.4 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.

1.10.4.5 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 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.

1.10.4.6 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, equipment etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.

1.10.4.7 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 drawls at the rate prescribed by manufacturing units.

1.10.4.8 No member of the already erected structure, platform, pipes, grills, other component and auxiliaries should be cut without specific approval of BHEL engineer.

1.10.4.9 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.

1.10.4.10 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – 2008 Standards.

1.10.4.11 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipment coming under this scope. Sometimes, more than one agencies may have to work in same location. Sometimes 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.

1.10.4.12 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.

1.10.4.13 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.

1.10.4.14 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.

1.10.4.15 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.

1.10.4.16 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.

1.10.4.17 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.

1.10.4.18 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.

1.10.4.19 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

1.10.4.20 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.

1.10.4.21 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.

1.10.4.22 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.

1.10.4.23 On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instructions of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

1.10.4.24 UTILITY POINTS

1.10.4.24.1 Number of utility points (Service / plant air, service / plant water, service / washing steam, inert gas (N_2) 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.

1.10.4.24.2 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.

1.10.4.25 DOCUMENTATION

1.10.4.25.1 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.

1.10.4.25.2 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.

1.10.4.25.3 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.

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

1.10.4.26 SITE INSPECTION

1.10.4.26.1 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.

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

1.10.4.27 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. 1.1

VOLUME-IA PART-I CHAPTER - XI
PROGRESS OF WORK

(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 IA Part-II)

1.11.2 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.

1.11.3 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding progress of work, labour availability, equipment deployment, testing, etc.

1.11.4 Contractor is required to draw mutually agreed monthly work programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

1.11.5 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.

1.11.6 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.

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

1.11.8 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.

1.11.9 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

1.11.10 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.

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 of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operators and helpers. Data shall be split up under the work areas like Boiler (pressure parts, structures), Rotating machines, etc.

e. Consumables report giving consumption of all types of gases and electrodes during the previous month.

f. Availability report of cranes.

g. Safety implementation report in the format.

h. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

VOLUME-IA PART-I CHAPTER -XII FOUNDATIONS AND GROUTING

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

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

1.12.1 Foundation for the equipment 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 equipment / 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 equipment/ equipment based on the foundations including shear lug provisions/ openings.

1.12.5 Foundation pockets are to be cleaned thoroughly before placing the supports / columns / equipment. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.

1.12.6 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with

foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by 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 / equipment including pocket grouting, grouting at the gap between foundation and base plates top surface of column / equipment 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 supplier's recommendation/ IS standard. Copy of those recommendations is to be submitted to BHEL for records.

VOLUME-IA PART-I CHAPTER -XIII
MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

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

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

1.13.1 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 / Equipment 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 2 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 Some consignments like ODC consignments may be unloaded near to erection site as per space availability.

1.13.6 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, trailor 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.

1.13.7 The equipment / 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.

1.13.8 Contractor shall plan and transport equipment, 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.

1.13.9 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.

1.13.10 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.

1.13.11 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.

1.13.12 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.

1.13.13 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.

1.13.14 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

ERECTION

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 ERECTION

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 equipment / 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 the work. If the contractor has drawn materials in excess

of design requirements, recoveries will be effected for such excess drawls 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 connect the joints at no extra cost.

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 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 thermo wells, 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 equipment /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 equipment like 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 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.

1.14.2 ERECTION OF BOILER & ITS AUXILIARIES AND ROTATING MACHINES

1.14.2.1 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.

1.14.2.2 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.

1.14.2.3 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 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.

1.14.2.4 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.

1.14.2.5 The following measuring and test equipment 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.

1.14.2.6 Detailed procedure available with BHEL site office should be collected before taking up the job by the contractor for preassembly of ceiling girders. Each ceiling girder will be supplied in maximum 3 pieces and welding & NDT test 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 142 MT and maximum elevation of ceiling girder is 99.944 m and top of silencer is 115 m maximum.

1.14.2.7 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.

1.14.2.8 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.

1.14.2.9 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.

1.14.2.10 The tightening procedures for HSFG bolts are to be obtained from BHEL at site before taking up the work. 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.

1.14.2.11 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.

1.14.2.12 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.

1.14.2.13 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.

1.14.2.14 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

a) Machine / flame / electric cutting, grinding, welding, radiography and stress relieving.

b) Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, cleaning, checking, levelling, blue matching, aligning and assembly.

c) Machining, surface grinding, drilling, doweling, shaping.

d) Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication.

1.14.2.15 Normally the 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. 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.

1.14.2.16 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.

1.14.2.17 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 wieldable primer as preservation and supply of the primer is in contractor scope.

1.14.2.18 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).

1.14.2.19 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over. Daily welding reports in the format suggested by BHEL should be submitted by next morning without fail.

1.14.2.20 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.

1.14.2.21 In case of any class of work for which there is no such specifications as laid down in the contract such us 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.

1.14.2.22 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.

1.14.2.23 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.

1.14.2.24 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.

1.14.2.25 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.

1.14.2.26 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).

1.14.2.27 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.,

1.14.2.28 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.

1.14.2.29 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.

1.14.2.30 **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.**

1.14.2.31 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 connect 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.

1.14.2.32 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.

(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.

1.14.2.33 The contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lub oil system, carry out the pressure test of oil coolers. etc.,

1.14.2.34 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.

1.14.2.35 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.

1.14.2.36 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.

1.14.2.37 Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before and after installation.

1.14.2.38 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.

1.14.2.39 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 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.

1.14.2.40 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 for 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.

1.14.2.41 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.

1.14.2.42 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.

1.14.2.43 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.

1.14.2.44 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.

1.14.2.45 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.

1.14.2.46 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 PG 21, 24 in the Welding Schedule 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 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.

1.14.2.47 Hydraulic test of SCAPH has to be carried out on the ground before lifting it to the position.

1.14.2.48 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.

1.14.2.49 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 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 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.
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.
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**

1.14.2.50 **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 1st 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.

1.14.2.51 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.

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

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

1.14.2.54 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.

1.14.2.55 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.

1.14.2.56 The civil foundations for passenger cum goods lifts (temporary lift) shall be made by the contractor. The contractor has to erect the passenger cum goods lifts, as per instruction of BHEL Engineer. 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.

1.14.2.57 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.

1.14.2.58 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.

1.14.2.59 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.

~~1.14.2.60 Corner tubes made of SS material supplied by manufacturing unit shall be welded at the corners of all hoppers with SS electrode.~~

1.14.2.61 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.

1.14.2.62 Temporary lugs / structures meant for transportation is to be removed by the contractor as and when instructed by BHEL Engineer.

1.14.3 APPLICATION OF INSULATION AND REFRACTORY

1.14.3.1 Application of refractory, wool insulation, sheet metal cladding, welding of hooks / supports to hold insulation and refractory under this contract including but are not limited to the following. Insulation of main boiler portion, boiler drum/ steam separator, 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.

1.14.3.2 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.

1.14.3.3 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.

1.14.3.4 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.

1.14.3.5 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.

1.14.3.6 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 Aluminium 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.

1.14.3.7 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 aluminium sheet is within the scope of the bidder at no extra cost.

1.14.3.8 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.

1.14.3.9 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.

1.14.3.10 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.

1.14.3.11 The contractor shall provide the required quantity of wire, nails and other materials for centering works at their cost.

1.14.3.12 Wherever iron components are to be welded on non-pressure parts, the contractor shall employ only approved structural welders. It shall also be 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.

1.14.3.13 Special type of insulation wool used in penthouse shall not be cut indiscriminately. All chicken mesh, cut bits shall be accounted for.

1.14.3.14 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.

1.14.3.15 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.

1.14.3.16 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.

1.14.3.17 Dressing of insulation bricks to suit site conditions curing the refractory concrete applied, sheet cladding over insulations, form the part of this work.

1.14.3.18 Removal type of insulation to be provided for valves fittings, expansion joints etc., as per the drawings or as directed by BHEL Engineer.

1.14.3.19 All piping insulations shall be carried out in such a manner as to facilitate removal of bolts nuts and washers from the flanges.

1.14.3.20 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.

1.14.3.21 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.

1.14.3.22 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 (by engaging approved welders) as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.

1.14.3.23 The contractor shall leave certain gap and opening while doing the work as per the instructions of BHEL Engineer to facilitate inspection by Boiler 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.

1.14.3.24 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.

1.14.3.25 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.

1.14.3.26 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.

1.14.3.27 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 drawls / deposits, on daily basis as instructed by BHEL.

1.14.3.28 Wastages allowance for the materials issued are envisaged as follows:

a) Castable refractory 2%

b) Insulation bricks & mortar2%

c) Wool mattresses2%

d) Cladding sheets 5%

1.14.3.29 Making structural supporting works for pourable insulation, laying pourable insulation, adhering to all specifications and instructions shall be the responsibility of the contractor.

1.14.3.30 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.

1.14.3.31 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.

1.14.3.32 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.

1.14.3.33 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.

1.14.3.34 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.

1.14.3.35 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.

1.14.3.36 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.

1.14.3.37 Contractor has to arrange required fire retardant covering material at their cost to protect the insulation materials drawn from BHEL before and after erection.

1.14.3.38 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, etc., which are required for temporary supporting of the insulation materials at site.

1.14.3.39 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.

1.14.3.40 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.

1.14.3.41 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.

1.14.3.42 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.

1.14.3.43 Welding of iron components directly on pressure parts and HP piping are to be carried out by certified IBR high pressure welders. This is included in the scope of erectors of respective equipment / components.

1.14.3.44 Field Quality Assurance Formats

1.14.3.45 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:

(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 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.

1.15.3 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 though portable UCI method only.

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

1.15.5 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.

1.15.6 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 quality engineer.

1.15.7 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.

1.15.8 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.

1.15.9 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.

1.15.10 All butt / fillet welds shall be subject to Non –Destructive testing as per the Drawing/Procedures/Welding Schedules/Documents at no additional cost.

1.15.11 The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld. He has to maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability or otherwise of the welds shall be final.

1.15.12 The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. 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 weildable primer.

1.15.13 All welds shall be painted with anticorrosive primer once radiography and stress reliving 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.

1.15.14 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.

1.15.15 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.
- 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.

1.15.16 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.

1.15.17 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.

1.15.18 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. Location for the pit shall be finalized and provided by BHEL.

1.15.19 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.

1.15.20 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.

1.15.21 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.

1.15.22 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.

1.15.23 Radiography personnel with sufficient experience and certified by M/s BARC for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection only have to be deployed. These personnel should also be registered with DRP / BARC for film badge service.

1.15.24 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.

1.15.25 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.

1.15.26 In case of radiography of less than 100%, the joints identified by BHEL at random shall be radiographed.

1.15.27 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 radio graphed 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.

1.15.28 All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radio graphed and submitted to BHEL / customer.

1.15.29 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.

1.15.30 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.

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

1.15.32 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.

1.15.33 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.

1.15.34 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.

1.15.35 All welded joints shall be subjected to acceptance by BHEL Engineer.

1.15.36 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.

1.15.37 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.

1.15.38 The field joints are to be radiographed and preheating and post weld heat treatment to be done as per BHEL procedure and manuals.

1.15.39 The percentage of Radiography are tentative, which may be increased depending upon the quality of joints at the discretion of BHEL.

1.15.40 Penetrometer as per ASME/ISO shall be used for all exposures.

1.15.41 Lead numbers and letters (generally of 6mm size) are to be used for identification of radiographic contract No., joints identification, sources used welders 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.

1.15.42 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.

1.15.43 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 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.

1.15.44 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.

1.15.45 All the radiographs shall be properly preserved in air-conditioned rooms and shall become the property of BHEL.

1.15.46 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.

1.15.47 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.

1.15.48 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.

1.15.49 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.

1.15.50 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 include such preparation and no extra charges are payable for this.

1.15.51 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.

1.15.52 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.

1.15.53 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.

1.15.54 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.

1.15.55 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.

1.15.56 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.

1.15.57 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.

1.15.58 MPI must be done on joints, those are undergone ultrasonic testing.

1.15.59 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.

1.15.60 After completion of Hydro Test (interval), all relevant joints, catalogue, RT, SR and NDT reports shall be submitted to BHEL.

VOLUME-IA PART-I CHAPTER – XVI
HYDRAULIC TEST

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.

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. 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 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 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.

VOLUME-IA PART-I CHAPTER- XVII
TESTING AND COMMISSIONING

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

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 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 thermo well 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.

1.17.7 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.

1.17.8 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.

1.17.9 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

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.

1.17.10 It shall be the responsibility of the contractor to preserve the boiler as per BHEL's requirement. The required nitrogen (N_2) will be provided by BHEL for boiler preservation if required.

1.17.11 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.

1.17.12 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.

1.17.13 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.

1.17.14 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.

1.17.15 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.

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

1.17.17 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.

1.17.18 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.

1.17.19 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.

1.17.20 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.

1.17.21 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.

1.17.22 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.

1.17.23 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.

1.17.24 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 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.

1.17.25 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.

1.17.26 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.

1.17.27 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.

1.17.28 Replacing / cleaning of filters of the erected equipments, piping system etc. during pre-commissioning / commissioning stage are within the scope of work.

1.17.29 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.

1.17.30 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.

1.17.31 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.

1.17.32 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.

1.17.33 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.

1.17.34 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.

1.17.35 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.

1.17.36 The contractor as per BHEL requirements will suitably make preservation of cleaned surfaces.

1.17.37 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.

1.17.38 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.

1.17.39 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.

1.17.40 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.

1.17.41 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.

1.17.42 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.

1.17.43 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.

1.17.44 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.

1.17.45 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.

1.17.46 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, Lub. 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.

1.17.47 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) Laggers
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 incharge 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

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.

1.17.48 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.

1.17.49 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.

1.17.50 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.

1.17.51 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.

1.17.52 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.

1.17.53 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.

1.17.54 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.

VOLUME-IA PART- I CHAPTER-XVIII

PAINTING

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

1.18.1 FINAL PAINTING

1.18.1.1 The scope of work shall also include supply and application of final painting of all the erected equipments as required and specified as per enclosed painting schedules in Part II in technical Specification of Contract (Volume-I Book-I).

1.18.1.2 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.

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

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

1.18.1.5 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 of suitable primer and required number of finish coats as indicated in the Painting Specification in 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.

1.18.1.6 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.

1.18.1.7 Before applying the subsequent coats the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.18.1.8 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. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,

1.18.1.9 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.

1.18.1.10 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.

1.18.1.11 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).

1.18.1.12 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.

1.18.1.13 The actual colour to be applied shall be approved by the customer before starting of actual painting work.

1.18.1.14 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 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.

1.18.1.15 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.

1.18.1.16 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.

1.18.1.17 Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.

1.18.1.18 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.

1.18.1.19 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 Aluminium 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.

1.18.1.20 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 PRESERVATION / TOUCH UP PAINTING

1.18.2.1 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.

1.18.2.2 Any rust on the materials shall be suitably cleaned and painted before erection of the material. Cleaning of rust and painting shall be done by the contractor within the rates awarded in the contract and no additional cost will be provided for the same.

1.18.2.3 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.

1.18.2.4 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.

1.18.2.5 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

1.18.2.6 Painting of portions of Employer's structures wherever connection/welding is carried out by contractor for supporting structures.

1.18.2.7 All rectification including painting of Employer's structure which are damaged by contractor during his work.

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 must furnish the prescribed amount of Earnest Money Deposit (EMD) in the manner described herein.

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

ii. Earnest Money Deposit (EMD) shall also be paid directly to BHEL-PSSR through Online EMD payment portal, before tender opening, by following these steps.
    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 'BHEL-PSSR, EVR Periyar Building, 690, Anna Salai, Nandanam, Chennai – 600035'
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).
v. In case EMD amount is more than Rs. Two Lakhs, Tenderer has the option to submit Rs. Two lakhs in the forms 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) Proforma of Bank Guarantee for EMD is enclosed with this Tender.
b) The Bank Guarantee shall be valid for atleast six months from the due date of tender submission mentioned in the Notice Inviting Tender.
c) Date of Expiry of Claim shall be minimum of 3 months after the validity of Bank Guarantee.

Bank Details for the purpose of Taking EMD BG

Name and Address of Beneficiary:	Bharat Heavy Electricals Ltd. #690, EVR Periyar Building, Nandanam, Anna Salai, Chennai - 35
Name of Bank of Client :	State Bank Of India

Bank Branch Address:	SBI Saidapet Branch, EVR Periyar Building, Nandanam, Anna Salai, Chennai - 35
IFSC Code :	SBIN0000912
Account No. :	10610819499

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

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
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.

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., at least 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:

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

Where,

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

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

H = Overhead Factor to be taken as 5

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

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

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

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

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

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

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

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

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

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

i). Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1

ii). Let the value of executed work till the time of termination of contract= X

iii). Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y

iv). Delay in executed work attributable to contractor i.e. T2=[1-(X/Y)] x T1

v). LD shall be calculated in line with LD clause (clause 2.7.9) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

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

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

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

Following sequence shall be applicable for recoveries from contractor:

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

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.

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 x 1.05)-1] x 100}

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

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

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

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

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

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

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

(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.

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,

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

9.1.1 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".

9.1.2 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".

9.1.3 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."

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**	
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.

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

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)

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:

1. 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
2. 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):
      vii. Base date shall be revised: Revised Base date = Previous base date + duration of Force Majeure.

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

      viii. 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.

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

Clauses 2.21 in GCC regarding Arbitration is amended as below

2.21 ARBITRATION & CONCILIATION

2.21.1 ARBITRATION:

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

The Arbitrator shall pass a reasoned award.

Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder as in force from time to time shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be **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.

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 (enclosed in Vol 1A Part II Chapter 12). The Procedure 2.3 together with its Formats will be treated as if the same is part and parcel hereof and shall be as effectual as if set out herein in this GCC.

The Contractor hereby agrees that BHEL may make any amendments or modifications to the provisions stipulated in the Procedure 2.3 (enclosed in Vol 1A Part II Chapter 12) from time to time and confirms that it shall be bound by such amended or modified provisions of the Procedure 2.3 with effect from the date as intimated by BHEL to it.

2.21.3 No Interest payable to Contractor

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

Sl. No.: 13

Procedure 2.3 that forms the part of the "Forms and Procedures (Volume 1 Book 2)" is published as chapter 10 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

Reverse Auction

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.

Sl No: 16

Existing format on BANK GUARANTEE FOR SECURITY DEPOSIT as available in Form No F-11 (Rev 00) of Volume ID Forms and Procedure stands deleted. Refer format provided as Volume IA Part II Chapter 09

Sl No: 17

Existing format on Monthly Plan Review of Contractor, as available in Form No F-14 of Volume ID Forms and procedure stands Deleted. Form No.- F-14 (Rev 01) is enclosed as Volume IA Part II Chapter 11.

Sl No: 18

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 as Volume IA Part II Chapter 12.

Sl No: 19

Existing format for Integrity Pact, as available in Volume ID Forms and procedure stands Deleted. Revised Format is enclosed as Volume IA Part II Chapter 16.

VOLUME-IA PART – II

CHAPTER 2 to 16

In next 413 pages as below

Description	Chapter	No. of pages
Welding Schedule	Chapter-2	79
Painting Schedule for Boiler & Auxiliary Boiler	Chapter-3	24
Painting schedule for APH, FAN, Gates & Damper etc	Chapter-4	14
Painting schedule for Bowl Mills	Chapter-5	07
"HSE Plan for Site Operations by Subcontractor" (Document No. HSEP: 14 Rev00)	Chapter-6	72
Hire charges on issue of capital tools & Plants (Only corresponding charges)	Chapter-7	14
Proforma of Bank Guarantee for Earnest Money Deposit (EMD)	Chapter-8	03
Proforma of Bank Guarantee for Security Deposit	Chapter-9	03
Procedure 2.3 for conduct of conciliation proceedings	Chapter-10	11
Format for Form no.: F-14 (Rev 01); Monthly Plan & Review with Contractor	Chapter-11	05
Format for Form no.: F-15 (Rev 02); Monthly Performance-Evaluation of Contractor	Chapter-12	06
Guidelines for Welding	Chapter-13	98
Guidelines for Heat treatment	Chapter-14	18
General Guidelines for Insulation Work	Chapter-15	54
Integrity Pact	Chapter-16	05

BHEL TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: NORTH CHENNAI 1x800 MW
UPPUR 2x800 MW

CUSTOMER NOS: 1818, 1821 & 1822

PG NO: 07

PG NAME : CIRCULATION SYSTEM

PRESSURE PARTS

SL. NO	TYPE OF ELECTRODE / ROD	SIZE & QTY				GTAW ROD WT(gm)	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01.	ER80S-B2					452163	
02.	ER70S-A1					666	
03.	ER90S-B3					22428	
04.	E8018-B2	279237	5553	14130			
05.	E7018-1	180	350	1626			
06.	E7018	18					

NOTES: -

1. RESERVE 50% ADDED.
2. QUANTITY GIVEN IS PER BOILER
3. THIS FIELD WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.

ENCL : FIELD WELDING SCHEDULE DRAWING NOS 4-07-992-06514 TO 4-07-992-06519

CC: 1. PROJECT CO-ORDINATOR/CONTRACTS:
2. DY.MANAGER/WTC
3. WELDING SCHEDULE FILE

PREPARED	CHECKED(DESIGNS)	APPROVED(WTC)	DRAWING NO.
YADAV	S.A.K	L.PRAVEEN KUMAR	4-07-992-06513/00

04.06.2018

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 07
PG NAME : CIRCULATION

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : CIRCULATION SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 1/6

SL. NO.	DRG NO. FOR WELD LOCAION &	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.				WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
								GTAW	SMAW SPEC.					TEMP. °C	HOLD. TIME				
							QTY	QTY	QTY ø2.5	QTY ø3.15	QTY ø4.0								
01	PPA PANEL ARRANGEMENT VERTICAL WALL	F-04UI+F-04U	SA213T12 + SA213T22	38.1	8.0	GTAW SMAW	8 V	ER80S-B2	E8018-B2			1011/01	150	-	-	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							408	6671	3672	—	—								
02	PPA PANEL ARRANGEMENT VERTICAL WALL	F-04U+F-05	SA213T22 + SA213T23	38.1	8.0	GTAW SMAW	8 V	ER90S-B3	E9018-B3			1053/04	200	745±15	60	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	100%HC 260HV (MAX)
							408	6671	3672	—	—								
03	PPA SPIRAL/ VERTICAL TRANSITION AT FRONT, REAR & SIDE WALL	F-04TI+F-03 F-04TI+F-04X F-10TI+F-10X F-10TI+F-09	SA213T12 + SA213T12	38.1	8.0	TIG ARC	8 V	ER80S-B2	E8018-B2			1009/03	150	-	-	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							1632	26684	14688	—	—								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4-07-992-06514	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12-98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 07
PG NAME : CIRCULATION

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : CIRCULATION SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 2/6

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.				WPS NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
								GTAW	SMAW SPEC. QTY					TEMP. °C	HOLD. TIME				
							QTY	QTY	ø2.5	ø3.15	ø4.0	REV. NO.							
04	PPA PANEL ARRANGEMENT–SPIRAL FURNACE FRONT, REAR & SIDE WALL PPA PANEL ARRANGEMENT–HOPPER SIDE WALL	F–03+F–02TO F–09+F–08TO F–18+F–17TO F–02U+INSERTS+WB+OFA F–02L+INSERTS+WB+OFA F–02L+INSERTS F–08U+INSERTS+WB+OFA F–08L+INSERTS+WB F–08L+INSERTS F–17U+INSERTS+WB+OFA F–17L+INSERTS+WB F–17L+INSERTS	SA213T12 + SA213T12	38.1 41.3	7.11 8.2	GTAW SMAW	8.2V	ER80S–B2	E8018–B2			1009/03	150	—	—	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							9286	171068	83574	—	—								
05	PPA SPIRAL/ VERTICAL TRANSITION AT SIDE WALL PPA PANEL ARRANGEMENT–SIDE VERTICAL WALL	F–19TI+F–19X F–19TI+F–18 F–19UI+F–19X F–19UI+F–19U F–19U+F–20 L&R	SA213T12 + SA213T12	38.1	9.5	GTAW SMAW	9.5V	ER80S–B2	E8018–B2			1009/03	150	—	—	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							3900	55110	58500	—	—								
06	PPA PANEL ARRANGEMENT–F&R VERTICAL WALL	F–08X+F–11 F–02X+F–04UI	SA213T12 + SA213T12	38.1	8.0	GTAW SMAW	8.0V	ER80S–B2	E8018–B2			1011/01	150	—	—	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							816	13342	7344	—	—								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–07–992–06515	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 07
PG NAME : CIRCULATION

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : CIRCULATION SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 3/6

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	REMARKS
07	0-06-741-04198 0-07-223-01767	F-11+F-12 F-11+F-13	SA213T12 + SA213T22	38.1	8.0	GTAW SMAW	8V 408	ER80S-B2 11118	E8018-B2 6120	—	—	1011/01	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
08	0-06-737-04363 PPA-SECTIONAL SIDE ELEVATION LOWER FURNACE	F-02L+F-08TI F-02L+F-02TI F-08L+F-02TI F-08L+F-08TI F-17L+F-02TI F-17L+F-08TI	SA213T12 + SA213T12	38.1	7.11	GTAW SMAW	7.11V 532	ER80S-B2 3360	E8018-B2 4788	—	—	1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
09	0-07-223-01767	F-13+F-14	SA213T22 + SA213T22	63.5	12.7	GTAW SMAW	13V 136	ER90S-B3 3834	E9018-B3 1904	952	—	1084/00	200	740±10	60	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	100%HC 260HV (MAX)
10	0-07-223-01767	F-12+F-14	SA213T22 + SA213T23	38.1	8.0	GTAW SMAW	8V 272	ER90S-B3 4447	E9018-B3 2448	–	—	1053/04	200	745±15	60				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4-07-992-06516	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12-98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 07
PG NAME : CIRCULATION

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : CIRCULATION SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 4/6

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	SMAW SPEC. QTY ø2.5	SMAW SPEC. QTY ø3.15	SMAW SPEC. QTY ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY	QTY											
11	PPA PLAN VIEW "A–A" HDRS & LINKS (FURNACE)	F–05+F–06 F–14+F–15 F–20+F–21 F–20+F–21	SA182F12CL2 + SA335P12	219.1	38.1	GTAW SMAW	38V	ER80S–B2	E8018–B2			1010/06	150	650–670	90	100%RT	*	*	
							16	1804	288	400	1040								
12	PPA FRONT ELEV SP–SP SEPARATOR PIPING ARRANGEMENT	F–06+F–31 F–15+F–31 F–21+F–31 F–21+F–31	SA182F22CL3 + SA335P12	219.1	38.1	GTAW SMAW	38V	ER80S–B2	E8018–B2			1012/04	150	680–720	90	100%RT	*	*	
							16	992	288	400	1040								
13	1–07–315–01036 TO 01039 1–07–316–01033 & 01034 1–07–318–01030 & 01031	F–06+F–06 F–15+F–15 F–21+F–21 F–21+F–21	SA335P12 + SA335P12 + SA234WP12	219.1	38.1	GTAW SMAW	38V	ER80S–B2	E8018–B2			1010/06	150	650–670	90	100%RT	*	*	
							60	3720	1080	1500	3900								
14	PPA FRONT ELEV SP–SP SEPARATOR PIPING ARRANGEMENT	F–34+F–33	SA182F22CL3 + SA335P12 + SA335P12	88.9	16	GTAW SMAW	16V	ER80S–B2	E8018–B2			1012/04	150	680–720	45	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							16	600	180	240	50								
15	05–231, 05–251 05–227 05–327, 05–330 05–350 HEADERS	INSP. NOZZLE + FLAT END COVER	SA182F12CL2 + SA182F12CL2	168.3	39.7	GTAW SMAW	39V	ER80S–B2	E8018–B2			1010/06	150	650–670	100	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							16	640	224	408	544								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–07–992–06517	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 07
PG NAME : CIRCULATION

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : CIRCULATION SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 5/6

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.				WPS NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
								GTAW	SMAW SPEC. QTY					TEMP. °C	HOLD. TIME				
							QTY	QTY	ø2.5	ø3.15	ø4.0	REV. NO.							
16	PPA FRONT ELEV SP–SP SEPARATOR PIPING ARRANGEMENT	S–01+F–34	SA182F12CL2 + SA335P12	88.9	16	GTAW SMAW	16V	ER80S–B2	E8018–B2			1010/06	150	650–670	45	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							2	60	20	26	10								
17	0–07–102–01708	F–32+F–32	SA335P12 + SA335P12	355.6	60	GTAW SMAW	53V	ER80S–B2	E8018–B2			1010/06	150	650–670	135	100%RT	*	*	
							4	741	108	176	640								
18	PPA FRONT ELEV SP–SP SEPARATOR PIPING ARRANGEMENT	F–33+F–32 F–32+F–31	SA182F22CL3 + SA335P12	355.6	60	GTAW SMAW	53V	ER80S–B2	E8018–B2			1012/04	150	680–720	135	100%RT	*	*	
							8	741	108	176	640								
19																			
20	PPA FRONT ELEV SP–SP SEPARATOR PIPING ARRANGEMENT 1–07–110–01020	F–50+F–49	SA182F12CL2 + SA335P12 + SA182F22CL3	406.4	65	GTAW SMAW	57V	ER80S–B2	E8018–B2			1012/04	150	680–670	160	100%RT	*	*	
							2	460	60	100	458								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–07–992–06518	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 07
PG NAME : CIRCULATION

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : CIRCULATION SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 6/6

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	SMAW SPEC. QTY ø2.5	SMAW SPEC. QTY ø3.15	SMAW SPEC. QTY ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY	QTY											
21	PPA–FRONT ELEV SP–SP SEPARATOR PIPING ARRANGEMENT	F–33+F–49	SA182F22CL3 + SA335P12	406.4	65	GTAW	57V	ER80S–B2	E8018–B2			1012/04	150	680–720	160	100%RT	*	*	
						SMAW	2	230	60	100	458								
22	PPA–SECTIONAL SIDE ELEVATION (LOWER FURNACE)	F–01+F–16 F–07+F–16	SA106GRC + SA234WPC	406.4	70	GTAW	61V	ER70S–A1	E7018–A1			1005/05	100	620–650	170	100%RT	*	*	
						SMAW	4	444	120	200	1084								
23	PPA–SECTIONAL SIDE ELEVATION (LOWER FURNACE)	F–01+F–02TI F–07+F–08TI	SA210GRC + SA210GRC	38.1	7.11	GTAW	7.1V	ER80S–B2	E8018–2			1009/03	150	—	—	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	532	3360	4788	—	—								
24		GAMMA PLUG	SA182F22CL3 + SA335P12			SMAW	7△	—	E8018–B2			1102/01	200	—	—	100%LPI OR 100%MPI	*	*	
							64	—	160	—	—								
25		GAMMA PLUG	SA106GRC + SA105			SMAW	7△	—	E7018			1101/01	–	—	—	100%LPI OR 100%MPI	*	*	
							4	—	10	—	—								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–07–992–06519	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

BHEL TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: NORTH CHENNAI 1x800 MW
UPPUR 2x800 MW

CUSTOMER NO: 1818, 1821 & 1822

PG NO: 12

PG NAME : SUPERHEATER SYSTEM

PRESSURE PARTS

SL. NO	TYPE OF ELECTRODE / ROD	SIZE & QTY				GTAW ROD WT(gm)	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01.	ER80S-B2					209439	
02.	ER90S-B3					40803	
03.	ER90S-B9					154728	
04.	9CRWV					2103	
05.	YT304H					56574	
06.	ER347					15417	
07.	E8018-B2	73078	39294	28080			
08.	E9018-B3	18609					
09.	E9015-B91	69830	8345	26811			
10.	THERMANIT MTS 616	545	100				
11.	E-347	9158	300				

NOTES:-

1. RESERVE 50% ADDED.
2. QUANTITY GIVEN IS PER BOILER
3. THIS FIELD WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.

ENCL : FIELD WELDING SCHEDULE DRAWING NOS 4-12-992-13991 TO 4-12-992-13999

CC: 1. PROJECT CO-ORDINATOR/CONTRACTS:
2. DY.MANAGER/WTC
3. WELDING SCHEDULE FILE

PREPARED	CHECKED(DESIGNS)	APPROVED(WTC)	DRAWING NO.
YADAV	S.A.K	L.P.K / 04.06.2018	4-12-992-13990/00

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 1/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
01	PPA–PLAN VIEW "A1–A1" HDRS & LINKS (BACKPASS)	S–22+S–25B	SA335P12 + SA335P12	406.4	65	GTAW	57	ER80S–B2	E–8018–B2			1010/06	150	650–670	135	100%RT	*	*	
						SMAW	2	866	120	200	916								
02	PPA–PLAN VIEW "A1–A1" HDRS & LINKS (BACKPASS) 1–12–852–01868 3–12–852–13347	S–25A+S–25B S–25A+S–25A S–23+S–25A	SA335P12 + SA234WP12CL1	406.4	65	GTAW	57	ER80S–B2	E–8018–B2			1010/06	150	650–670	135	100%RT	*	*	
						SMAW	8	1732	240	400	1832								
03	PPA–PLAN VIEW "A–A" HDRS & LINKS (FURNACE) 0–12–852–02833	S–25A+S–25 S–25+S–25 S–25+S–26	SA335P12 + SA335P12 + SA234WP12	508	80	GTAW	70	ER80S–B2	E–8018–B2			1010/06	150	650–670	195	100%RT	*	*	
						SMAW	8	2281	304	504	4224								
04	PPA–PLAN VIEW "A–A" HDRS & LINKS (FURNACE) 1–12–178–01869 1–12–178–01870	S–28+S–29 S–29+S–29 S–29+S–30 S–30+S–31	SA335P91 + SA234WP91	558.8	76.2	GTAW	67	ER90S–B9	E–9015–B91			1050/06	220	740–770	185	100%RT	*	*	100%HC 300HV (MAX)
						SMAW	14	6442	588	966	8274								
05	0–12–187–02829 0–12–187–02832	S–24+S–24	SA335P12 + SA335P12 + SA234WP12	219.1	36	GTAW	57	ER80S–B2	E–8018–B2			1010/06	150	650–670	85	100%RT	*	*	
						SMAW	32	930	576	800	1760								
06	PPA–PLAN VIEW "A–A" HDRS & LINKS (FURNACE) 0–12–179–02836 & 0–12–179–02837	S–35+S–35+S–36 S–35+S–35 S–36+S–37+S–37	SA335P91 + SA234WP91	558.8	100	GTAW	88	ER90S–B9	E–9015–B91			1050/06	220	740–770	240	100%RT	*	*	100%HC 300HV (MAX)
						SMAW	14	4543	750	560	9600								
07		GAMMA PLUGS	SA335P12 + SA182F2CL3			SMAW	7	–	E–8018–B2			1102/01	200	–	–	100%LPI OR 100%MPI	*	*	
							50		150	–	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13991	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 2/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
08	PPA–PLAN VIEW "E–E" (BP RING HEADER)	S–14+S–13 S–13+S–17	SA335P12 + SA234WP12CL1	406.4	93.4	GTAW SMAW	82 V̂ 4	ER80S–B2 720	E–8018–B2 120	200	660	1010/06	150	650–670	225	100%RT	*	*	
09	PPA–PANEL ARRANGEMENT–BACKPASS	S–14+S–15L S–15L+S–15U S–15U+S–16	SA213T12 + SA213T12	50.8	9.14	GTAW SMAW	9 V̂ 410	ER80S–B2 13088	E–8018–B2 5440	2176		1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
10		S–16+S–22 S–20L+S–20U S–20U+S–21 S–22+S–21 S–17+S–20L	SA213T12 + SA213T12	50.8	10.2	GTAW SMAW	10V̂ 680	ER80S–B2 29137	E–8018–B2 8160	3264		1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
11		S–12I+S–12U S–12U+S–11 S–12L+S–12I S–13+S–13 S–13+S–12L	SA213T12 + SA213T12	50.8	10.2	GTAW SMAW	10V̂ 1344	ER80S–B2 47990	E–8018–B2 13440	5376		1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13992	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 3/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
12	PPA-DIVISIONAL PANEL LOOSE TU UPPER & LOWER	S-26+S-27TI S-27TI+S-27	SA213T22 + SA213T22	44.5	7.1	GTAW SMAW	7.1V 1200	ER90S-B3 26900	E-9018-B3 12000	–	–	1013/02	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
13	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-32+S-33	SA213T91 + SA213T91	54	6.6	GTAW SMAW	6.6V 33	ER90S-B9 224	E-9015-B91 224	–	–	1036/08	220	745± 15	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	100%HC 300HV (MAX)
14	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-32+S-33	SA213T91 + SA213T91	50.8	6.6	GTAW SMAW	6.6V 33	ER90S-B9 918	E-9015-B91 330	–	–	1036/08	220	745± 15	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	100%HC 300HV (MAX)
15	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-32+S-33	SA213T91 + SA213T91	42.4	8.13	GTAW SMAW	8.1V 297	ER90S-B9 5744	E-9015-B91 3564	–	–	1036/08	220	745± 15	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	100%HC 300HV (MAX)
16	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-32+S-33	SA213T91 + SA213T91	47.63	6.3	GTAW SMAW	6.3V 297	ER90S-B9 7698	E-9015-B91 2673	–	–	1036/08	220	745± 15	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	100%HC 300HV (MAX)
17	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-33TO+S-33	SA213S304H + SA213S304H	54	8.64	GTAW	8.6V 33	YT304H 1200				1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
18	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-33TO+S-33	SA213S304H + SA213S304H	44.45	7.11	GTAW	7.1V 66	YT304H 2008				1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
19	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-33TO+S-33	SA213S304H + SA213S304H	44.45	7.6	GTAW	7.6V 66	YT304H 1910				1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
20	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-33TO+S-33	SA213TP347H + SA213TP347H	44.45	8.6	GTAW SMAW	8.6V 66	ER347 1331	E-347 528	198	–	1016/02	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
21	PPA-SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S-33TO+S-33	SA213TP347H + SA213TP347H	44.45	8.13	GTAW SMAW	8.1V 429	ER347 8947	E-347 5577	–	–	1016/02	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4-12-992-13993	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12-98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 4/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.					WPS NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF.		RE-MARKS
								GTAW	SMAW SPEC.						TEMP. °C	HOLD. TIME		SPEC. NO.	ACC NORM REF	
							QTY(NOS)	QTY(gm)	QTY(NOS) ø2.5	ø3.15	ø4.0		REV. NO.							
22	PPA–SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S–33TO+S–34	SA213T92 + SA213T92	57.15	9.91	GTAW SMAW	9.9V	9CRWV	THERMANIT MTS–616				1058/01	205	730–770	30	100%RT	*	*	
							33	1402	363	55	–									
23	PPA–SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S–33TO+S–34	SA213T91 + SA213T91	51	11.0	GTAW SMAW	11V	ER90S–B9	E–9015–B91				1036/08	220	745± 15	30	100%RT	*	*	100%HC 300HV (MAX)
							66	1416	660	330	–									
24	PPA–SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S–33TO+S–34	SA213T91 + SA213T91	44.5	9.0	GTAW SMAW	9V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							495	9705	3960	1485	–									
25	PPA–SIDE ELEV OF PLATEN INLET AND OUTLET HDRS	S–33TO+S–34	SA213T91 + SA213T91	42.4	7.11	GTAW SMAW	7.1V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							66	1376	594	–	–									
26	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–38+S–39TI	SA213T91 + SA213T91	42.4	8.13	GTAW SMAW	8.1V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							707	13673	7070	–	–									
27	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–38+S–39TI	SA213T91 + SA213T91	44.45	7.6	GTAW SMAW	7.6V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							202	4372	2020	–	–									
28	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–38+S–39TI	SA213T91 + SA213T91	50.8	7.11	GTAW SMAW	7.1V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							101	2733	1212	–	–									

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13994	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 5/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC.	QTY(NOS) ø2.5	QTY(NOS) ø3.15	QTY(NOS) ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)												
29	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–39+S–40	SA213S304H + SA213S304H	50.8	9.14	GTAW	9.1V	YT304H					1054/01	–	–	30	100%RT	*	*	
							101	3240												
30	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–39+S–40	SA213S304H + SA213S304H	44.45	7.6 8.1	GTAW	7.6V	YT304H					1054/01	–	–	30	100%RT	*	*	
							404	11657												
31	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–39+S–40	SA213S304H + SA213S304H	44.45	8.1	GTAW SMAW	8.1V	YT304H					1054/01	–	–	30	100%RT	*	*	
							505	14072												
32	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–40+S–41	SA213T91 + SA213T91	44.45	10.67	GTAW SMAW	10.7V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							404	6908	3636	1616	–									
33	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–40+S–41	SA213T91 + SA213T91	38.1	9.0	GTAW SMAW	9.0V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							505	7510	6060	–	–									
34	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–40+S–41	SA213T91 + SA213T91	51.0	12	GTAW SMAW	12V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							101	2242	1212	606	–									
35	PPA–DIVISIONAL PANEL LOOSE TU UPPER & LOWER	S–28+S–27TO S–27TO+S–27	SA213T91 + SA213T91	44.45	7.11 7.6	GTAW SMAW	7.1V	ER90S–B9	E–9015–B91				1036/08	220	730–760	30	100%RT	*	*	100%HC 300HV (MAX)
							1200	26838	12000	–	–									

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13995	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 6/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.					WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	REMARKS
								GTAW	SMAW SPEC.						TEMP. °C	HOLD. TIME				
									QTY(NOS)											
							QTY(NOS)	QTY(gm)	ø2.5	ø3.15	ø4.0									
36	PPA–SECTIONAL SIDE ELEVATION–BACKPASS	S–14+S–10	SA335P12 + SA335P12	323.9	56	GTAW	49	ER80S–B2	E8018–B2				1010/06	150	650–670	135	100%RT	*	*	
						SMAW	2	334	48	78	336									
37	0–12–184–02801 PPA–ECON MIXING LINE ARRANGEMENT	S–10+S–10	SA234WP12CL1 + SA335P12	323.9	56	GTAW	49	ER80S–B2	E8018–B2				1010/06	150	650–670	135	100%RT	*	*	
						SMAW	8	1336	192	312	1344									
38		S–10+S–09C	SA234WP12CL1 + SA335P12	323.9	56	GTAW	49	ER80S–B2	E8018–B2				1010/06	150	650–670	135	100%RT	*	*	
						SMAW	2	334	48	78	336									
39	EQUALIZING LINE	S–09D+S–09D	SA213T12 + SA213T12	38.1	6.1	GTAW	6.1	ER80S–B2	E8018–B2				1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	16	300	150	–	–									
40	PPA–ECON MIXING LINE ARRANGEMENT	S–09+S–09A	SA335P12 + SA234WP12	508	110	GTAW	96	ER80S–B2	E8018–B2				1010/06	150	650–670	250	100%RT	*	*	
						SMAW	1	250	400	–	–									
41	PPA–ECON MIXING LINE ARRANGEMENT	S–09A+S–09B S–09B+S–09C	SA335P12 + SA335P12	168.3	47.6	GTAW	42	ER80S–B2	E8018–B2				1010/06	150	650–670	120	100%RT	*	*	
						SMAW	40	2515	600	1100	1420									

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13996	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 7/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
42	PPA–PANEL ARRANGEMENT EXTENDED SIDE WALL	S–09+S–08 S–08+S–07 S–07+S–06	SA213T12 + SA213T12	57.15	10.2	GTAW	10.2V	ER80S–B2	E8018–B2			1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	468	12725	5148	7488	–								
43		S–06+S–05	SA234WP12CL1 + SA335P22	457.2	100	GTAW	88V	ER80S–B2	E8018–B2			1012/04	150	680–720	240	100%RT	*	*	
						SMAW	2	418	68	112	930								
44		S–06+S–11	SA234WP12CL1 + SA335P12	457.2	100	GTAW	88V	ER80S–B2	E8018–B2			1010/06	150	650–670	240	100%RT	*	*	
						SMAW	2	418	68	112	930								
45		GAMMA PLUG	SA182F11CL2 + SA234WP12CL1			SMAW	7◺	–	E8018–B2			1102/01	200	–	–	–	*	*	
							15		40	–	–								
46	PPA–PLAN VIEW 'B–B' FURNACE ROOF TUBES	S–03+S–02	SA213T12 + SA213T12	50.8	10.2	GTAW	10.2V	ER80S–B2	E8018–B2			1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	204	4452	5460	–	–								
47		S–03+S–04 S–04+S–04 S–05+S–04	SA213T12 + SA213T12	57.15	11.0	GTAW	11V	ER80S–B2	E8018–B2			1009/03	150	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	612	15915	7344	3060	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13997	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 8/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	SMAW SPEC. QTY(NOS) Ø2.5	Ø3.15	Ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
48	PPA–PLAN VIEW 'A–A' FURNACE HDRS & LINKS	S–02+S–01	SA234WP12CL1 + SA335P12	323.9	60	GTAW	53	ER80S–B2	E8018–B2			1010/06	150	650–670	135	100%RT	*	*	
						SMAW	8	1295	192	312	1344								
49	PPA–FRONT ELEV 'SP–SP' SEPARATOR PIPING ARRGT.	S–01+F–31	SA234WP12CL1 + SA182F22CL3	323.9	60	GTAW	53	ER80S–B2	E8018–B2			1012/04	150	680–720	135	100%RT	*	*	
						SMAW	8	1295	192	312	1344								
50	0–12–850–02854 0–12–850–02856	S–01+S–01	SA234WP12CL1 + SA335P12	323.9	60	GTAW	53	ER80S–B2	E8018–B2			1010/06	150	650–670	135	100%RT	*	*	
						SMAW	8	1295	192	312	1344								
51		GAMMA PLUG	SA182F22CL3 + SA335P22			SMAW	7	–	E9018–B3			1103/01	200	–	–	100%LPI OR 100%MPI	*	*	
							2	–	6	–	–								
52	PPA–SECTIONAL SIDE ELEVATION–BACKPASS PPA–FLUID COOLED SPACERS	S–32+S–44	SA213T91 + SA213T91	50.8	7.11	GTAW	7.1	ER90S–B9	E9015–B91			1036/08	220	730–760	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							4	38	–	–	–								
53		S–44+S–44	SA213S304H + SA213S304H	50.8	9.14	GTAW	9.1	YT304H	–			1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							39	1251	–	–	–								
54		S–44+S–09A	SA213T22 + SA213T22	50.8	8.13	GTAW	8.1	ER90S–B3	E9018–B3			1013/02	150	650–670	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	4	102	200	–	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13998	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 12
PG NAME : SUPERHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : SUPERHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 9/9

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
55	PPA–SECTIONAL SIDE ELEVATION–BACKPASS PPA–FLUID COOLED SPACERS	S–26+S–43	SA213S304H + SA213S304H	63.5	9.14	GTAW	9.1 V	YT304H				1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							6	270	–	–	–								
56		S–43+S–43	SA213S304H + SA213S304H	50.8	7.6	GTAW	7.6 V	YT304H	–			1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							60	2108	–	–	–								
57		S–43+S–34	SA213T22 + SA213T22	63.5	9.0	GTAW SMAW	9 V	ER90S–B3	E9018–B3			1013/02	150	650–670	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
							6	200	200	–	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	29.05.2018	4–12–992–13999	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

BHEL TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: NORTH CHENNAI 1x800 MW
UPPUR 2x800 MW

CUSTOMER NOS: 1818, 1821 & 1822

PG NO: 17

PG NAME : REHEATER SYSTEM – PP

SL. NO	TYPE OF ELECTRODE / WIRE	SIZE & QTY				GTAW ROD WT(gm)	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01.	ER80S–B2					89580	
02	ER90S–B3					143418	
03	ER90S–B9					107390	
04	YT304H					70650	
05	E8018–B2	56834	207	468			
06	E9018–B3	114750	51646	24716			
07	E9015–B91	36413					

NOTES: –

1. RESERVE 50% ADDED.
2. QUANTITY GIVEN IS PER BOILER
3. THIS FIELD WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.

ENCL : FIELD WELDING SCHEDULE DRAWING NOS 4–17–992–03533 TO 4–17–992–03536

CC: 1. PROJECT CO–ORDINATOR/CONTRACTS:
2. DY.MANAGER/WTC
3. WELDING SCHEDULE FILE

PREPARED	CHECKED(DESIGNS)	APPROVED(WTC)	DRAWING NO.
YADAV	S.A.K	L.PRAVEEN KUMAR	4–17–992–03532/00

DT : 22.02.2018

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 17
PG NAME : REHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : REHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 1/4

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
01	LTRH INLET HEADER SPOOL PIPE	R–03+R–03	SA335P12 + SA335P12	558.8	40	GTAW	35	ER80S–B2	E8018–B2			1010/06	150	650–670	100	100%RT	*	*	
						SMAW	2	372	84	138	312								
02	LTRH INLET HEADER PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–03+R–04TI	SA213T12 + SA213T12	69.85	4.57	GTAW	4.5	ER80S–B2	E8018–B2			1009/03	150	—	—	20%RT/MIN 2 WELD/ WELDER	*	*	
						SMAW	945	14836	9450	—	—								
03	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–04TI+R–04L R–04L+R–04LI	SA213T12 + SA213T12	69.85	4.57	GTAW	4.5	ER80S–B2	E8018–B2			1009/03	150	—	—	20%RT/MIN 2 WELD/ WELDER	*	*	
						SMAW	1890	29673	18900	—	—								
04	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–04LI+R–04UI	SA213T12 + SA213T22	69.85	4.57 5.59	GTAW	4.5	ER80S–B2	E8018–B2			1011/01	150	—	—	20%RT/MIN 2 WELD/ WELDER	*	*	
						SMAW	945	14836	9450	—	—								
05	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–04UI+R–04U	SA213T22 + SA213T22	69.85	5.59	GTAW	5.6	ER90S–B3	E9018–B3			1013/02	150	—	—	20%RT/MIN 2 WELD/ WELDER	*	*	
						SMAW	945	14270	11340	—	—								
06	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–04U+R–07	SA213T91 + SA213T91	63.5	4.19 4.57	GTAW	4.2	ER90S–B9	E9015–B91			1036/08	220	730–760	30	100%RT	*	*	100% HC 300 HV (MAX)
						SMAW	945	13230	7560	—	—								
07	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–07+R–07TO	SA213T91 + SA213T91	63.5	4.57	GTAW	4.6	ER90S–B9	E9015–B91			1036/08	220	730–760	30	100%RT	*	*	100% HC 300 HV (MAX)
						SMAW	810	11097	7290	—	—								
08	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–07+R–07TO	SA213T91 + SA213T91	63.5	4.19 4.57	GTAW	4.2	ER90S–B9	E9015–B91			1036/08	220	730–760	30	100%RT	*	*	100% HC 300 HV (MAX)
						SMAW	135	1890	1080	—	—								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	22.02.2018	4–17–992–03533	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 17
PG NAME : REHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : REHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 2/4

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
09	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–07TO+R–08	SA213T91 + SA213T91	57.15	4.19	GTAW SMAW	4.2√	ER90S–B9	E9015–B91			1036/08	220	730–760	30	100%RT	*	*	100% HC 300 HV (MAX)
							135	1661	540	—	—								
10	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–07TO+R–08	SA213T91 + SA213T91	50.8	5.08	GTAW SMAW	5.1√	ER90S–B9	E9015–B91			1036/08	220	730–760	30	100%RT	*	*	100% HC 300 HV (MAX)
							675	7090	6075	—	—								
11	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	R–07TO+R–08	SA213T91 + SA213T91	63.5	4.19	GTAW SMAW	4.2√	ER90S–B9	E9015–B91			1036/08	220	730–760	30	100%RT	*	*	100% HC 300 HV (MAX)
							135	1890	1080	—	—								
12	1–17–174–00590 0–17–174–00630 PPA– PLAN VIEW "A–A" HDRS AND LINKS (FURNACE)	R–08+R–09 R–09+R–09 R–09+R–10	SA335P22 + SA335P22 + SA234WP22CL1	813	70	GTAW SMAW	61√	ER90S–B3	E9018–B3			1014/03	150	680–720	170	100%RT	*	*	
							6	1965	421	601	7258								
13		R–10+R–11 R–11+R–11	SA335P22 + SA335P22 + SA234WP22CL1	813	70	GTAW SMAW	61√	ER90S–B3	E9018–B3			1014/03	150	680–720	135	100%RT	*	*	
							6	1965	421	601	7258								
14		R–11+R–12	SA234WP22CL1 + SA335P22	660	75	GTAW SMAW	65.6√	ER90S–B3	E9018–B3			1014/03	150	680–720	140	100%RT	*	*	
							2	462	118	189	1961								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	22.02.2018	4–17–992–03534	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 17
PG NAME : REHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : REHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 3/4

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	REMARKS
							QTY(NOS)	QTY(gm)											
15	PPA–FINISH RH HEADERS	R–13TO+R–13	SA213S304H + SA213S304H	63.5	3.81	GTAW	4 V	YT304H	–			1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER	*	*	
							650	41600	–	–	–								
16	PPA–FINISH RH HEADERS	R–13TO+R–14	SA213T91 + SA213T91	76.2	5.59	GTAW SMAW	5.6V	ER90S–B9	E9015–B91			1036/08	220	730–760	30	20%RT/MIN 2 WELD/ WELDER	*	*	100% HC 300 HV (MAX)
							50	835	650	–	–								
17	PPA–FINISH RH HEADERS	R–13TO+R–14	SA213T91 + SA213T91	57.15	4.19	GTAW	4.2V	ER90S–B9	–			1036/08	220	730–760	30	20%RT/MIN 2 WELD/ WELDER	*	*	100% HC 300 HV (MAX)
							100	6000	–	–	–								
18	PPA–FINISH RH HEADERS	R–13TO+R–14	SA213T91 + SA213T91	50.8	4.19	GTAW	4.2V	ER90S–B9	–			1036/08	220	730–760	30	20%RT/MIN 2 WELD/ WELDER	*	*	100% HC 300 HV (MAX)
							100	5400	–	–	–								
19	PPA–FINISH RH HEADERS	R–13TO+R–14	SA213T91 + SA213T91	44.45	4.19	GTAW	4.2V	ER90S–B9	–			1036/08	220	730–760	30	20%RT/MIN 2 WELD/ WELDER	*	*	100% HC 300 HV (MAX)
							450	22500	–	–	–								
20		GAMMA PLUGS	SA182F22CL3 + SA335P22			SMAW	7 ◺	–	E9018–B3			1103/01	200	–	–	100%LPI OR 100%MPI	*	*	
							20	–	50	–	–								
21		GAMMA PLUGS	SA335P12 + SA335P12			SMAW	7 ◺	–	E8018–B2			1102/01	200	–	–	100%LPI OR 100%MPI	*	*	
							2	–	5	–	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	22.02.2018	4–17–992–03535	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12–98

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PG(S) : 17
PG NAME : REHEATER

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : REHEATER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 4/4

SL. NO.	DRG NO. FOR WELD LOCATION& IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC. QTY(NOS) ø2.5	ø3.15	ø4.0	WPS NO. / REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT TEMP. °C	HEAT TREATMENT HOLD. TIME	NDT METHOD / QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
							QTY(NOS)	QTY(gm)											
22	PPA–FINISH RH HEADERS	R–12+R–13	SA213T22 + SA213T22	50.8	4.19	GTAW	4 V	ER90S–B3	–			1013/02	150	–	–	20%RT/MIN 2 WELD/ WELDER	*	*	
							250	12676	–	–	–								
23	PPA–FINISH RH HEADERS	R–12+R–13	SA213T22 + SA213T22	44.45	4.19	GTAW	4 V	ER90S–B3	–			1013/02	150	–	–	20%RT/MIN 2 WELD/ WELDER	*	*	
							350	15435	–	–	–								
24	PPA–FINISH RH HEADERS	R–12+R–13	SA213T22 + SA213T22	63.5	4.19	GTAW	4.2V	ER90S–B3	–			1013/02	150	–	–	20%RT/MIN 2 WELD/ WELDER	*	*	
							50	3250	–	–	–								
25	PPA–FINISH RH HEADERS	R–12+R–13	SA213T22 + SA213T22	76.2	5.08	GTAW SMAW	5.1V	ER90S–B3	E9018–B3			1013/02	150	–	–	20%RT/MIN 2 WELD/ WELDER	*	*	
							50	845	550	–	–								
26	PPA–FINISH RH HEADERS	R–13TO+R–13	SA213S304H + SA213S304H	76.2	4.57	GTAW	4.6V	YT304H	–			1054/01	–	–	–	20%RT/MIN 2 WELD/ WELDER	*	*	
							50	5500	–	–	–								
27	PPA–SECTIONAL SIDE ELEVATION (BACKPASS) PPA–LTRH INLET HDR ECO. OUTLET HDR SUPPORT TUBE ARRANGEMENT	S–18B+LTRH HGR S–18B+S–60 S–19A/B+S–19A/B S–19A/B+S–60	SA213T22 + SA213T22	63.5	12.7	GTAW SMAW	12.7V	ER90S–B3	E9018–B3			1014/03	150	680–720	35	20%RT/MIN 2 WELD/ WELDER	*	*	
							3480	34452	48720	24360	–								
28		S–18B+S–18BTO S–18BTO+S–23 S–19A/B+S–19A/BTO S–19A/BTO+S–23		57.2	12.7		12.7V	ER90S–B3		E9018–B3		1014/03	150	680–720	35	20%RT/MIN 2 WELD/ WELDER			
							1240	10292	14880	8680	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	22.02.2018	4–17–992–03536	00

* REFER NDE MANUAL NO.PS:CMX:002 REV.NO.01/12–98

BHEL TIRUCHY

SUMMARY LIST OF SITE ELECTRODES

PROJECT: NORTH CHENNAI 1x800 MW
UPPUR 2x800 MW

CUSTOMER NOS: 1818, 1821 & 1822

PG NO: 19

PG NAME : ECONOMISER SYSTEM

PRESSURE PARTS

SL. NO	TYPE OF ELECTRODE / ROD	SIZE & QTY				GTAW ROD WT(gm)	REMARKS
		ø2.5	ø3.15	ø4.0	ø5.0		
01.	ER90S-B3					22910	
02.	ER70S-A1					73038	
03.	E9018-B3	28728	13680				
04.	E7018-A1	2154	3294	31716			
05.	E7018-1	82080					
06.	E7018	165					

NOTES: -

1. RESERVE 50% ADDED.
2. QUANTITY GIVEN IS PER BOILER
3. THIS FIELD WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.

ENCL : FIELD WELDING SCHEDULE DRAWING NOS 4-19-992-07638 & 4-19-992-07639

CC: 1. PROJECT CO-ORDINATOR/CONTRACTS:
2. DY.MANAGER/WTC
3. WELDING SCHEDULE FILE

PREPARED	CHECKED(DESIGNS)	APPROVED(WTC)	DRAWING NO.
YADAV	S.A.K	L.PRAVEEN KUMAR	4-19-992-07637/00

01.03.2018

PG(S) : 19
PG NAME : ECONOMISER

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : ECONOMISER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 1/2

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC. GTAW	ELECTRODE FILLER SPEC. SMAW SPEC.			WPS NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
									SMAW SPEC. QTY(NOS)			REV. NO.		TEMP. °C	HOLD. TIME				
							QTY(NOS)	QTY(gm)	Ø2.5	Ø3.15	Ø4.0								
01	PPA–ECONOMISER MIXING LINE ARRANGEMENT 0–19–851–01967	EF–01+EF–01 EF–01+EF–02	SA234WPC + SA106GRC	508	61.3	GTAW	61.3√	ER70S–A1	E7018–A1			1005/05	100	620–650	155	100%RT	*	*	
						SMAW	8	1192	304	504	2832								
02	PPA–ECONOMISER MIXING LINE ARRANGEMENT 0–19–851–01967	EF–09+EF–01	SA106GRC + SA106GRC	508	61.3	GTAW	61.3√	ER70S–A1	E7018–A1			1005/05	100	620–650	155	100%RT	*	*	
						SMAW	2	298	76	126	708								
03	PPA–ECONOMISER MIXING LINE ARRANGEMENT 0–19–851–01967 0–19–852–01969 0–19–853–01968	EF–02+EF–03 EF–03+EF–03 EF–03+F–16	SA234WPC + SA106GRC	508	61.3	GTAW	61.3√	ER70S–A1	E7018–A1			1005/05	100	620–650	155	100%RT	*	*	
						SMAW	6	894	228	378	2124								
04	PPA–SECTIONAL SIDE ELEVATION BACKPASS (HANGER TUBES)	S–14/17+S–18A	SA213T22 + SA213T22	51.0	10.0	GTAW	10√	ER90S–B3	E9018–B3			1014/03	150	680–720	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	456	3648	4560	1824	–								
05	PPA–SECTIONAL SIDE ELEVATION BACKPASS (HANGER TUBES)	S–18A+E–06L E–06L+E–06U E–06U+S–18A S–18A+S–60	SA213T22 + SA213T22	44.5	10.0	GTAW	10√	ER90S–B3	E9018–B3			1014/03	150	680–720	30	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
						SMAW	1824	11624	14592	7296	–								

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	01.03.2018	4–19–992–07638	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

PG(S) : 19
PG NAME : ECONOMISER

Name of Contractor/Subcontractor

FIELD WELDING SCHEDULE

PROJECT : NORTH CHENNAI 1x800 MW (1818)
UPPUR 2x800 MW (1821 & 1822)
CONTRACTOR : BHEL
CONTRACT NO:
SYSTEM : ECONOMISER SYSTEM

DOC.NO: –
REV.NO. : –
WELDING CODE : IBR/ASME
PAGE NO. : 2/2

SL. NO.	DRG NO. FOR WELD LOCAION & IDENTIFICATION MARK	DESCRIPTION OF PARTS TO BE WELDED	MATERIAL SPEC.	OD	THICK	PROCESS OF WELDING	TYPE OF WELD	ELECTRODE FILLER SPEC.					WPS NO. REV. NO.	MIN. PRE. HEAT TEMP	HEAT TREATMENT		NDT METHOD/ QUANTUM	REF. SPEC. NO.	ACC NORM REF	RE-MARKS
								GTAW	SMAW SPEC. QTY(NOS)						TEMP. °C	HOLD. TIME				
							QTY(NOS)	QTY(gm)	ø2.5	ø3.15	ø4.0									
06	PPA–ECONOMISER MIXING LINE ARRANGEMENT 0–19–850–01980	VALVE+E–04 E–04+E–04	SA234WPC + SA106GRC + SA106GRC	610	70	GTAW SMAW	70V̂ 12	ER70S–A1 1992	E7018–A1 552	792	10320		1005/05	100	620–650	175	100%RT	*	*	
07	PPA–SECTIONAL SIDE ELEVATION (BACKPASS)	E–05+E–06TI E–06TI+E–06L E–06L+E–06U E–06U+E–06TO E–06TO+E–07	SA210GRC + SA210GRC	44.45	7.11	GTAW SMAW	7V̂ 4560	ER70S–A1 43320	E7018–1 54720	–	–		1002/03	–	–	–	20%RT/MIN 2 WELD/ WELDER/ SHIFT	*	*	
08		GAMMA PLUGS	SA106GRC + SA105			SMAW	7◺ 40	– –	E7018 110	–	–		1101/01	150	–	–	100%LPI OR 100%MPI	*	*	
09	PPA–ECONOMISER MIXING LINE ARRANGEMENT 0–19–850–01980	E–05+E–04 E–04+E–04	SA234WPC + SA106GRC + SA106GRC	508	61.3	GTAW SMAW	61.3V̂ 6	ER70S–A1 894	E7018–A1 228	378	2124		1005/05	100	620–650	155	100%RT	*	*	

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO:	REV.NO.
YADAV	S.ANAND KUMAR	L.PRAVEEN KUMAR	S.ANAND KUMAR	01.03.2018	4–19–992–07639	00

* REFER NDE MANUAL NO.PS: CMX: 002 REV.NO.01/12–98

355-005/A	ERECTION WELDING SCHEDULE	P.G. NO.:-	21
	WELDING CODE : I.B.R / ASME		
	PRESSURE PARTS/~~NON PRESSURE PARTS~~	SYSTEM DESCRIPTION.:-	SOOT BLOWER PIPING
	PROJECT :- KOTHAGUDAM TPS- 1 X 800 MW	CUST. No :- 1810	

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
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos.					TIME in mins		SPEC. NO	ACC NORM REF.	
									Ø2.5	Ø3.15	Ø4.0							
01	0-21-600-00480	PIPE WITH STUB+VALVE	SA335P91+ SA234C12A	127.00	20.00	GTAW+SMAW	20 ▽▽	ER90S-B9	E9015-B91			1050/06	220	755±10	100% RT /UT 10%HC/300HB(MAX)			NDE METHOD REVISED(REV.01)
							2	62	24	28	6			60				
02	0-21-600-00480 0-21-600-00483	PIPE+PIPE BEND(OR)FE(OR) PIPE WITH STUB(OR) SV STUB(OR)REDUCER	SA335P22+ SA335P22(OR) SA182F22CL3	127.00	12.50	GTAW+SMAW	12.50 ▽	ER90S-B3	E9018-B3			1014/3	150	680-720	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							15	399	180	255	-			60				
03	0-21-600-00480	PIPE+VALVE	SA234C12A+ SA335P22	127.00	12.50	GTAW+SMAW	12.50 ▽	ER90S-B3	E9018-B3			1038/4	220	730-770	100% RT 10%HC/300HB(MAX)			NDE METHOD REVISED(REV.01)
							1	27	12	17	-			60				
04	0-21-600-00480 0-21-600-00481 0-21-600-00482 0-21-600-00483	PIPE+PIPE(OR) REDUCER	SA335P22+ SA335P22(OR) SA234WP22CL1	60.30	5.54	GTAW+SMAW	5.54 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							380	4788	3800	-	-			-				
05	0-21-600-00480 0-21-600-00483	PIPE+EQ.TEE	SA335P22+ SA182F22CL3	60.30	5.54	SMAW	5.54 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							20	-	57	-	-			-				
06	0-21-600-00480	PIPE+PIPE(OR)FE(OR) REDUCER	SA335P22+ SA335P22(OR SA335P22 (OR) SA182F22CL3	88.90	5.49	GTAW+SMAW	5.49 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							16	314	240	-	-			-				
07	0-21-600-00480	PIPE+VALVE	SA335P22+ SA182F22	60.30	5.54	SMAW	5.54 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							8	-	23	-	-			-				
08	0-21-600-00480	PIPE+ REDUCER	SA335P22+ SA234WP22CL1	33.40	4.55	GTAW+SMAW	4.55 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	26	20	-	-			-				
09	0-21-600-00480 0-21-600-00483	PIPE+VALVE	SA335P22+ SA182F22	33.40	4.55	SMAW	4.55 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							12	-	14	-	-			-				
10	0-21-600-00480	VALVE+REDUCER	SA182F22 +SA234WPPCL2	33.40	4.55	SMAW	4.55 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							8	-	9	-	-			-				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P.DEEPAK	A JAI GANESH	LAKAVATH PRAVEEN KUMAR	K.SRIDHARAN	10/01/18	*4-21-992-02927*	*01*

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A

ERECTION WELDING SCHEDULE

WELDING CODE : I.B.R / ASME

PRESSURE PARTS/~~NON PRESSURE PARTS~~

PROJECT :- KOTHAGUDAM TPS- 1 X 800 MW | **CUST. No :- 1810**

P.G. NO.:- 21

SYSTEM DESCRIPTION.:- SOOT BLOWER PIPING

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
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos.					TIME in mins		SPEC. NO	ACC NORM REF.	
									Ø2.5	Ø3.15	Ø4.0							
11	0-21-600-00480	COND.PIPE+ REDUCER	SA335P22+ SA234WP22CL1	21.30	4.78	GTAW+SMAW	4.55 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	60	-	-	-			-				
12	0-21-600-00480	PIPE+REDUCER	SA335P22+ SA182F22CL3	73.00	5.16	GTAW+SMAW	5.16 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							1	16	11	-	-			-				
13	0-21-600-00480	PIPE+VALVE	SA335P22+ SA217WC9	73.00	5.16	GTAW+SMAW	5.16 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	64	44	-	-			-				
14	0-21-600-00480	PIPE+REDUCER	SA335P22+ SA182F22CL3	60.30	5.54	GTAW+SMAW	5.54 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	50	40	-	-			-				
15	0-21-600-00480 0-21-600-00483	PIPE+PIPE	SA335P22+ SA335P22	33.40	4.55	GTAW+SMAW	4.55 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							17	109	85	-	-			-				
16	0-21-600-00480	SV STUB+FLANGE	SA182F22CL3+ SA182F22CL3	88.90	12.70	GTAW+SMAW	12.7 ▽	ER90S-B3	E9018-B3			1014/3	150	680-720	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							1	17	8	10	-			60				
17	0-21-600-00480 0-21-600-00483	PIPE+PIPE(OR)BEND	SA335P22+ SA335P22	73.00	5.16	GTAW+SMAW	5.16 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							125	2013	1375	-	-			-				
18	0-21-600-00480	PIPE+PIPE	SA335P91+ SA335P91	33.40	9.09	GTAW+SMAW	9.09 ▽	ER90S-B9	E9015-B91			1036/08	220	745±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							2	7	28	-	-			30				
19	0-21-600-00480	PIPE+VALVE	SA335P91+ F91	33.40	9.09	SMAW	9.09 ◺	-	E9015-B91			1118/00	220	745±15	100%LPI OR MPI 10%HC/300HV(MAX)			
							3	-	-	6	-			30				
20	0-21-600-00480	VALVE+REDUCER	SA182F91+ SA234WP91	33.40	9.09	SMAW	9.09 ◺	-	E9015-B91			1118/00	220	745±15	100%LPI OR MPI 10%HC/300HV(MAX)			
							1	-	-	2	-			30				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P.DEEPAK	A JAI GANESH	LAKAVATH PRAVEEN KUMAR	K.SRIDHARAN	10/01/18	*4-21-992-02928*	*00*

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A

ERECTION WELDING SCHEDULE

WELDING CODE : I.B.R / ASME

PRESSURE PARTS/~~NON PRESSURE PARTS~~

PROJECT :- KOTHAGUDAM TPS- 1 X 800 MW | **CUST. No :- 1810**

P.G. NO.:- 21

SYSTEM DESCRIPTION.:- SOOT BLOWER PIPING

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 / TIME in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos. Ø2.5	Qty in Nos. Ø3.15	Qty in Nos. Ø4.0					SPEC. NO	ACC NORM REF.	
21	0-21-600-00480	COND. LOOP+REDUCER	SA213TP347H+ SA234WP91	26.70	7.82	GTAW+SMAW	7.82 ▽	ERNicr-3	ENicrFe-3			1047/1	220	730-770 / 60	100% RT /UT 10%HC/300HB(MAX)			NDE METHOD REVISED(REV.01)
							1	5	7	-	-							
22	0-21-600-00480 0-21-600-00481 0-21-600-00482 0-21-600-00483	PIPE+PIPE(OR) ORIFICE PLATE	SA335P22+ SA335P22	33.40	4.55	GTAW+SMAW	4.55 ▽	ER90S-B3	E9018-B3			1013/2	150	- / -	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							20	128	100	-	-							
23	0-21-600-00481 0-21-600-00482	PIPE+TEE (OR) SB FLANGE	SA335P22+ SA182F22CL3 (OR) SA234WP22CL1	60.30	5.54	SMAW	5.54 ◺	-	E9018-B3			1020/1	150	- / -	100%LPI OR MPI			
							624	-	1778	-	-							
24	0-21-600-00481 0-21-600-00482 0-21-600-00483	PIPE+TEE	SA335P22+ SA182F22CL3	33.40	4.55	SMAW	4.55 ◺	-	E9018-B3			1020/1	150	- / -	100%LPI OR MPI			
							40	-	46	-	-							
25	0-21-600-00481 0-21-600-00482 0-21-600-00483	PIPE+REDUCER	SA335P22+ SA234WP22CL1	60.30	5.54	GTAW+SMAW	5.54 ▽	ER90S-B3	E9018-B3			1013/2	150	- / -	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							10	126	100	-	-							
26	0-21-600-00483	EQ.TEE+REDUCER	SA234WP22CL1+SA182F22CL3	127.00	12.50	GTAW+SMAW	12.5 ▽	ER90S-B3	E9018-B3			1014/3	150	680-720 / 60	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	106	48	68	-							
27	0-21-600-00483	PIPE+REDUCER	SA335P22+ SA182F22CL3	73.00	5.16	GTAW+SMAW	5.16 ▽	ER90S-B3	E9018-B3			1013/2	150	- / -	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							12	193	132	-	-							
28	0-21-600-00483	PIPE+EQ.TEE	SA335P22+ SA234WP22CL1	127.00	12.50	GTAW+SMAW	12.5 ▽	ER90S-B3	E9018-B3			1014/3	150	680-720 / 60	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							2	53	24	34	-							
29	0-21-600-00483	EQ.TEE+REDUCER	SA234WP22CL1+SA182F22CL3	88.90	11.13	GTAW+SMAW	11.13 ▽	ER90S-B3	E9018-B3			1014/3	150	680-720 / 60	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							18	328	144	162	-							
30	0-21-600-00483	REDUCER+REDUCER	SA182F22CL3+ SA182F22CL3	73.00	5.16	GTAW+SMAW	5.16 ▽	ER90S-B3	E9018-B3			1013/2	150	- / -	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							2	32	22	-	-							

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P.DEEPAK	A JAI GANESH	LAKAVATH PRAVEEN KUMAR	K.SRIDHARAN	10/01/18	*4-21-992-02929*	*01*

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A

ERECTION WELDING SCHEDULE

WELDING CODE : I.B.R / ASME

PRESSURE PARTS/~~NON PRESSURE PARTS~~

PROJECT :- KOTHAGUDAM TPS- 1 X 800 MW | CUST. No :- 1810

P.G. NO.:- 21

SYSTEM DESCRIPTION.:- SOOT BLOWER PIPING

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 / TIME in mins	NDT METHOD/ QUANTUM	* REF-.		REMARKS
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos. Ø2.5	Qty in Nos. Ø3.15	Qty in Nos. Ø4.0					SPEC. NO	ACC NORM REF.	
31	0-21-600-00483	PIPE+ REDUCER	SA335P22+ SA182F22CL3	33.40	4.55	GTAW+SMAW	4.55 ▽	ER90S-B3	E9018-B3			1013/2	150	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							2	13	10	-	-			-				
32	0-21-600-00483	REDUCER+VALVE	SA234WP22CL1+SA182F22	33.40	4.55	SMAW	4.55 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							2	-	2	-	-			-				
33	0-21-600-00483	PIPE+VALVE	SA335P22+F22	33.40	4.55	SMAW	4.55 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							4	-	5	-	-			-				
34	0-21-600-00483	REDUCER+VALVE	SA182F22CL3+ SA182F22	60.30	5.54	SMAW	5.54 ◺	-	E9018-B3			1020/1	150	-	100%LPI OR MPI			
							4	-	11	-	-			-				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P.DEEPAK	A JAI GANESH	LAKAVATH PRAVEEN KUMAR	K.SRIDHARAN	10/01/18	*4-21-992-02930*	*00*

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									**P.G. NO.:-**				**24**					
	WELDING CODE : I.B.R / ASME									**SYSTEM DESCRIPTION.:-**				**SAFETY VALVES & ERV**					
	PRESSURE PARTS/~~NON PRESSURE PARTS~~																		
	PROJECT :- NORTHKARANPURA - 3 X 660 MW					**CUST. Nos :- 1720, 1721 & 1722**													
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**
				SIZE	**THICK**			**TIG**	**ARC SPEC.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
							Qty in Nos.	**Qty in gms**	**Qty in Nos.**									
									Ø2.5	**Ø3.15**	**Ø4.0**							
01		S-01 SV NOZZLE + SEPARATOR SAFETY VALVE	SA182 F12 CL2 + SA217 Gr.WC9	D184.0	60.3	TIG+ARC	⌒	ER80S-B2	E8018-B2			1012/04	150	680-720	100% UT			
							8	400	144	200	1132			150				
02		MS LINE SV STUB + MS SAFETY VALVE	SA182 F92 + SA182 F92	D184.0	60.3	TIG+ARC	57.00⌒V	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							4	200	68	124	608			145				
03		CRH LINE SV STUB + CRH SAFETY VALVE	SA105 + SA105	D222.3	34.95	TIG+ARC	31.7⌒V	ER70S-A1	E7018-1			1004/04	100	620-650	100% UT			
							4	275	64	105	265			80				
04		HRH LINE SV STUB + HRH SAFETY VALVE	SA182 F92 + SA182 F92	D245.0	46.30	TIG+ARC	43.1⌒V	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							6	387	102	174	534			108				
05		MS LINE ERV STUB (OR) MS ERV + ISOLATING GATE VALVE	SA182 F92 + SA182 F92	D132	34.00	TIG+ARC	34.00⌒V	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							4	148	56	76	136			85				
06		HRH LINE ERV STUB + ISOLATING GATE VALVE	SA182 F92 + SA182 F92	D160	31.50	TIG+ARC	31.5⌒V	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							4	148	56	76	136			85				
07																		
PREPARED		**CHECKED (DESIGN)**		**CHECKED (W.T.C)**				**APPROVED**				**DATE**	**DRAWING NO.**			**REV NO.**		
P RAVIRAJA		***R.GOPINATH***		***PRAVEEN LAKAVATH***				***V.GUNASEKARAN***				***15.12.2018***	***4-24-992-10701***			***0***		
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						

355-005/A
(09-09-2016)

ERECTION WELDING SCHEDULE

WELDING CODE : I.B.R / ASME

PRESSURE PARTS/~~NON PRESSURE PARTS~~

PROJECT :- GADARWARA STPP - 2 X 800 MW | **CUST. Nos :- 1804, 1805**

P.G. NO.:- 24

SYSTEM DESCRIPTION.:- SV ORIENTATION & EXHAUST PIPE ARRGT FOR MS,CRH,HRH & SEPARATOR

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
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos.					TIME in mins		SPEC. NO	ACC NORM REF.	
									Ø2.5	Ø3.15	Ø4.0							
01		PIPE + ELBOW	SA182 F91 + SA234WP91	D168.3	7.11	GTAW + SMAW	7.11▽	ER90S-B9	E9015-B91			1036/08	220	745±15	10% RT MIN 2 WELDS/ WELDER/ SHIFT			
							8	424	120	72	-			30				
02		PIPE + ELBOW	SA312TP304H + SA234 WP91	D273.0	6.35	GTAW + SMAW	6.35▽	ERNiCr-3	ENiCrFe-3			1047/01	220 ON P91 SIDE	750±20	100% RT			
							12	1068	240	108	-			60				
03		PIPE + ELBOW	SA106 GR.B + SA234 WPB	D273.0	6.35	GTAW + SMAW	6.35▽	ER70S-A1	E7018-1			1002/03	-	-	10% RT MIN 2 WELDS/ WELDER/ SHIFT			
							8	712	160	72	-			-				
04		EXHAUST PIPE + ENLARGER (OR) MITRE BEND (OR) EXHAUST PIPE	API 5L GR.B + API 5L GR.B	-	6.4/9.5	SMAW	6.35▽ / 9.5▽	-	E7018			1213/00	-	-	10% RT MIN 1 WELD/ WELDER/ SHIFT			
							170M	-	5250	-	-			-				
05		PIPE + ELBOW	SA213T91 + SA182 F91	D47.63	5.00	SMAW	5◺	-	E9015-B91			1036/08	220	745±15	100% MPI (OR) LPI			
							6M	-	66	-	-			30				
06		PIPE + ELBOW	SA213T91 + SA182 F91	D76.2	5.10	SMAW	5.10▽	ER90S-B9	E9015-B91			1036/08	220	745±15	10% RT MIN 1 WELD/ WELDER/ SHIFT			
							36	-	396	-	-			30				
07		PIPE + ELBOW	SA106 GR.B + SA234 WPB	D73.0	5.16	GTAW + SMAW	5.16▽	ER70S-A1	E7018-1			1002/03	-	-	10% RT MIN 1 WELD/ WELDER/ SHIFT			
							36	591	396	-	-			-				
08		PIPE + PIPE	IS1239 + IS1239	D27.2	2.65	SMAW	2.65▽	-	E7018			1201/02	-	-	100% MPI (OR) LPI			
							28	-	392	-	-			-				
09		PIPE + PIPE	IS1239 + IS1239	D34.2	3.25	SMAW	3.25▽	-	E7018			1201/02	-	-	100% MPI (OR) LPI			
							28	-	392	-	-			-				
10		MS SV PIPE + FLANGE	SA335 F91 + SA182 F91	D168.3	7.11	SMAW	7.7◺	-	E9015-B91			1036/08	220	745±15	100% MPI (OR) LPI			
							3M	-	30	24	-			30				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P RAVIRAJA	*R.GOPINATH*	*PRAVEEN LAKAVATH*	*V.GUNASEKARAN*	*15.12.2018*	*4-24-992-10703*	*00*

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A (09-09-2016)		**ERECTION WELDING SCHEDULE**									P.G. NO.:-			24					
		WELDING CODE : I.B.R / ASME																	
		PRESSURE PARTS/~~NON PRESSURE PARTS~~									**SYSTEM DESCRIPTION.:-**			**SV ORIENTATION & EXHAUST PIPE ARRGT FOR MS,CRH,HRH & SEPARATOR**					
		PROJECT :- GADARWARA STPP - 2 X 800 MW				**CUST. Nos :- 1804, 1805**													
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**
				SIZE	**THICK**			**GTAW**	**SMAW**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
							Qty in Nos.	**Qty in gms**	**Qty in Nos.**									
									Ø2.5	**Ø3.15**	**Ø4.0**							
11		HRH SV PIPE + FLANGE	SA312TP304H + SA182 F91	D273.1	6.35	SMAW	8 ◺	-	ENiCrFe-3			1063/01	220 ON P91 SIDE	745±15	100% LPI			
							6M	-	60	48	-			30				
12		CRH SV PIPE + FLANGE	SA106 GR.B + SA105	D273.1	6.35	SMAW	7 ◺	-	E7018-1			1022/00	-	-	100% MPI (OR) LPI			
							4M	-	80	-	-			-				
13		MS ERV PIPE + FLANGE	SA335 P91 + SA182 F91	D114.3	6.02	SMAW	6.5 ◺	-	E9015-B91			1036/08	220	745±15	100% MPI (OR) LPI			
							2M	-	40	-	-			30				
14		HRH ERV PIPE + FLANGE	SA312TP304H + SA182 F91	D219.1	8.18	SMAW	9 ◺	-	ENiCrFe-3			1063/01	220 ON P91 SIDE	745±15	100% LPI			
							3M	-	30	33	-			30				
15		STRUCTURE + STRUCTURE	SA2062FE410A + SA2062FE410A	-	5.70	SMAW	6 ◺	-	E7018			1201/02	-	-	10% MPI (OR) LPI			
							58	-	870	-	-			-				
16		PIPE + ELBOW	SA335 Gr.P11 + SA234 Gr.WP11CL.1	D168.3	21.95	GTAW + SMAW	21.95 ▽▽	ER80S-B2	E8018-B2			1010/06	150	660±10	10% RT MIN 2 WELDS/ WELDER/ SHIFT			SEPARATOR SV
							8	424	120	72	-			60				
17		PIPE + ELBOW	SA335 Gr.P11 + SA234 Gr.WP11CL.1	D219.1	22.20	GTAW + SMAW	22.20 ▽▽	ER80S-B2	E8018-B2			1010/06	150	660±10	10% RT MIN 2 WELDS/ WELDER/ SHIFT			SEPARATOR SV
							8	536	136	200	72			60				
18		EXHAUST PIPE + EXHAUST PIPE	SA106 GR.C + SA106 GR.C	D406.4	9.53	SMAW	9.53 ▽	-	E7018			1213/00	-	-	10% RT MIN 1 WELD/ WELDER/ SHIFT			SEPARATOR SV
							11M	-	330	-	-			-				
19		EXHAUST PIPE + EXHAUST PIPE	SA106 GR.C + SA106 GR.C	D457	9.53	SMAW	9.53 ▽	-	E7018			1213/00	-	-	10% RT MIN 1 WELD/ WELDER/ SHIFT			SEPARATOR SV
							13M	-	390	-	-			-				

PREPARED	**CHECKED (DESIGN)**	**CHECKED (W.T.C)**	**APPROVED**	**DATE**	**DRAWING NO.**	**REV NO.**
P RAVIRAJA	***R.GOPINATH***	***PRAVEEN LAKAVATH***	***V.GUNASEKARAN***	***15.12.2018***	***4-24-992-10704***	***00***

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

355-005/A (09-09-2016)		**ERECTION WELDING SCHEDULE**									P.G. NO.:-		24						
		WELDING CODE : I.B.R / ASME									SYSTEM DESCRIPTION.:-		SAMPLING SYSTEM						
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																	
		PROJECT :- GADARWARA STPP - 2 X 800 MW				**CUST. Nos :- 1804, 1805**													
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**
				SIZE	**THICK**			**GTAW**	**SMAW**								**SPEC. NO**	**ACC NORM REF.**	
							Qty in Nos.	**Qty in gms**	**Qty in Nos.**						**TIME in mins**				
									Ø2.5	**Ø3.15**	**Ø4.0**								
01		PIPE + VALVE (OR) TEE	SA213TP347H + SA182 F316	D31.8	7.2	SMAW	8	-	E316				1071/00	20	-	100% LPI			
							110	-	231	-	-				-				
02		PIPE + BEND (OR) PIPE	SA213TP347H + SA213TP347H	D31.8	7.2	GTAW + SMAW	7.2	ER347	E347				1016/01	-	-	10% RT MIN 1 WELD/ WELDER/ SHIFT			
							1000	5000	6000	-	-				-				
03		STUB + TUBE	SA182F91 + SA213TP347H	D31.8	7.2	SMAW	8	-	ENiCr Fe-3				1063/ 00	220 ON F91 SIDE	745±15	100% LPI (OR) MPI			MS & HRH SAMPLING TAPPING
							2	-	5	-	-				30				
04		STUB + TUBE	SA182F12CL2+ SA213TP347H	D31.8	7.2	SMAW	8	-	E309				1027/ 02	150 ON F12 SIDE ONLY	-	100% LPI			S-01 LINE & WATER STORAGE DOWNCOMER SAMPLING TAPPING
							9	-	-	19	-				-				
05		STUB + TUBE	SA105+ SA213TP347H	D31.8	7.2	GTAW + SMAW	7.2	ERNiCr3	ENiCr Fe-3				1025/01	Nil	610 ± 15	20% RT subject to min 2 weld/ welder/ shift			BOILER FEED LINE SAMPLING TAPPING
							2	12	25	-	-				30				
06		PIPE + PR. REDUCER	SA213TP347H + SA182F316	D31.8	7.2	GTAW + SMAW	7.2	ER316L	E316				1071/00	20	-	10% RT MIN 1 WELD/ WELDER/ SHIFT			
							10	55	60	-	-				-				
PREPARED		**CHECKED (DESIGN)**		**CHECKED (W.T.C)**			**APPROVED**					**DATE**	**DRAWING NO.**			**REV NO.**			
P RAVIRAJA		***R.GOPINATH***		***PRAVEEN LAKAVATH***			***V.GUNASEKARAN***					***15.12.2018***	***4-24-992-10702***			***00***			
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										P.G. NO.:-		24			
		WELDING CODE : I.B.R / ASME										SYSTEM DESCRIPTION.:-		BOILER TRIM PIPING - DRAINS			
		PRESSURE PARTS/~~NON PRESSURE PARTS~~															
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				CUST. Nos :- 1818											
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
								GTAW	SMAW									
									Qty in Nos.					TIME in mins		SPEC. NO	ACC NORM REF.	
				SIZE	THICK		Qty in Nos.	Qty in gms	Ø2.5	Ø3.15	Ø4.0							
01	0-00-047-16365	VALVE + PIPE	SA105 + SA106 GR.C	D33.4	9.09	SMAW	10	-	E7018-1			1021/01	NIL	-	10% LPI or MPI			
							8	-	-	16	-			-				
02	0-00-047-16365	PIPE + BEND (OR) PIPE	SA106 GR.C + SA106 GR.C	D33.4	9.09	GTAW+SMAW	9.09	ER70S-A1	E7018-1			1003/03	NIL	-	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							51	219	612	-	-			-				
03	0-00-047-16366	PIPE + PIPE (OR) BEND (OR) VALVE (OR) CONNECTOR	SA106 GR.C + SA106 GR.C (OR) SA216WCC (OR) SA105	D159	30	GTAW+SMAW	30	ER70S-A1	E7018-A1			1005/05	100	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							12	492	156	228	312			75				
04	0-00-047-16366	PIPE + PIEP(OR) EQ TEE (OR) ELBOW (OR) VALVE (OR) CONNECTOR	SA106 GR.C + SA106 GR.C (OR)SA234WPC (OR) SA216WCC (OR) SA105	D114.3	20	GTAW+SMAW	20	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							20	620	240	280	120			50				
05	0-00-047-16366	PIPE + BEND (OR) PIPE	SA106 GR.C + SA106 GR.C	D33.4	9.09	GTAW+SMAW	9.09	ER70S-A1	E7018-1			1003/03	NIL	-	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							5	22	60					-				
06	0-00-047-16366	VALVE + PIPE	SA105 + SA106 GR.C	D33.4	9.09	SMAW	10	-	E7018-1			1021/01	NIL	-	10% LPI or MPI			
							4	-	-	8	-			-				
07	0-00-047-16367, 0-00-047-16368, 0-00-047-16369, 0-00-047-16370	PIPE + BEND (OR) PIPE (OR) VALVE	SA335P22 + SA335P22+ SA182F22	D73	14.02	GTAW+SMAW	14.02	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							57	701	627.00	513	-			60				
08	0-00-047-16367, 0-00-047-16368, 0-00-047-16369, 0-00-047-16370	F-03/F-09/F-18 HEADER NOZZLE + PIPE (OR) BEND	SA182F12CL2 + SA335P22	D73	14.02	GTAW+SMAW	14.02	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							4	49	44.00	36	-			60				
09	0-00-047-16371	PIPE + PIPE (OR) BEND (OR) EQ.TEE	SA106 GR.B + SA106 GR.B (OR) SA234WPB	D73	14.02	GTAW+SMAW	14.02	ER70S-A1	E7018-1			1004/03	NIL	610±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							13	160	143	156	-			35				
10	0-00-047-16371	PIPE + VALVE (OR) F-59C STUB FOR DRAIN	SA106 GR.B + SA216WCC (OR) SA105	D73	14.02	GTAW+SMAW	14.02	ER70S-A1	E7018-1			1004/03	NIL	610±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							6	74	66	72	-			35				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P RAVIRAJA	*R.GOPINATH*	*PRAVEEN LAKAVATH*	*V.GUNASEKARAN*	*15.12.2018*	*4-24-992-10689*	*00*

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

		ERECTION WELDING SCHEDULE										**P.G. NO.:-**		**24**				
		WELDING CODE : I.B.R / ASME										**SYSTEM DESCRIPTION.:-**		**BOILER TRIM PIPING - DRAINS**				
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**												
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**
								GTAW	**SMAW**									
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**							
01	0-00-047-16372	PIPE + PIPE (OR) PIPE WITH STUB (OR) ELBOW (OR) EQ.TEE (OR) F-61C STUB FOR DRAIN (OR) VALVE	SA106 GR.C + SA106 GR.C (OR) SA234 WPC (OR) SA105 (OR) SA216WCC	D168.3	26.00	GTAW+SMAW	26	ER70S-A1	E7018-A1			1005/05	100	635±15	10%RT SUBJECTED TO A MINIMUM OF 2 WELD/WELDER			
							22	1078	308	528	286			65				
02	0-00-047-16372	PIPE + ELBOW (OR) REDUCER (OR) VALVE (OR) FLAT END COVER	SA106 GR.C + SA234 WPC (OR) SA216WCC (OR) SA105	D114.3	17.12	GTAW+SMAW	17.12	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							9	288	108	126	27			45				
03	0-00-047-16372	PIPE + PIPE (OR) PIPE WITH STUB (OR) BEND	SA106 GR.C + SA106 GR.C	D33.4	9.09	GTAW+SMAW	9.09	ER70S-A1	E7018-1			1003/03	NIL	-	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							15	65	180	-	-			-				
04	0-00-047-16372	PIPE + VALVE (OR) F-61B STUB FOR DRAIN	SA106 GR.C + SA105	D33.4	9.09	SMAW	10	-	E7018-1			1021/01	NIL	-	10% LPI or MPI			
							3	-	-	6	-			-				
05	0-00-047-16373	PIPE (OR) REDUCER + EQ.TEE (OR) VALVE	SA106 GR.C + SA234 WPC (OR) SA216WCC	D88.90	15.24	GTAW+SMAW	15.24	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							7	168	56	70	35			38				
06	0-00-047-16373	PIPE + PIPE (OR) BEND	SA106 GR.C + SA106 GR.C	D60.3	11.07	GTAW+SMAW	11.07	ER70S-A1	E7018-1			1003/03	NIL	-	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							26	257	312	130	-			-				
07	0-00-047-16373	PIPE + REDUCER	SA106 GR.C + SA105	D60.3	11.07	GTAW+SMAW	11.07	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							2	20	24	10	-			30				
08	0-00-047-16373	REDUCER (OR) PIPE + EQ.TEE (OR) VALVE (OR) F-67B&C DRAIN STUB	SA234 WPC (OR) SA106 GR.C + SA234 WPC (OR) SA105	D60.3	11.07	SMAW	12	-	E7018-1			1021/01	NIL	-	10%LPI OR MPI			
							12	-	-	23	32			-				
09	0-00-047-16373	PIPE + PIPE (OR) BEND	SA106 GR.C + SA106 GR.C	D48.3	10.15	GTAW+SMAW	10.15	ER70S-A1	E7018-1			1003/03	NIL	-	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							10	77	80	30	-			-				
10	0-00-047-16373	PIPE + REDUCER	SA106 GR.C + SA234 WPC	D48.3	10.15	GTAW+SMAW	10.15	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							2	15	16	6	-			30				

PREPARED	**CHECKED (DESIGN)**	**CHECKED (W.T.C)**	**APPROVED**	**DATE**	**DRAWING NO.**	**REV NO.**
P RAVIRAJA	***R.GOPINATH***	***PRAVEEN LAKAVATH***	***V.GUNASEKARAN***	***15.12.2018***	***4-24-992-10690***	***00***

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										**P.G. NO.:-**			**24**			
		WELDING CODE : I.B.R / ASME										**SYSTEM DESCRIPTION.:-**			**BOILER TRIM PIPING - DRAINS**			
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**												
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**
								GTAW	**SMAW**									
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**							
01	0-00-047-16373	EQ TEE + REDUCER (OR) BEND (OR) PIPE	SA234 WPC + SA105 (OR) SA106 GR.C	D48.3	10.15	SMAW	11	-	E7018-1			1021/01	NIL	-	10%LPI OR MPI			
							6	-	-	21	-			-				
02	0-00-047-16373	REDUCER + CONNECTOR	SA105 + SA105	D33.4	9.09	GTAW+SMAW	9.09	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							2	9	24	-	-			30				
03	2-00-047-47722	PIPE + PIPE (OR) BEND (OR) VALVE	SA335P22 + SA335P22 (OR) SA217WC9	D73	14.02	GTAW+SMAW	14.02	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							12	148	132	144	-			60				
04	2-00-047-47722	PIPE + S-02 NOZZLE FOR DRAIN	SA335P22 + SA182F12CL2	D73	14.02	GTAW+SMAW	14.02	ER80S-B2	E8018-B2			1012/04	150	700±20	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			
							1	12	11	12	-			60				
05	2-00-047-47723 2-00-047-47724	PIPE + ELBOW (OR) S-14/S-17 NOZZLE FOR DRAIN	SA335P91 + SA234WP91 (OR) SA182F91	D88.90	15.24	GTAW+SMAW	15.24	ER90S-B9	E9015-B9			1036/07	220	745±15	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			10% HC MAX-300HV
							42	1008	336	420	210			38				
06	2-00-047-47723 2-00-047-47724	PIPE + VALVE	SA335P91 + SA217WC9	D88.90	15.24	GTAW+SMAW	15.24	ER90S-B3	E9018-B3			1038/04	220	750±20	10%RT SUBJECTED TO A MINIMUM OF 1 WELD/WELDER			10% HC MAX-300HV
							8	192	64	80	40			60				
PREPARED		**CHECKED (DESIGN)**		**CHECKED (W.T.C)**			**APPROVED**				**DATE**	**DRAWING NO.**				**REV NO.**		
P RAVIRAJA		***R.GOPINATH***		***PRAVEEN LAKAVATH***			***V.GUNASEKARAN***				***15.12.2018***	***4-24-992-10691***				***00***		
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									**P.G. NO.:-**				**24**				
		WELDING CODE : I.B.R / ASME									**SYSTEM DESCRIPTION.:-**				**BOILER FILL PIPING**				
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																	
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**													
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**
								TIG	**ARC SPEC.**										
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**						**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**								
01	1-00-047-48188	PIPE + PIPE (OR) ELBOW (OR) REDUCER (OR) VALVE	SA106 GR.B + SA106 GR.B (OR) SA234WPB (OR) WCC	D168.3	7.11	GTAW+SMAW	7.11	ER70S-A1	E7018-1				1002/03	-	-	10% RT MINIMUM OF 2 WELDS/ WELDER/ SHIFT			
							18	954	270	162	-								
02	1-00-047-48188	PIPE + TEE (OR) REDUCER (OR) ELBOW	SA106 GR.B + SA234WPB	D219.1	6.35	GTAW+SMAW	6.35	ER70S-A1	E7018-1				1002/03	-	-	100% RT			
							5	355	185	-	-								
03	1-00-047-48188	PIPE + PIPE (OR) ELBOW (OR) TEE (OR) VALVE	SA106 GR.B + SA106 GR.B (OR) SA234 WPB (OR) WCC	D114.3	6.02	GTAW+SMAW	6.02	ER70S-A1	E7018-1				1002/03	-	-	10% RT MINIMUM OF 2 WELDS/ WELDER/ SHIFT			
							7	186	147	-	-								
04	1-00-047-48188	PIPE + PLATE 12MM	SA106 GR.B + SA515 GR70	D114.3	6.02	SMAW	6	-	E7018-1				1022/00	-	-	100% LPI			
							0.6m	-	9	-	-								
05	1-00-047-48188	PIPE + FLANGE	SA312 TP304H + SA387 GR22CL2	D219.1	6.35	SMAW	7	-	E309				1027/02	150	-	100% LPI or MPI			
							2	-	28	-	-								
06	1-00-047-48188	PIPE + FLANGE	SA106 GR.B + SA105	D219.1	6.35	SMAW	7	-	E7018-1				1022/00	-	-	10%LPI OR MPI			
							2	-	28	-	-								
PREPARED		**CHECKED (DESIGN)**		**CHECKED (W.T.C)**				**APPROVED**				**DATE**	**DRAWING NO.**				**REV NO.**		
P RAVIRAJA		***R.GOPINATH***		***PRAVEEN LAKAVATH***				***V.GUNASEKARAN***				***15.12.2018***	***4-24-992-10692***				***00***		
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	P.G. NO.:-	24
	WELDING CODE : I.B.R / ASME	SYSTEM DESCRIPTION.:-	BOILER TRIM PIPING - INSTRUMENTATION
	PRESSURE PARTS/~~NON PRESSURE PARTS~~		
	PROJECT :- NORTH CHENNAI - 1 X 660 MW; CUST. Nos :- 1818		

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
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos. Ø2.5	Ø3.15	Ø4.0			TIME in mins		SPEC. NO	ACC NORM REF.	
01	0-00-047-16374 0-00-047-16375	PIPE + PIPE (OR) BEND (OR) REDUCER	SA335P22 + SA335P22 (OR) SA182F22	D33.4	9.09	GTAW+SMAW	9.09	ER90S-B3	E9018-B3			1014/03	150	700±20	10% RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							440	1892	5720	-	-			60				
02	0-00-047-16374 0-00-047-16375	PIPE (OR) REDUCER + VALVE	SA335P22 (OR) SA234WP22CL1 + SA182F22	D33.4	9.09	SMAW	10	-	E9018-B3			1020/01	150	-	100% LPI or MPI			
							120	-	-	239	-			-				
03	0-00-047-16374	PIPE + PIPE (OR) BEND	SA335P91 + SA335P91	D33.4	9.09	GTAW+SMAW	9.09	ER90S-B9	E9015-B9			1036/07	220	745±15	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			10% HC MAX-300HV
							56	241	728	-	-			60				
04	0-00-047-16374	PIPE (OR) REDUCER + VALVE	SA335P91 (OR) SA234WP91 + SA182F22	D33.4	9.09	SMAW	10	-	E9018-B3			1113/02	220	745±15	100% LPI or MPI			10% HC MAX-300HV
							10	-	-	20	-			60				
05	0-00-047-16374 0-00-047-16375	PIPE + PIPE (OR) BEND	SA106 GR.C + SA106 GR.C	D33.4	9.09	GTAW+SMAW	9.09	ER70S-A1	E7018-1			1003/03	NIL	-	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							164	705	2132	-	-			-				
06	0-00-047-16374 0-00-047-16375	PIPE + VALVE	SA106 GR.C + SA105	D33.4	9.09	SMAW	10	-	E7018-1			1021/01	NIL	-	10% LPI or MPI			
							48	-	-	96	-			-				
07	0-00-047-16374	CONNECTOR + PIPE (CONDENSING LOOP ASSY.) (OR) IMPULSE PIPE	SA105 + SA106 GR.C	D21.3	4.78	SMAW	5	-	E7018-1			1021/01	NIL	-	10% LPI or MPI			
							12	-	-	24	-			-				
08	0-00-047-16375	PIPE+ VALVE	SA106 GR.B+ SA105	D26.7	7.82	SMAW	8	-	E7018-1			1021/01	NIL	-	10% LPI or MPI			
							24	-	20	16	-			-				

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P RAVIRAJA	*R.GOPINATH*	*PRAVEEN LAKAVATH*	*V.GUNASEKARAN*	*15.12.2018*	*4-24-992-10693*	*00*

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

	ERECTION WELDING SCHEDULE	P.G. NO.:-	24
	WELDING CODE : I.B.R / ASME PRESSURE PARTS/~~NON PRESSURE PARTS~~	SYSTEM DESCRIPTION.:-	BOILER TRIM PIPING - VENTS
	PROJECT :- NORTH CHENNAI - 1 X 660 MW / CUST. Nos :- 1818		

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
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos. Ø2.5	Ø3.15	Ø4.0			TIME in mins		SPEC. NO	ACC NORM REF.	
01	0-00-047-16393 0-00-047-16396	PIPE + BEND (OR) PIPE	SA335P22 + SA335P22	D48.3	10.16	GTAW+SMAW	10.16	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							80	616	640	240	-			60				
02	0-00-047-16393 0-00-047-16396	PIPE + TEE (OR) VALVE	SA335P22 + SA182F22	D48.3	10.16	SMAW	11	-	E9018-B3			1020/01	150	-	100% MPI OR LPI			
							16	-	-	56	-			-				
03	0-00-047-16393, 16394,16395, 16398,16402	PIPE + TEE (OR) VALVE	SA335P22 + SA182F22	D33.4	9.09	SMAW	10	-	E9018-B3			1020/01	150	-	100% MPI OR LPI			
							27	-	-	54	-			-				
04	0-00-047-16394, 16395,16397,16401, 16402	PIPE + BEND (OR) PIPE	SA335P22 + SA335P22	D33.4	9.09	GTAW+SMAW	9.09	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							446	0	0	-	-			60				
05	0-00-047-16397 0-00-047-16398	PIPE + PIPE WITH STUB (OR) FLAT ENDCOVER	SA335 P22 + SA335 P22 (OR) SA182 F22	D114.3	20.00	GTAW+SMAW	20.0	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							43	0	0	0	0			60				
06	0-00-047-16401 0-00-047-16402	PIPE + PIPE WITH STUB (OR) FLAT ENDCOVER	SA335 P22 + SA335 P22 (OR) SA182 F22	D88.9	15.24	GTAW+SMAW	15.24	ER90S-B3	E9018-B3			1014/03	150	700±20	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							26	112	338	0	0			60				
07	0-00-047-16399 0-00-047-16404	PIPE + BEND (OR) PIPE	SA335P91 + SA335P91	D48.3	10.16	GTAW+SMAW	10.16	ER90S-B9	E9015-B9			1036/07	220	745±15	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			10% HC MAX-300HV
							100	3100	1200	1400	-			30				
08	0-00-047-16399 0-00-047-16404	PIPE + TEE (OR) VALVE	SA335P91 + SA182F91	D48.3	10.16	SMAW	11	-	E9015-B9			1118/00	220	745±15	100% MPI OR LPI			10% HC MAX-300HV
							36	-	-	126	-			30				
09																		
10																		

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P RAVIRAJA	*R.GOPINATH*	*PRAVEEN LAKAVATH*	*V.GUNASEKARAN*	*15.12.2018*	*4-24-992-10694*	*00*

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

355-005/A	**ERECTION WELDING SCHEDULE**	**P.G. NO.:-**	**24**
	WELDING CODE : I.B.R / ASME	**SYSTEM DESCRIPTION.:-**	**BOILER TRIM PIPING - VENTS & SOOTBLOWER SUPPLY PIPING UPTO PRESSURE REDUCTION STATION**
	PRESSURE PARTS/~~NON PRESSURE PARTS~~		
	PROJECT :- NORTH CHENNAI - 1 X 660 MW **CUST. Nos :- 1818**		

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
								GTAW	SMAW									
				SIZE	THICK		Qty in Nos.	Qty in gms	Qty in Nos. Ø2.5	Ø3.15	Ø4.0			TIME in mins		SPEC. NO	ACC NORM REF.	
01	0-00-047-16399 0-00-047-16404	PIPE + TEE (OR) VALVE	SA335P91 + SA182F91	D33.4	9.09	SMAW	10	-		E9015-B9		1118/00	220	745±15	100% MPI (OR) LPI			10% HC MAX-300HV
							12	-	-	24	-			30				
02	0-00-047-16362, 0-00-047-16364	PIPE + PIPE (OR) ELBOW(OR) REDUCER (OR) NOZZLE	SA335P91 + SA335 P91 (OR) SA234WP91 (OR) SA182F91	D88.9	15.24	GTAW+SMAW	15.24	ER90S-B9		E9015-B9		1036/07	220	745±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER			10% HC MAX-300HV
							30	1050	420	570	750			60				
03	0-00-047-16362	PIPE (OR) REDUCER + PIPE (OR) EQ.TEE (OR) ELBOW (OR) VALVE (OR) PIPE WITH STUB	SA335P91 (OR) SA234WP91 + SA335P91 (OR) SA234WP91 (OR) SA234 C12A	D127	20	GTAW+SMAW	20.0	ER90S-B9		E9015-B9		1050/05	220	755±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER			10% HC MAX-300HV
							21	735	294	399	525			60				
04	0-00-047-16392	PIPE + VALVE (OR) TEE	SA106 GRC+ SA105	D48.3	10.15	SMAW	11	-		E7018-1		1021/01	NIL	-	10%LPI OR MPI			
							6	-	-	21	-			-				
05	0-00-047-16392	PIPE + PIPE (OR) BEND	SA106 GRC+ SA106GRC (OR) SA106GRB (OR)	D48.3	10.16	GTAW+SMAW	10.16	ER70S-A1		E7018-1		1003/03	NIL	-	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							20	700	240	340	-			-				
06	0-00-047-16392	PIPE + VALVE (OR) TEE	SA106 GRC+ SA105	D33.4	9.09	SMAW	10	-		E7018-1		1021/01	NIL	-	10% LPI or MPI			
							3	-	-	6	-			-				
07	0-00-047-16400	PIPE + PIPE WITH STUB (OR) PIPE (OR) BEND	SA335P91 + SA335P91	D33.4	9.09	GTAW+SMAW	9.09	ER90S-B9		E9015-B9		1036/07	220	745±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			10% HC MAX-300HV
							26	200	208	-	-			30				
08	0-00-047-16400	PIPE (OR) BEND + VALVE	SA335P91 + SA182F91	D33.4	9.09	SMAW	10	-		E9015-B9		1118/00	220	745±15	100% MPI OR LPI			10% HC MAX-300HV
							8	-	-	16	-			30				
09																		
10																		

PREPARED	CHECKED (DESIGN)	CHECKED (W.T.C)	APPROVED	DATE	DRAWING NO.	REV NO.
P RAVIRAJA	*R.GOPINATH*	*PRAVEEN LAKAVATH*	*V.GUNASEKARAN*	*15.12.2018*	*4-24-992-10695*	*00*
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		

355-005/A		**ERECTION WELDING SCHEDULE**									**P.G. NO.:-**			**24**					
		WELDING CODE : I.B.R / ASME									**SYSTEM DESCRIPTION.:-**			**BOILER TRIM PIPING - SH SPRAY PIPING**					
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																	
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**													
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**
								GTAW	**SMAW**										
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**						**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**								
01	0-00-047-16428, 0-00-047-16435, 0-00-047-49039, 0-00-047-16433.	PIPE + PIPE WITH STUB (OR) PIPE (OR) BEND	SA106 GR.C + SA106 GR.C	D33.4	9.09	GTAW+SMAW	9.09 ▽	ER70S-A1	E7018-1				1003/03	NIL	-	10%RT SUBJECT TO A MINIMUM OF 1 WELD/WELDER			
							60	258	720	-	-				-				
02	0-00-047-16428, 0-00-047-16435, 0-00-047-49039, 0-00-047-16433.	PIPE + VALVE	SA106 GR.C + SA105	D33.4	9.09	SMAW	10◺	-	E7018-1				1021/01	NIL	-	10% LPI or MPI			
							38	-	-	76	-				-				
03	0-00-047-16435, 0-00-047-16429	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) REDUCER (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D168.3	21.95	GTAW+SMAW	21.95▽▽	ER70S-A1	E7018-A1				1005/05	NIL	635±15	10%RT SUBJECT TO A MINIMUM OF 2 WELD/WELDER			
							84	4284	1176	2016	672				65				
04	0-00-047-16429	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) REDUCER (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D114.3	17.12	GTAW+SMAW	17.12▽▽	ER70S-A1	E7018-A1				1005/05	NIL	635±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							75	2400	900	1050	225				65				
05	0-00-047-16429 0-00-047-16430	PIPE + CONNECTOR	SA106 GR.C + SA182F12CL2	D114.3	17.12	GTAW+SMAW	17.12▽▽	ER70S-A1	E7018-1				1033/04	150	660±10	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							8	256	96	112	24				65				
06	0-00-047-16429 0-00-047-16430	CONNECTOR + CONNECTOR	SA182F12CL2 + SA182F22CL3	D114.3	17.12	GTAW+SMAW	17.12▽▽	ER80S-B2	E8018-B2				1012/04	200	700±20	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							8	256	96	112	24				65				
07	0-00-047-16429 0-00-047-16430	VALVE + CONNECTOR	SA217 C12A + SA182F22CL3	D114.3	17.12	GTAW+SMAW	17.12▽▽	ER90S-B3	E9018-B3				1035/04	220	750±20	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							8	256	96	112	24				60				
08	0-00-047-16430, 0-00-047-16432	PIPE (OR) VALVE + PIPE (OR) PIPE WITH STUB (OR) EQ.TEE (OR) ELBOW (OR) SPRAY NOZZLE	SA335 P91 (OR) SA217 C12A + SA335 P91 (OR) SA234 WP91 (OR) SA182F91	127	20.00	GTAW + SMAW	20 ▽▽	ER90S-B9	E9015-B91				1050/06	220	740-770	100% UT			
							130	5221	1973	2632	2069				60				
09	0-00-047-49044, 49045, 49046, 49047, 49049, 49050	PIPE + PIPE WITH STUB (OR) PIPE (OR) BEND	SA335P91 + SA335P91	D33.4	9.09	GTAW+SMAW	9.09 ▽	ER90S-B9	E9015-B9				1036/07	220	745±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							78	335	1014	-	-				30				
10	0-00-047-49044, 49045, 49046, 49047, 49049, 49050	PIPE (OR) BEND + VALVE	SA335P91 + SA182F91	D33.4	9.09	SMAW	10◺	-	E9015-B9				1118/00	220	745±15	100% MPI OR LPI			
							66	-	-	132	-				30				

PREPARED	**CHECKED (DESIGN)**	**CHECKED (W.T.C)**	**APPROVED**	**DATE**	**DRAWING NO.**	**REV NO.**
P RAVIRAJA	***R.GOPINATH***	***PRAVEEN LAKAVATH***	***V.GUNASEKARAN***	***15.12.2018***	***4-24-992-10696***	***00***

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

355-005/A		**ERECTION WELDING SCHEDULE**										**P.G. NO.:-**		**24**					
		WELDING CODE : I.B.R / ASME										**SYSTEM DESCRIPTION.:-**		**BOILER TRIM PIPING - SH SPRAY PIPING**					
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																	
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**													
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**
								GTAW	**SMAW**										
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**							
01	0-00-047-16431 0-00-047-16432 0-00-047-16434	VALVE + CONNECTOR	SA182 F91 + SA182 F316	D33.4	9.09	SMAW	10◺	-	ENiCrFe-3			1063/01	220	745±15	100% LPI FOR ALL SIZES			
							6	-	-	12	-			30				
02	0-00-047-16431 0-00-047-16432 0-00-047-16434	CONNECTOR + PIPE	SA182 F316 + SA213TP347H	D26.7	7.82	SMAW	8.5◺	-	E347			1029/01	10	-	100% LPI FOR ALL SIZES			
							6	-	5	6	-			-				
03	0-00-047-16431 0-00-047-16432 0-00-047-16434	PIPE + PIPE (OR) BEND	SA213TP347H + SA213TP347H	D26.7	7.82	GTAW+SMAW	7.82▽	ER 347	E347			1016/02	10	-	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							130	-	109	120	-			-				
04	0-00-047-16431 0-00-047-16432 0-00-047-16434	PIPE + VALVE	SA213TP347H + SA182 F91	D26.7	7.82	SMAW	8.5◺	-	ENiCrFe-3			1063/01	220	745±15	100% LPI FOR ALL SIZES			
							18	-	15	17	-			30				
05	0-00-047-16428	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) REDUCER (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D114.3	17.12	GTAW+SMAW	17.12▽▽	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							84	2688	1008	1176	252			65				
06	0-00-047-16430, 0-00-047-16432	PIPE (OR) VALVE + PIPE (OR) PIPE WITH STUB (OR) EQ.TEE (OR) ELBOW (OR) SPRAY NOZZLE	SA335 P91 (OR) SA217 C12A + SA335 P91 (OR) SA234 WP91 (OR) SA182F91	D88.9	17.00	GTAW + SMAW	17▽▽	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							130	3400	1381	1842	791			60				
07	0-00-047-16433	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) REDUCER (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D114.3	13.49	GTAW+SMAW	13.49▽▽	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							12	288	96	120	60			35				
08	0-00-047-16433	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							37	888	296	370	185			35				
09	0-00-047-16433	PIPE + CONNECTOR	SA106 GR.C + SA182F12CL2	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER70S-A1	E7018-1			1033/04	150	660±10	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	96	32	40	20			60				
10	0-00-047-16433	CONNECTOR + CONNECTOR	SA182F12CL2 + SA182F22CL3	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER80S-B2	E8018-B2			1012/04	200	700±20	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	92	32	40	12			65				

PREPARED	**CHECKED (DESIGN)**	**CHECKED (W.T.C)**	**APPROVED**	**DATE**	**DRAWING NO.**	**REV NO.**
P RAVIRAJA	***R.GOPINATH***	***PRAVEEN LAKAVATH***	***V.GUNASEKARAN***	***15.12.2018***	***4-24-992-10697***	***00***

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A		**ERECTION WELDING SCHEDULE**									**P.G. NO.:-**		**24**					
		WELDING CODE : I.B.R / ASME																
		PRESSURE PARTS/~~NON PRESSURE PARTS~~									**SYSTEM DESCRIPTION.:-**		**BOILER TRIM PIPING - RH SPRAY PIPING**					
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**												
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**
								GTAW	**SMAW**									
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**							
01	0-00-047-16433	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) REDUCER (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D114.3	13.49	GTAW+SMAW	13.49▽▽	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							12	288	96	120	60			35				
02	0-00-047-16433	PIPE (OR) PIPE WITH STUB + PIPE (OR) EQ.TEE (OR) ELBOW (OR) VALVE	SA106GR.C + SA106GR.C (OR) SA234WPC (OR) SA216 WCC	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER70S-A1	E7018-A1			1005/05	NIL	635±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							37	366	444	185	0			35				
03	0-00-047-16433	PIPE + CONNECTOR	SA106 GR.C + SA182F12CL2	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER70S-A1	E7018-1			1033/04	150	660±10	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	0	0	0	0			60				
04	0-00-047-16433	CONNECTOR + CONNECTOR	SA182F12CL2 + SA182F22CL3	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER80S-B2	E8018-B2			1012/04	200	700±20	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	40	48	20	0			65				
05	0-00-047-16433	VALVE + CONNECTOR	SA217 C12A + SA182F22CL3	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER90S-B3	E9018-B3			1035/04	220	750±20	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							4	40	48	20	0			60				
06	0-00-047-16433, 0-00-047-16434	PIPE (OR) VALVE + PIPE (OR) PIPE WITH STUB (OR) EQ.TEE (OR) ELBOW (OR) SPRAY NOZZLE	SA335 P91 (OR) SA217 C12A + SA335 P91 (OR) SA234 WP91 (OR) SA182F91	D88.9	11.13	GTAW+SMAW	11.13▽▽	ER90S-B9	E9015-B91			1050/06	220	755±15	10% R.T SUBJECT TO A MINIMUM OF 1 WELD/ WELDER/ SHIFT			
							150	1485	1800	750	0			60				
07																		
08																		
09																		
10																		

PREPARED	**CHECKED (DESIGN)**	**CHECKED (W.T.C)**	**APPROVED**	**DATE**	**DRAWING NO.**	**REV NO.**
P RAVIRAJA	***R.GOPINATH***	***PRAVEEN LAKAVATH***	***V.GUNASEKARAN***	***15.12.2018***	***4-24-992-10698***	***00***

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A		**ERECTION WELDING SCHEDULE**										**P.G. NO.:-**		**24**					
		WELDING CODE : I.B.R / ASME										**SYSTEM DESCRIPTION.:-**		**BOILER TRIM PIPING - START-UP VENT**					
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																	
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**													
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**
								GTAW	**SMAW**										
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**							
01	0-00-047-16010	PIPE + VALVE	SA213T92 + SA182F92	76.2	5.08	GTAW	5.08	ER90S-B9	E9015-B91			1036/08	220	745 ± 15	100% RT			
							6	785	-	-	-			30				
02	0-00-047-16010	PIPE + BEND (OR) PIPE	SA213T92 + SA213T92	76.2	5.08	GTAW	5.08	9CrWV TIG/ Thermanit-MTS616	E9015-B92			1058/02	220	745 ± 15	100% RT			
							40	5233	-	-	-			30				
03	0-00-047-16010	PIPE + VALVE	SA213T22 + SA182F92	76.2	4.57	GTAW	4.57	ER90S-B3	E9018-B3			1038/05	220	745 ± 15	20% RT subject to min 2 weld/ welder/ shift			
							2	219	-	-	-			30				
04	0-00-047-16010	PIPE + BEND (OR) PIPE	SA213T22 + SA213T22	76.2	4.57	GTAW + SMAW	4.57	ER90S-B3	E9018-B3			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift			
							8	166	64	-	-							
05	0-00-047-16010	PIPE + CONNECTOR	SA213T22 + SA335P22	76.2	4.57	GTAW + SMAW	4.57	ER90S-B3	E9018-B3			1013/02	150	Nil	20% RT subject to min 2 weld/ welder/ shift			
							2	42	16	-	-							
06	0-00-047-16010	PIPE + DIFFUSER	SA335P22 + SA335P22	88.9	15.24	GTAW + SMAW	15.24	ER90S-B3	E9018-B3			1014/03	150	680-720	100% RT			
							2	56	13	21	6			60				
07	0-00-047-16009	PIPE + PIPE	SA335P92 + SA335P92	141.3	32	GTAW + SMAW	32	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							20	719	338	451	894			80				
08	0-00-047-16009	PIPE + VALVE(OR) ELBOW	SA335P92 + SA182F92	141.3	32	GTAW + SMAW	32	ER90S-B9	E9015-B91			1050/06	220	740-770	100% UT			
							44	1581	743	991	1966			80				
09	0-00-047-16009	PIPE + CONNECTOR	SA335P92 + SA335P22	141.3	32	GTAW + SMAW	32	ER90S-B3	E9018-B3			1035/05	220	740-770	100% RT			
							4	144	41	67	128			80				
10	0-00-047-16009	PIPE + BEND (OR) PIPE	SA335P22 + SA335P22	159	17.5	GTAW + SMAW	17.5	ER90S-B3	E9018-B3			1014/03	150	680-720	100% RT			
							30	1690	342	561	324			60				

PREPARED	**CHECKED (DESIGN)**	**CHECKED (W.T.C)**	**APPROVED**	**DATE**	**DRAWING NO.**	**REV NO.**
P RAVIRAJA	***R.GOPINATH***	***PRAVEEN LAKAVATH***	***V.GUNASEKARAN***	***15.12.2018***	***4-24-992-10699***	***00***

* REFER NDE MANUAL No.PS:CMX:002 REV.No.01/12-98

355-005/A		**ERECTION WELDING SCHEDULE**										**P.G. NO.:-**		**24**					
		WELDING CODE : I.B.R / ASME										**SYSTEM DESCRIPTION.:-**		**BOILER TRIM PIPING - START-UP VENT**					
		PRESSURE PARTS/~~NON PRESSURE PARTS~~																	
		PROJECT :- NORTH CHENNAI - 1 X 660 MW				**CUST. Nos :- 1818**													
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**
								GTAW	**SMAW**										
				SIZE	**THICK**		**Qty in Nos.**	**Qty in gms**	**Qty in Nos.**					**TIME in mins**		**SPEC. NO**	**ACC NORM REF.**	
									Ø2.5	**Ø3.15**	**Ø4.0**								
11	0-00-047-16009	CONNECTOR + DIFFUSER	SA335P92 + SA335P22	141.3	32	GTAW + SMAW	32	ER90S-B3	E9018-B3			1035/05	220	740-770	100% RT				
							2	72	21	34	64			80					
PREPARED		**CHECKED (DESIGN)**		**CHECKED (W.T.C)**				**APPROVED**				**DATE**		**DRAWING NO.**				**REV NO.**	
P RAVIRAJA		***R.GOPINATH***		***PRAVEEN LAKAVATH***				***V.GUNASEKARAN***				***15.12.2018***		***4-24-992-10700***				***00***	
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							

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

HEAT TRANSFER ENGINEERING/HPVP

ERECTION WELDING SCHEDULE(WITH WPS No.)

PROJECT	TANGEDCO-NORTH CHENNAI & TANGEDCO-UPPUR
CUSTOMER No(s).	7789&7792
PRODUCT GROUP	07

SL. NO.	DRG NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY gms/ (NOS)	PREHEAT DEG °C	PWHT DEG °C	MIN RECOMMENDED NDE	WPS NO.
							SPECN	PROCESS ARC/ TIC	SIZE (mm)						
01	0-00-027-U0025	HDR STUB/ DRUM STUB + TUBE(RISER)	SA192 + SA192	OD76.1	4.5	4.75 $\hat{V}$	ER70SA1	TIG	ø2.4	0.24M/ 36NoS	1.5 KG	15°C MIN.	–		T.1.1.29
02	0-00-027-U0025	HDR STUB + TUBE(PANEL)	SA192 + SA192	OD76.1	4.5	4.75 $\hat{V}$	ER70SA1	TIG	ø2.4	0.24M/ 128NoS	5.5 KG	15°C MIN.	–		T.1.1.29
03	0-00-027-U0025	TUBE(PANEL) + TUBE(PANEL)	SA192 + SA192	OD76.1	4.5	4.75 $\hat{V}$	ER70SA1	TIG	ø2.4	0.24M/ 104NoS	4.25 KG	15°C MIN.	–		T.1.1.29
04	0-00-027-U0025	HDR STUB/ DRUM STUB + TUBE(SUPPLY TUBE)	SA192 + SA192	OD76.1	4.5	4.75 $\hat{V}$	ER70SA1	TIG	ø2.4	0.24M/ 22NoS	1.0 KG	15°C MIN.	–		T.1.1.29

		REV. 00		REV. 01		REV. 02		1.QUANTITY IS INDICATED FOR ONE BOILER ONLY.	
	NAME	SIGNATURE	DATE	SIGN.	DATE	SIGN.	DATE		
PREPARED	MVR PRASAD		30.07.18						
CHECKED(DESIGN)	G.G.N RAO		30.07.18					SHEET NO 1 OF 1	
CHECKED(W.T.C.)	G.SANKARABABU		30.07.18					DRAWING NO.	REV.No.
APPROVED	Y.PRASANNA KUMAR/ G.SANKARABABU		30.07.18					4-07-992-U8135	00

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

HEAT TRANSFER ENGINEERING/HPVP

ERECTION WELDING SCHEDULE(WITH WPS No.)

PROJECT	TANGEDCO-NORTH CHENNAI & TANGEDCO-UPPUR
CUSTOMER No(s).	7789&7792
PRODUCT GROUP	12

SL. NO.	DRG NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY gms/ (NOS)	PREHEAT DEG °C	PWHT DEG °C	MIN RECOMMENDED NDE	WPS NO.
							SPECN	PROCESS ARC/ TIC	SIZE (mm)						
01	0-00-027-U0027	DRUM STUB + PIPE(SATLINK)	SA106Gr.B + SA106Gr.B	OD 219.1	14.2	12.7 V	ER70SA1	TIG	ø2.4	0.69M/ 2Nos	0.75KG 6 NO'S 8 NO'S 8 NO'S	15°C MIN.	*		T.M.1.1.31
							E7018A1	SMAW	ø3.15 ø4.0 ø5.0						
02	0-00-027-U0027	HDR STUB + TUBE(COIL)	SA213T11 + SA213T11	OD50.8	4.0	4.0 V	ER80SA2	TIG		0.16M/ 64Nos	1.6KG	150°C MIN.	–		T.4.4.03
03	0-00-027-U0027	PIPE + PIPE	SA106Gr.C + SA106Gr.C	OD 323.9	25	21.85W	ER70SA1	TIG	ø2.4	1.02M/ 1No	0.6 KG 22 NO'S 29 NO'S 27 NO'S	95°C MIN.	*		T.M.1.1.31
							E7018A1	SMAW	ø3.15 ø4.0 ø5.0						
04	0-00-027-U0027	PIPE + PIPE	SA106Gr.C + SA106Gr.C	OD368	32	28 W	ER70SA1	TIG	ø2.4	1.12M/ 1No	0.6 KG 43 NO'S 58 NO'S 54 NO'S	95°C MIN.	*		T.M.1.1.31
							E7018A1	SMAW	ø3.15 ø4.0 ø5.0						

		REV. 00		REV. 01		REV. 02		1.QUANTITY IS INDICATED FOR ONE BOILER ONLY. 2.'*' INDICATES AS PER APPLICABLE SR CYCLES.	
	NAME	SIGNATURE	DATE	SIGN.	DATE	SIGN.	DATE		
PREPARED	MVR PRASAD		30.07.18						
CHECKED(DESIGN)	G.G.N RAO		30.07.18					SHEET NO 1 OF 1	
CHECKED(W.T.C.)	G.SANKARABABU		30.07.18					DRAWING NO.	REV.No.
APPROVED	Y.PRASANNA KUMAR/ G.SANKARABABU		30.07.18					4-12-992-U8106	00

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

HEAT TRANSFER ENGINEERING/HPVP

ERECTION WELDING SCHEDULE(WITH WPS No.)

PROJECT	TANGEDCO-NORTH CHENNAI & TANGEDCO-UPPUR
CUSTOMER No(s).	7789&7792
PRODUCT GROUP	19

SL. NO.	DRG NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY gms/ (NOS)	PREHEAT DEG °C	PWHT DEG °C	MIN RECOMMENDED NDE	WPS NO.
							SPECN	PROCESS ARC/ TIC	SIZE (mm)						
01	0-19-850-U8003	DRUM STUB /PIPE(FEED) + PIPE(FEED)	SA106GRC + SA106GRC	OD127	10	8.5 $\hat{V}$	ER70SA1	TIG	ø2.4	0.4M/ 18NoS	1.76KG	95°C MIN.	*		T.M.1.1.31
							E7018A1	SMAW	ø3.15 ø4.0 ø5.0		27 NO'S 36 NO'S 34 NO'S				

		REV. 00		REV. 01		REV. 02	
	NAME	SIGNATURE	DATE	SIGN.	DATE	SIGN.	DATE
PREPARED	MVR PRASAD		30.07.18				
CHECKED(DESIGN)	G.G.N RAO		30.07.18				
CHECKED(W.T.C.)	G.SANKARABABU		30.07.18				
APPROVED	Y.PRASANNA KUMAR/ G.SANKARABABU		30.07.18				

1. QUANTITY IS INDICATED FOR ONE BOILER ONLY.
2. '*' INDICATES AS PER APPLICABLE SR CYCLES.

SHEET NO 1 OF 1

DRAWING NO.	REV.No.
4-19-992-U8101	00

05-290

SUMMARY LIST OF SITE ELECTRODES

From

Dy. Manager
Engineering
DT: 20-01-2018

To

The Construction Manager
Project: TANGEDCO-Uppur
Auxiliary Boiler

Project: TANGEDCO-Uppur
Auxiliary Boiler
Customer No:7792
P.G. No: 21
P.G. Name: SOOT BLOWER PIPING AND SUPPORTS

SL.NO.	TYPE OF ELECTRODE/WIRE	SIZE & QTY IN NOS.				TIG WIRE WT IN KG.	REMARKS.
		D 2.5	D 3.15	D 4.00	D 5.00		
01	ER 70S-A1	✓				0.514	
02	E 7018-1		31				
03	E 7018		130				

NOTES

1. RESERVE 25% ADDED.
2. QUANTITY GIVEN IS PER BOILER.
3. THIS ERECTION WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.
   ENCL: ERECTION WELDING SCHEDULE SHEET ::4-21-992-U0011 & 4-21-992-U0012

C.C 1. PROJECT COORDINATOR : Shri. C. Srinivasa Chary, Commercial-Project Management group

2. W.T.CENTRE. Shri. G. Sankara Babu , Welding Technology

DRG NO.	REV
4-21-992-U0010	00

Prepared	Checked	Approved/WTC	Date	SH.NO.
Munayya k	A Venkata Rao	Tarakesh Kanakala	20.01.2018	01 / 01

BHEL

355-005/A

ERECTION WELDING SCHEDULE.

Pressure Parts – Boiler Mountings – Soot Blower Piping & Supports

PROJECT	TANGEDCO-Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	21

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
01	1-21-600-U0004	REDUCER + CONDENSING LOOP (OR) PIPE	SA234WPB+ SA106GR.B	D21.3	2.77	2.77V	ER 70S-A1	TIG	Ø2.4	2 Nos	0.01 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
02	1-21-600-U0004	PIPE+PIPE (OR) BW CON.RED(OR) ORIFICE PLATE	SA106GR.B+ SA106GR.B(OR) SA234WPB	D33.4	3.38	3.38V	ER 70S-A1	TIG	Ø2.4	10 Nos	0.09 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
03	1-21-600-U0004	PIPE+VALVE(OR) TEE	SA106GR.B+ SA105	D33.4	3.38	3	E 7018-A1	ARC	Ø3.15	20 NOS	4 Nos	-	-	10%MPI (OR)LPI
04	1-21-600-U0004	PIPE+PIPE (OR) REDUCER(OR) BEND (FABRICATED AT SITE)	SA106 Gr.B+ SA106 Gr.B(OR) SA234WPB	D60.3	3.91	3.91V	ER 70S-A1	TIG	Ø2.4	20 Nos	0.414 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
05	1-21-600-U0004	PIPE+VAL.(OR) TEE(OR)ELL(OR) SB INLET	SA106GR.B+ SA105(OR) SA234WPB(OR) BMC16	D60.3	3.91	4	E 7018-A1	ARC	Ø3.15	45 Nos	27 Nos	-	-	10%MPI (OR)LPI
														WELDER

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4-21-992-U0011	00

BHEL

355-005/A

ERECTION WELDING SCHEDULE.

Non-Pressure Parts – Boiler Mountings – Soot Blower Piping & Supports

PROJECT	TANGEDCO-Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	21

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
06	1-21-600-U0004	STRUCTURAL WELD	IS2062FE410A + IS2062FE410A	-	-	5△	E 7018	ARC	Ø3.15	22 m	109 NOS	-	-	-
07	1-21-600-U0004	EYE HANGER+ROD	IS2062FE410A + IS2062FE410A	-	-	10 ⊠	E 7018	ARC	Ø3.15	18 NOS	11 NOS	-	-	
08	1-21-600-U0004	STRUCTURAL WELD	IS2062FE410A + IS2062FE410A	-	-	4△	E 7018	ARC	Ø3.15	3 m	10 NOS	-	-	

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4-21-992-U0012	00

05-290

SUMMARY LIST OF SITE ELECTRODES

From

Dy. Manager
Engineering
DT: 20-01-2018

To

The Construction Manager
Project: TANGEDCO-Uppur
Auxiliary Boiler

Project: TANGEDCO-Uppur
Auxiliary Boiler
Customer No:7792
P.G. No: 21
P.G. Name: SOOT BLOWER PIPING AND SUPPORTS

SL.NO.	TYPE OF ELECTRODE/WIRE	SIZE & QTY IN NOS.				TIG WIRE WT IN KG.	REMARKS.
		D 2.5	D 3.15	D 4.00	D 5.00		
01	ER 70S-A1	✓				0.514	
02	E 7018-1		31				
03	E 7018		130				

NOTES

1. RESERVE 25% ADDED.
2. QUANTITY GIVEN IS PER BOILER.
3. THIS ERECTION WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.
   ENCL: ERECTION WELDING SCHEDULE SHEET ::4-21-992-U0011 & 4-21-992-U0012

C.C 1. PROJECT COORDINATOR : Shri. C. Srinivasa Chary, Commercial-Project Management group
2. W.T.CENTRE. Shri. G. Sankara Babu , Welding Technology

DRG NO.	REV
4-21-992-U0010	00

Prepared	Checked	Approved/WTC	Date	SH.NO.
Munayya k	A Venkata Rao	Tarakesh Kanakala	20.01.2018	01 / 01

BHEL

355-005/A

ERECTION WELDING SCHEDULE.

Pressure Parts – Boiler Mountings – Soot Blower Piping & Supports

PROJECT	TANGEDCO–Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	21

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
01	1-21-600-U0004	REDUCER + CONDENSING LOOP (OR) PIPE	SA234WPB+ SA106GR.B	D21.3	2.77	2.77V	ER 70S-A1	TIG	Ø2.4	2 Nos	0.01 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
02	1-21-600-U0004	PIPE+PIPE (OR) BW CON.RED(OR) ORIFICE PLATE	SA106GR.B+ SA106GR.B(OR) SA234WPB	D33.4	3.38	3.38V	ER 70S-A1	TIG	Ø2.4	10 Nos	0.09 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
03	1-21-600-U0004	PIPE+VALVE(OR) TEE	SA106GR.B+ SA105	D33.4	3.38	3	E 7018-A1	ARC	Ø3.15	20 NOS	4 Nos	-	-	10%MPI (OR)LPI
04	1-21-600-U0004	PIPE+PIPE (OR) REDUCER(OR) BEND (FABRICATED AT SITE)	SA106 Gr.B+ SA106 Gr.B(OR) SA234WPB	D60.3	3.91	3.91V	ER 70S-A1	TIG	Ø2.4	20 Nos	0.414 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
05	1-21-600-U0004	PIPE+VAL.(OR) TEE(OR)ELL(OR) SB INLET	SA106GR.B+ SA105(OR) SA234WPB(OR) BMC16	D60.3	3.91	4	E 7018-A1	ARC	Ø3.15	45 Nos	27 Nos	-	-	10%MPI (OR)LPI
														WELDER

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4–21–992–U0011	00

BHEL

355-005/A

ERECTION WELDING SCHEDULE.

Non-Pressure Parts - Boiler Mountings - Soot Blower Piping & Supports

PROJECT	TANGEDCO-Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	21

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
06	1-21-600-U0004	STRUCTURAL WELD	IS2062FE410A + IS2062FE410A	-	-	5△	E 7018	ARC	Ø3.15	22 m	109 NOS	-	-	-
07	1-21-600-U0004	EYE HANGER+ROD	IS2062FE410A + IS2062FE410A	-	-	10 ⊠	E 7018	ARC	Ø3.15	18 NOS	11 NOS	-	-	
08	1-21-600-U0004	STRUCTURAL WELD	IS2062FE410A + IS2062FE410A	-	-	4△	E 7018	ARC	Ø3.15	3 m	10 NOS	-	-	

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4-21-992-U0012	00

05-290

SUMMARY LIST OF SITE ELECTRODES

From

Dy. Manager
Engineering
DT: 20-01-2018

To

The Construction Manager
Project: TANGEDCO-Uppur
Auxiliary Boiler

Project: TANGEDCO-Uppur
Auxiliary Boiler
Customer No:7792
P.G. No: 24
P.G. Name: Boiler Trim Piping and Supports
Sample Coolers Arrangement
SV. orientation and Exhaust Pipe Arrangement

SL.NO.	TYPE OF ELECTRODE/WIRE	SIZE & QTY IN NOS.				TIG WIRE WT IN KG.	REMARKS.
		D 2.5	D 3.15	D 4.00	D 5.00		
01	ER 70S-A1	✓				3.9	
02	ER 70S-2	✓				3.3	
03	E309L	51 Nos					
04	E347	11 Nos					
05	E 7018-A1		93 Nos	63 Nos			
06	E 7018		656 Nos	8 Nos			

NOTES

1. RESERVE 25% ADDED.
2. QUANTITY GIVEN IS PER BOILER.
3. THIS ERECTION WELDING SCHEDULE IS FOR REFERENCE PURPOSE ONLY.
   ENCL: ERECTION WELDING SCHEDULE SHEET ::4-21-992-U0092 & 4-21-992-U0095

C.C 1. PROJECT COORDINATOR : Shri. C. Srinivasa Chary, Commercial-Project Management group
2. W.T.CENTRE. Shri. G. Sankara Babu , Welding Technology

DRG NO.	REV
4-21-992-U0090	00

Prepared	Checked	Approved/WTC	Date	SH.NO.
Munayya k	A Venkata Rao	Tarakesh Kanakala	20.01.2018	01 / 01

BHEL

355–005/A

ERECTION WELDING SCHEDULE.

Pressure Parts – Boiler Mountings – Boiler Trim Piping & Supports

PROJECT	TANGEDCO–Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	24

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
01	0-00-047-U0035 1-00-047-U0023	PIPE+VALVE(OR) SOCKET(OR) INLET OF SAMPLE COOLER (OR) PR. REDUCER	SA213TP347H +SA182F316 (OR) SA479TYP304	D14	2.9	3△	E 347	ARC	Ø2.5	140 Nos	11 Nos	-	-	100%LPI
02	0-00-047-U0035	PIPE+ CONNECTOR	SA213TP347H + SA182F12CL2	D14	2.9	3△	E 309 L	ARC	Ø2.5	1 No	1 No	150°C ON F12 SIDE		100%LPI
03	0-00-047-U0035	PIPE+PIPE (OR) BW CON.RED(OR) CONNECTOR	SA106Gr.B+ SA106Gr.B(OR) SA234 WPB (OR)IS1239	D33.4	3.38	3.38V	ER 70S-A1	TIG	Ø2.4	78 Nos	0.70 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
04	0-00-047-U0035	PIPE+VALVE(OR) TEE(OR) CONNECTOR	SA106 Gr.B+ SA105(OR) IS1239	D33.4	3.38	4△	E 7018	ARC	Ø3.15	80 Nos	27 Nos	-	-	10%MPI (OR)LPI
05	0-00-047-U0035	PIPE+PIPE (OR)+BW CON.RED	SA106Gr.B+ SA106Gr.B(OR) SA234WPB	D48.3	3.68	3.68V	ER 70S-A1	TIG	Ø2.4	30 Nos	0.4 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
06	0-00-047-U0035	PIPE+VALVE (OR) DWLG	SA106Gr.B+ SA105	D48.3	3.68	4△	E 7018	ARC	Ø3.15	32 Nos	15 Nos	-	-	10%MPI (OR)LPI
07	0-00-047-U0035	PIPE+PIPE	SA106Gr.B+ SA106Gr.B	D60.3	3.91	3.91V	ER 70S-A1	TIG	Ø2.4	6 Nos	0.11 Kgs	-	-	10%RT MIN. 1WELD/ WELDER
08	0-00-047-U0035	PIPE + VALVE (OR) TEE	SA106Gr.B+ SA105	D60.3	3.91	4△	E 7018	ARC	Ø3.15	8 Nos	5 Nos	-	-	10%MPI(OR) LPI
09	0-00-047-U0035	PIPE + PIPE(OR) VALVE	SA106Gr.B+ SA216WCB	D73.0	5.16	5.16 V	ER 70S-A1 + E 7018-A1	TIG&ARC	Ø2.4 Ø3.15	12 Nos	0.284 Kgs 26 Nos	-	-	10%RT MIN. 1WELD/ WELDER
10	0-00-047-U0035	PIPE + PIPE(OR) VALVE (OR) REDUCER	SA106 Gr.B SA106 Gr.B(OR) SA234WPB	D114.3	8.56	8.56 V	ER 70S-A1 + E 7018-A1	TIG&ARC	Ø2.4 Ø3.15 Ø4.0	26 Nos.	1.44 Kgs 44 Nos 59 Nos	-	-	10%RT MIN. 2 WELDS/ WELDER

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4–24–992–U0091	00

BHEL

355-005/A

ERECTION WELDING SCHEDULE.

Pressure Parts – Boiler Mountings – Boiler Trim Piping & Supports

PROJECT	TANGEDCO–Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	24

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
11	0-00-047-U0035	VALVE+VALVE (E001+E002)	SA216WCB + SA216WCB	D127	10	10 V	ER 70S-A1 + E 7018-A1	TIG&ARC	Ø2.4 Ø3.15 Ø4.0	1 No.	0.086 Kgs 3 Nos 4 Nos	-	-	10%RT MIN. 2 WELDS/ WELDER
12	0-00-047-U0035	REDUCER + PIPE	SA234WPB + SA106Gr.B	D21.3	2.77	2.77 V	ER70S-A1	TIG	Ø2.4	9 Nos	0.032 Kgs	-	-	10% RT MIN OF 1WELD/WELDER

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4-24-992-U0092	00

BHEL

355-005/A

ERECTION WELDING SCHEDULE.

Non Pressure Parts – Boiler Mountings – Boiler Trim Piping & Supports

PROJECT	TANGEDCO–Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	24

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
01	0-00-047-U0035	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	5△	E 7018	ARC	Ø3.15	50m	248 Nos.	-	-	
02	0-00-047-U0035	PIPE + PIPE	IS2062Fe410WB + IS2062Fe410WB	D113.9	3.6	3.65▽	ER70S2	TIG	Ø2.4	6 Nos.	0.2 Kgs	-	-	
03	1-00-047-U0028	PIPE + DRAIN SOCKET	SA106Gr.B + SA105	D21.3	2.77	3△	E 7018A1	ARC	Ø3.15	3 Nos.	1 No.	-	-	
04	1-00-047-U0028	PIPE + PIPE	SA106Gr.B + SA106Gr.B	D21.3	2.77	2.77 ▽	ER70S-A1	TIG	Ø2.4	6 Nos.	0.022 Kgs	-	-	
05	1-00-047-U0028	PIPE + PIPE	IS1239+ IS1239	D34.2	3.2	3.25 ▽	ER70S-A1	TIG	Ø2.4	10 Nos.	0.09 Kgs	-	-	
06	1-00-047-U0028	PIPE + DRAIN SOCKET	IS1239+ IS1239	D34.2	3.2	3△	E 7018A1	ARC	Ø3.15	1 No.	1 No.	-	-	
07	1-00-047-U0028	PIPE + PIPE	API5L Gr.B+ API5L Gr.B	D273	6.4	6.4▽	ER70S-2	TIG	Ø2.4	6 Nos.	1.26 Kgs	-	-	
08	1-00-047-U0028	PIPE + PIPE	API5L Gr.B+ API5L Gr.B	D323.9	7.9	7.9▽	ER70S-2	TIG	Ø2.4	5 Nos.	1.5 Kgs	-	-	
09	1-00-047-U0028	PIPE + PIPE	API5L Gr.B+ API5L Gr.B	D355.6	7.92	7.9▽	ER70S-2	TIG	Ø2.4	1 No.	0.329 Kgs	-	-	
10	1-00-047-U0028	ELL ST.PIPE + FLANGE	SA106Gr.B+ SA105	D114.3	6.02	6△	E 7018A1	ARC	Ø3.15	3 Nos.	8 Nos.	-	-	
11	1-00-047-U0028	ELL ST.PIPE + FLANGE	SA106Gr.B+ SA105	D168.3	7.11	7△	E 7018A1	ARC	Ø3.15	1 No.	5 Nos.	-	-	
12	1-00-047-U0028	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	6△	E 7018	ARC	Ø3.15	8m	57 Nos.	-	-	
13	1-00-047-U0028	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	5△	E 7018	ARC	Ø3.15	20m	100 Nos.	-	-	

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4–24–992–U0093	00

355–005/A

ERECTION WELDING SCHEDULE.

Non Pressure Parts – Boiler Mountings – Boiler Trim Piping & Supports

PROJECT	TANGEDCO–Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	24

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
14	1-00-047-U0028	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	4 △	E 7018	ARC	Ø3.15	25m	70 Nos.	-	-	-
15	1-00-047-U0023	PIPE + PIPE (OR) CONN. PIECE	IS1239 + IS1239(OR) SA 105	D34.2	3.2	3.25 V	ER70S-A1	TIG	Ø2.4	18 Nos.	0.16 Kgs	-	-	
16	1-00-047-U0023	PIPE + COOLER (OR)PIPE	IS1239+ SA 105(OR) IS1239	D34.2	3.2	3 △	E7018-A1	ARC	Ø3.15	12 Nos.	2 Nos.	-	-	
17	1-00-047-U0023	PIPE + CONN. PIECE (OR) BW CON.RED	SA106Gr.B+ SA234WPB(OR) IS1161YST240	D60.8	3.6	4.5 V	ER70S-A1	TIG	Ø2.4	8 Nos.	0.147 Kgs	-	-	
18	1-00-047-U0023	PIPE + PIPE	IS2062Fe410A+ IS2062Fe410A	D113.9	3.6	3.65 V	ER70S-A1	TIG	Ø2.4	6 Nos.	0.207 Kgs	-	-	
19	1-00-047-U0023	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	6 △	E 7018	ARC	Ø3.15	3m	21 Nos.	-	-	
20	1-00-047-U0023	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	5 ⊓	E 7018	ARC	Ø3.15	1.0m	8 Nos.	-	-	
21	1-00-047-U0023	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	3.15 △	E7018	ARC	Ø3.15	4m	8 Nos.	-	-	
22	0-00-047-U0035	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	6 △	E 7018	ARC	Ø3.15	10m	71 Nos.	-	-	
23	0-00-047-U0035	EYE HANGER + ROD	IS2062Fe410A + IS2062Fe410A	-	-	12 X	E7018	ARC	Ø3.15 Ø4.0	0.5m	6 Nos. 8 Nos.	-	-	-
24	1-00-047-U0029	PIPE+PIPE (OR)REDUCER	SA106Gr.B+ SA106GrB(OR) SA234WPB	D48.3	3.68	3.68 ▽	ER70S-A1	TIG	Ø2.4	10Nos	0.146 Kgs	-	-	10% RT MIN OF 1WELD/WELDER
25	1-00-047-U0029	PIPE+REDUCER	SA106Gr.B+ SA234WPB	D60.3	3.91	3.91▽	ER70S-A1	TIG	Ø2.4	1Nos	0.02 Kgs	-	-	10% RT MIN OF 1WELD/WELDER

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4–24–992–U0094	00

355-005/A

ERECTION WELDING SCHEDULE.

Non Pressure Parts – Boiler Mountings – Boiler Trim Piping & Supports

PROJECT	TANGEDCO–Uppur Auxiliary Boiler
Sale Order No.	7792
PRODUCT GROUP	24

SL NO	DRAWING No.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECN.	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QTY. (Kgs./Nos.)	PREHEAT °C	PWHT °C	MIN. RECOMMENDED NDE
							SPECN.	PROCESS ARC/TIG	SIZE (mm)					
26	1-00-047-U0029	PIPE+VALVE	SA106Gr.B+ SA105	D48.3	3.68	4△	E7018-A1	ARC	Ø3.15	1Nos	1 No.	-	-	10%MPI (OR) LPI
27	1-00-047-U0029	STRUCTURAL WELD	IS2062Fe410A + IS2062Fe410A	-	-	5△	E7018	ARC	Ø3.15	4m	20 Nos.	-	-	-
28	ALL ERECTION DRG.	NAME PL.HOLDER + PIPE	SA106GR.B + SA240TYPE304	≤D108	19	3△	E309L	ARC	Ø2.5	15m	60 Nos.	-	-	100%LPI

PREPARED	CHECKED DESIGN	CHECKED WTC	APPROVED	DATE	DRG NO.	REV
Munayya k	A Venkata Rao	Sankara Babu G	Tarakesh Kanakala	20.01.2018	4–24–992–U0095	00

HPVP–ENGG/WT

SUMMARY LIST OF SITE ELECTRODES

FROM
MANAGER,
ENGG. / WT
BHEL–HPVP

REF: –

TO

CONSTRUCTION MANAGER,
UPPUR–AUX. BOILER .....SITE

~~PSNR/PSWR/PSER/~~PSSR

PROJECT: TANGEDCO–UPPUR AUX. BLR

CUSTOMER No(s).: 7792

P.G.No(s).: 80

P.G. NAME(s): MAIN, AUX. STEAM, BF PUMP SUCTION, DISCHARGE, DRAINS.

SL.NO.	TYPE OF ELECTRODE/WIRE	SIZE	QUANTITY – NOs.			TIG WIRE	REMARKS
			D3.15	D4.0	D5.0	Wt.–Kg	
01	ER70S–A1	D2.4	—	—	—	10.00	ATTEST
02	E7018–1	—	767	—	—	—	
03	E7018–1	—	—	655	—	—	
04	E7018–1	—	—	—	372	—	
05	ER308 H	D2.4	—	—	—	5.50	

NOTES:–

1. RESERVE 25% ADDED
2. QUANTITY GIVEN IS PER BOILER
3. THIS WELDING SCHEDULE IS FOR REFERENCE PURPOSES ONLY.

ENCL : ERECTION WELDING SCHEDULE SHEET DRG.NOS. FROM 4–80–XXX–U9066 TO 4–80–XXX–U9080.

C.C 1. ~~DGM/PEM/PCPS~~
2. SENIOR MANAGER / WELDING TECHNOLOGY

XXX–U9066 TO XXX–U9080 = 300,345,366, 417,,420,421,446,450,451,453,,473,600,601, 616, 612 Respectively.

DRAWING No. 4–80–992–U9065

				REV. 01		REV. 02	
	NAME	SIGNATURE	DATE	SIGN.	DATE	SIGN.	DATE
PREPARED	A V R	Sd/–XXX	28.02.18				
CHECKED	A V RAO	Sd/–XXX	28.02.18				
APPROVED	A C MOHANTY	Sd/–XXX	28.02.18				

A4 SIZE

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01		PIPE+PIPE	SA312TP304H + SA312TP304H	D33.4	3.38	3.38▽	ER308 H	TIG	D2.4	10NOS	0.09KGS	20°C		10%RT 100%LPT
02		PIPE+FITTING	SA312TP304H + SA403WP304H	D33.4	3.38	3.38▽	ER308 H	TIG	D2.4	35NOS	0.313KGS	20°C		10%RT 100%LPT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	27.02.18	ALTERED.						4-80-600-U9077	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	27.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01		PIPE+SOCKET +PIPE	IS1239 + IS1239	D21.3	3.25	3.25 ◺	E7018 A1	ARC	D3.15	4NOS	01PCS			
02		PIPE+SOCKET +PIPE	IS1239 + IS1239	D48.3	4.0	4.0 ◺	E7018 A1	ARC	D3.15	8NOS	05PCS			
03		PIPE+SOCKET +PIPE	IS1239 + IS1239	D60.3	4.5	4.5 ◺	E7018 A1	ARC	D3.15	10NOS	08PCS			
04		PIPE+FITTING	IS1239 + IS1239	D48.3	4.0	4.0 ◺	E7018 A1	ARC	D3.15	23NOS	11PCS			
05		PIPE+FITTING	IS1239 + IS1239	D60.3	4.5	4.5 ◺	E7018 A1	ARC	D3.15	21NOS	16PCS			
06		PIPE+SOCKET +PIPE	IS1239 + IS1239	D33.4	4.0	4.0 ◺	E7018 A1	ARC	D3.15	10NOS	04PCS			

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	27.02.18	ALTERED.						4-80-612-U9080	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	27.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	3-80-451-U9025	PIPE+PIPE	SA106GRB+ SA106GRB	D60.3	5.54	5.54▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15	5NOS	0.016KGS 07PCS	10°C		10%RT
02	3-80-451-U9025	PIPE+PIPE	SA106GRB+ SA106GRB	D33.4	4.55	4.55▽	ER70S A1	TIG	D2.4	10NOS	0.1178KGS	10°C		10%RT
03	3-80-451-U9025	PIPE+ FORGING	SA106GRB+ SA105	D60.3	5.54	5.54◺	E7018 A1	ARC	D3.15	3M	24PCS	10°C		10%RT
04	3-80-451-U9025	PIPE+ FORGING	SA106GRB+ SA105	D33.4	4.55	4.55◺	E7018 A1	TIG ARC	D3.15	2M	16PCS	10°C		10%RT
05	3-80-451-U9025	PIPE+PIPE	SA106GRB+ SA106GRB	D88.9	5.49	5.49▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15	5NOS	0.024KGS 10PCS	10°C		10%RT
06	3-80-451-U9025	PIPE+FITTING	SA106GRB+ SA234WPB	D88.9	5.49	5.49▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15	22NOS	0.106KGS 44PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05
PREPARED	A V R	Sd/-XX	27.02.18	ALTERED.					
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18	DATE					
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.					
APPROVED	A C MOHANTY	Sd/-XX	27.02.18	DATE					

DRAWING NO.	REV.	SHEET NO.
4-80-451-U9074	00	01

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	1-80-446-U9022	PIPE+FITTING	SA106GRB+ SA234WPB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	24NOS	0.19KGS 26PCS 35PCS	10°C		10%RT
02	1-80-446-U9022	PIPE+VALVE	SA106GRB+ SA216WCB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	4 NOS	0.031KGS 04PCS 06PCS	10°C		10%RT
03	1-80-446-U9022	PIPE+PIPE	SA106GRB+ SA106GRB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	6 NOS	0.047KGS 07PCS 09PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.						4-80-446-U9072	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	3-80-453-U9026	PIPE+PIPE	SA106GRB+ SA106GRB	D33.4	4.55	4.55▽	ER70S A1	TIG	D2.4	10 NOS	0.178KGS	10°C		10%RT
02	3-80-453-U9026	PIPE+ FITTING	SA106GRB+ SA105	D33.4	4.55	4.55◺	E7018 A1	ARC	D3.15	9 M	71PCS	10°C		10%RT
03	3-80-453-U9026	PIPE+PIPE	SA106GRB+ SA106GRB	D21.3	3.73	3.73▽	ER70S A1	TIG	D2.4	4 NOS	0.026KGS	10°C		10%RT
04	3-80-453-U9026	PIPE+ FITTING	SA106GRB+ SA105	D21.3	3.73	3.73◺	E7018 A1	TIG	D3.15	0.75 M	03PCS	10°C		10%RT

	NAME	SIGNATURE	DATE
PREPARED	A V R	Sd/-XX	27.02.18
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18
APPROVED	A C MOHANTY	Sd/-XX	27.02.18

REV. No:	01	02	03	04	05
ALTERED.					
DATE					
CHD.& APPD.					
DATE					

DRAWING NO.	REV.	SHEET NO.
4-80-453-U9075	00	01

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	2-80-420-U9011	PIPE+FITTING	SA106GRB+ SA234WPB	D168.3	7.11	7.11▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	20NOS	0.312KGS 43PCS 58PCS	10°C		10%RT
02	2-80-420-U9011	PIPE+VALVE	SA106GRB+ SA216WCB	D168.3	7.11	7.11▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	6NOS	0.094KGS 13PCS 17PCS	10°C		10%RT
03	2-80-420-U9011	PIPE+FLANGE	SA106GRB+ SA105	D168.3	7.11	7.11▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	4NOS	0.065KGS 09PCS 12PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.						4-80-420-U9070	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	1-80-417-U9021	PIPE+FITTING	SA106GRB+ SA234WPB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	40NOS	0.315KGS 44PCS 58PCS	10°C		10%RT
02	1-80-417-U9021	PIPE+VALVE	SA106GRB+ SA216WCB	D114.3	6.02	6.02V	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	22NOS	0.174KGS 24PCS 32PCS	10°C		10%RT
03	1-80-417-U9021	FITTING+ VALVE	SA234WPB+ SA216WCB	D73	5.16	5.16▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	1NO	0.01KGS 01PCS 01PCS	10°C		10%RT
04	1-80-417-U9021	PIPE+PIPE	SA106GRB+ SA106GRB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	4NOS	0.032KGS 04PCS 06PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.					
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE					
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.					
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE					

DRAWING NO.	REV.	SHEET NO.
4-80-417-U9069	00	01

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	2-80-421-U9012	PIPE+PIPE	SA106GRB+ SA106GRB	D60.3	5.54	5.54▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	12NOS	0.04KGS 05PCS 07PCS	10°C		10%RT
02	2-80-421-U9012	PIPE+VALVE	SA106GRB+ SA105	D60.3	5.54	5.54◺	E7018 A1	ARC	D3.15	10NOS	15PCS	10°C		10%RT
03	2-80-421-U9012	PIPE+FITTING	SA106GRB+ SA105	D60.3	5.54	5.54◺	E7018 A1	ARC	D3.15	10NOS	15PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.					
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE					
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.					
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE					

DRAWING NO.	REV.	SHEET NO.
4-80-421-U9071	00	01

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	1-80-366-U9023	PIPE+PIPE	SA106GRB+ SA106GRB	D219.1	6.35	6.35▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	2NOS	0.034KGS 03PCS 03PCS 03PCS	10°C		10%RT
02	1-80-366-U9023 3-80-366-U9023	PIPE+FITTING	SA106GRB+ SA234WPB	D219.1	6.35	6.35▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	14NOS	0.237KGS 16PCS 22PCS 20PCS	10°C		10%RT
03	1-80-366-U9023	PIPE+PIPE	SA106GRB+ SA106GRB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	3NOS	0.024KGS 03PCS 03PCS 03PCS	10°C		10%RT
04	1-80-366-U9023	PIPE+FITTING	SA106GRB+ SA234WPB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	23NOS	0.181KGS 13PCS 17PCS 16PCS	10°C		10%RT
05	1-80-366-U9023	PIPE+ FORGING	SA106GRB+ SA105	D60.3	5.54	5.54△	E7018 A1	TIG ARC	D3.15	2M	12PCS	10°C		10%RT
06	1-80-366-U9023	PIPE+VALVE	SA106GRB+ SA216WCB	D60.3	5.54	5.54▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15	2NOS	0.01KGS 03PCS	10°C		10%RT
07	1-80-366-U9023	PIPE+ FORGING	SA106GRB+ SA105	D33.4	4.55	4.55△	E7018 A1	TIG ARC	D3.15	2M	08PCS	10°C		10%RT
08	2-80-366-U9005	PIPE+ PLATE	SA106GRB+ SA515GR70	D168.3	10.97	10.97▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	2NOS	0.091KGS 06PCS 08PCS 08PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.						4-80-366-U9068	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	1-80-300-U9019	PIPE+PIPE	SA106GRC+ SA106GRC	D368	32	28.0▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	1NO	0.67KGS 46PCS 61PCS 58PCS	10°C		10%RT
02	1-80-300-U9019	PIPE+PIPE	SA106GRB+ SA106GRB	D323.9	9.53	9.53▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	3NOS	0.194KGS 13PCS 18PCS 17PCS	10°C		10%RT
03	1-80-300-U9019	PIPE+FITTING	SA106GRB+ SA106GRB	D323.9	9.53	9.53▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	7NOS	0.453KGS 31PCS 42PCS 39PCS	10°C		10%RT
04	1-80-300-U9019	PIPE+PIPE	SA106GRB+ SA106GRB	D323.9	12.7	11.0▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	3NOS	0.336KGS 23PCS 31PCS 29PCS	10°C		10%RT
05	1-80-300-U9019	PIPE+PIPE	SA106GRB+ SA106GRB	D21.3	3.73	4.0▷	ER70S A1	TIG	D2.4	0.5M	0.055KGS	10°C		10%RT

	NAME	SIGNATURE	DATE
PREPARED	AVR	Sd/-XX	24.02.18
CHECKED DESIGN	A V RAO	Sd/-XX	24.02.18
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18
APPROVED	A C MOHANTY	Sd/-XX	24.02.18

REV. No:	01	02	03	04	05
ALTERED.					
DATE					
CHD.& APPD.					
DATE					

DRAWING NO. 4-80-300-U9066

REV. 00

SHEET NO. 01

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	3-80-450-U9024	PIPE+PIPE	SA106GRB+ SA106GRB	D88.9	5.49	5.49▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	6 NOS	0.029KGS 04PCS 05PCS	10°C		10%RT
02	3-80-450-U9024	PIPE+FITTING	SA106GRB+ SA234WPB	D88.9	5.49	5.49▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	24NOS	0.115KGS 16PCS 21PCS	10°C		10%RT
03	3-80-450-U9024	PIPE+PIPE	SA106GRB+ SA106GRB	D48.3	5.08	5.08▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	2NOS	0.01KGS 01PCS 01PCS	10°C		10%RT
04	3-80-450-U9024	FITTING+ FORGING	SA234WPB+ SA105	D48.3	5.08	5.08▷	E7018 A1	ARC	D3.15	2M	18PCS	10°C		10%RT
05	3-80-450-U9024	FITTING+ VALVE	SA234WPB SA216WCB	D60.3	5.54	5.54▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0	1 NO	0.01KGS 01PCS 01PCS	10°C		10%RT
06	3-80-450-U9024	FITTING+ VALVE	SA234WPB SA105	D33.4	4.55	4.55▷	E7018 A1	ARC	D3.15	0.4M	03PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.						4-80-450-U9073	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	1-80-345-U9020	PIPE+PIPE	SA106GRB+ SA106GRB	D355.6	9.53	9.53▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	2NOS	0.142KGS 10PCS 13PCS 12PCS	10°C		10%RT
02	1-80-345-U9020	PIPE+FITTING	SA106GRB+ SA234WPB	D355.6	9.53	9.53▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	13NOS	0.928KGS 64PCS 86PCS 80PCS	10°C		10%RT
03	1-80-345-U9020	PIPE+VALVE	SA106GRB+ SA216WCB	D355.6	9.53	9.53▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	7NOS	0.5KGS 35PCS 46PCS 43PCS	10°C		10%RT
04	1-80-345-U9020	PIPE+PIPE	SA106GRB+ SA106GRB	D219.1	6.35	6.35▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	3NOS	0.05KGS 04PCS 05PCS 04PCS	10°C		10%RT
05	1-80-345-U9020	PIPE+FITTING	SA106GRB+ SA234WPB	D219.1	6.35	6.35▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	6NOS	0.101KGS 07PCS 09PCS 09PCS	10°C		10%RT
06	1-80-345-U9020	PIPE+VALVE	SA106GRB+ SA216WCB	D219.1	6.35	6.35▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	6NOS	0.101KGS 07PCS 09PCS 09PCS	10°C		10%RT
07	1-80-345-U9020	PIPE+FITTING	SA106GRB+ SA234WPB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	23NOS	0.181KGS 13PCS 17PCS 16PCS	10°C		10%RT
08	1-80-345-U9020	PIPE+VALVE	SA106GRB+ SA216WCB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	6NOS	0.047KGS 03PCS 04PCS 04PCS	10°C		10%RT
09	1-80-345-U9020	PIPE+PIPE	SA106GRB+ SA106GRB	D114.3	6.02	6.02▽	ER70S A1 E7018 A1	TIG ARC	D2.4 D3.15 D4.0 D5.0	3NOS	0.023KGS 02PCS 02PCS 02PCS	10°C		10%RT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05
PREPARED	A V R	Sd/-XX	26.02.18	ALTERED.					
CHECKED DESIGN	A V RAO	Sd/-XX	26.02.18	DATE					
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.					
APPROVED	A C MOHANTY	Sd/-XX	26.02.18	DATE					

DRAWING NO.	REV.	SHEET NO.
4-80-345-U9067	00	01

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01		PIPE+PIPE	SA312TP304H + SA312TP304H	D48.3	3.68	3.68▽	ER308 H	TIG	D2.4	10NOS	0.147KGS	20°C		10%RT 100%LPT
02		PIPE+PIPE	SA312TP304H + SA312TP304H	D21.3	2.77	2.77▽	ER308 H	TIG	D2.4	15NOS	0.054KGS	20°C		10%RT 100%LPT
03		PIPE+FITTING	SA312TP304H + SA403WP304H	D48.3	3.68	3.68▽	ER308 H	TIG	D2.4	30NOS	0.44KGS	20°C		10%RT 100%LPT
04		PIPE+FITTING	SA312TP304H + SA403WP304H	D21.3	2.77	2.77▽	ER308 H	TIG	D2.4	60NOS	0.216KGS	20°C		10%RT 100%LPT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	27.02.18	ALTERED.						4-80-616-U9079	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	27.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01		PIPE+PIPE	SA312TP304H + SA312TP304H	D33.4	3.38	3.38▽	ER308 H	TIG	D2.4	10NOS	0.09KGS	20°C		10%RT 100%LPT
02		PIPE+FITTING	SA312TP304H + SA403WP304H	D33.4	3.38	3.38▽	ER308 H	TIG	D2.4	30NOS	0.269KGS	20°C		10%RT 100%LPT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	27.02.18	ALTERED.						4-80-601-U9078	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	27.02.18	DATE								

HPVP/WT

ERECTION WELDING SCHEDULE

PRESSURE PARTS / ~~NON PRESSURE PARTS~~

PROJECT	AUX. BOILER
CUSTOMER. NO.	7792
PRODUCT GROUP	80

SL. NO.	DRAWING NO.	DESCRIPTION OF PARTS	MATERIAL	SIZE OF THE ITEM	THICKNESS	WELD SPECIFICATION	RECOMMENDED ELECTRODE / WIRE			TOTAL LENGTH/ NO OF WELD	ACTUAL QUANTITY grams/ NO(S)	PREHEAT °C	PWHT °C	MINIMUM RECOMMENDED NDE
							SPECIFICATION	PROCESS ARC/ TIG	SIZE (mm)					
01	1-80-473-U9024	PIPE+PIPE	SA312TP304H+ SA312TP304H	D114.3	3.05	3.05▽	ER308 H	TIG	D2.4	20 NOS	0.544KGS			10%RT 100%LPT
02	1-80-473-U9024	PIPE+PIPE	SA312TP304H+ SA312TP304H	D60.3	3.91	3.91▽	ER308 H	TIG	D2.4	15 NOS	0.316KGS			10%RT 100%LPT
03	1-80-473-U9024	PIPE+PIPE	SA312TP304H+ SA312TP304H	D48.3	5.08	5.08▽	ER308 H	TIG	D2.4	5 NOS	0.198KGS			10%RT 100%LPT
04	1-80-473-U9024	PIPE+PIPE	SA312TP304H+ SA312TP304H	D33.4	3.37	3.37▽	ER308 H	TIG	D2.4	8 NOS	0.07KGS			10%RT 100%LPT
05	1-80-473-U9024	PIPE+PIPE	SA312TP304H+ SA312TP304H	D21.3	2.27	2.27▽	ER308 H	TIG	D2.4	8 NOS	0.1621KGS			10%RT 100%LPT
06	1-80-473-U9024	PIPE+FITTING	SA312TP304H+ SA403WP304H	D114.3	3.05	3.05▽	ER308 H	TIG	D2.4	45NOS	1.335KGS			10%LPT

	NAME	SIGNATURE	DATE	REV. No:	01	02	03	04	05	DRAWING NO.	REV.	SHEET NO.
PREPARED	A V R	Sd/-XX	27.02.18	ALTERED.						4-80-473-U9076	00	01
CHECKED DESIGN	A V RAO	Sd/-XX	27.02.18	DATE								
CHECKED WTC	G.SANKARA BABU	Sd/-XX	06.07.18	CHD.& APPD.								
APPROVED	A C MOHANTY	Sd/-XX	27.02.18	DATE								

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 equivant) and Alloy steel(inclusive of T91/P91/T92/P92) (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: No of equivated Joints = Dia X Thickness / (63.5x6.3) = Dia X 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.

8)	All the joints shall be carried out root run by TIG welding & subsequent run by ARC welding or full TIG welding as per drawing/schedule and as per the decision of BHEL Engineer at site. The decision of BHEL engineer at site is final and binding on the contractor.
9)	All the joints are to be carried by the BHEL approved welders who possess the requisite statutory authority certificate and are tested at site by BHEL engineers for specific category of work.
10)	Radiography/ UT and other NDT requirements are to be carried out as per the welding schedule or as per the direction of BHEL Engineer with in the quoted rate.
11)	Pre-Heating & PWHT/SR have to be carried out as per the welding schedule or as per the direction of BHEL Engineer with in the quoted rate.
12)	The Panel to panel welding should have proper penetration and it is necessary to weld on both sides if uniform penetration is not achieved. The decision of BHEL engineer is final & binding on the contractor.
13)	A separate section "GUIDELINES FOR WELDING, NDE AND OTHER HEAT TREATMENT" is enclosed in the tender
14)	All butt welds will be subjected to UT or RT and MPI. For weld on alloy steel piping, UT or RT will be done after stress relieving in line with IBR. Wherever the code/standard/process specifies random sampling, the same will be minimum 20%.
15)	Additional welding, due to reasons attributable to contractor such as poor workmanship, shall not be considered for Extra Weld Joints.
16)	One set of annealing cable shall be provided irrespective of the number of induction machines provided by BHEL, ie even if more than one Induction Heating Machine provided by BHEL, only one set of annealing cable shall be provided. Additional annealing cables required, if any, till total work completion, shall be procured by the contractor, at his cost.
17)	Heat Treatment hold time: a) For tubes: 2.5 minutes/ mm of thickness (or) 30 miuntes minimum. b) For pipes: 2.5 minutes/ mm of thickness (or) 60 miuntes minimum.
18)	Thickness limitation of RT: upto 65 mm Above 65 mm: conduct UT with MPT
19)	Typical erection welding schedule enclosed for bidder reference. Actual welding schedule will be provided during execution.

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	--	--	--

PROJECT	2X800 MW UPPUR TPS	
	CUSTOMER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5th Floor, Western Wing, NPKRR Maaligai, 144, Anna Salai, Chennai-600002
	CONSULTANT	TRACTEBEL ENGINEERING PVT LTD
	CO	BHARAT HEAVY ELECTRICALS LIMITED UPPUR SUPER CRITICAL HIGH PRESSURE BOILER PLANT THERMAL POWER PROJECT TIRUCHIRAPPALLI (2 X 800 MW)
LOGO	EPC CONSULTANT:	Category: I APPROVED Lr.No.CE/Projects/SE/T&H(P)/EE9/A1/F.Uppur-BTG/D.113 /17 dt. 04.05.2017. This Approval herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits conforming to the relevant codes and standards as per the specification and performance requirements nor does it limit the purchaser's rights under the contract.
LOGO	VENDOR	04/05/17 CHIEF ENGINEER/PROJECTS TANGEDCO, CHENNAI-02

DOCUMENT TITLE:

Painting schedule of boiler components

DOCUMENT NO:	PL:C3-PS/1821	Rev: 03
SUB VENDOR DOCUMENT NO :		

Prepared by	**K. Srinivasan** **Senior Engineer/ Plant Lab**		**Document No: PL: C3 - PS / 1821**
Reviewed by	**D. Vijayakumar** **SM /PE/FB**		**Revision No: 03 Dated: 03-05-2017**
Approved by	**Dr. V. Anbazhagan** **DGM / Plant Lab**		**Sheet No. 02 of 13.**

m:\ chem. \ contracts 15\TANGEDCO UPPUR 2X800 MW TPS\psword_00.doc

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	13-03-2017	New	**Prepared in line with bid resolutions between TANGEDCO/DESEIN & BHEL on BID spec No. SE/E/T&H(P)/OT No.01/2015-16, Ref: Annexure- 6, Trichy-FB Paint, 2x800MW UPPUR TPS.**
01	13-04-2017	Document Title is modified	Modified as per comments for CAT.III approval by TANGEDCO 'Letter for comments on painting schedule of SG Lr. No.SE/E/T&H(P)/ E9/A1/F.Uppur-BTG/D.81/17, dt.10.04.2017.
02	28-04-2017	Sl. No. 5 – No. of coats of Finish paint is indicated.	Incorporated as per comments for CAT.III approval by TANGEDCO 'Transmittal for comments on painting schedule of SG, Ref. No. P.010210/ TANGEDCO/2X800MW-UPPUR TPP/127 & dt. 27.04.2017.
03	03-05-2017	Consultant name and logo updated	Incorporated as per comments for CAT.III approval by TANGEDCO 'TE / TANGEDCO Comment dated 02.05.2017'

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	Collector & Separator Vessels (Except Internals), Supports 04 – 147,321,323,547	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	1	--	--	Synthetic enamel paint (Long Oil Alkyd) to IS2932 (DFT = 20µm/ coat)	2	International orange Shade No: 592 of IS 5	70
2 PS5	Collector & Separator Vessels internals and Dd items (threaded and machined surfaces only) (Refer Note 25) 04-347;07-302,309,331,361,362,393; 08-911,912,913;12-314,317,324,327,328; 12-344,348,354,393;17-304,306,319; 19-306,307;21-602,605,700; 24-352,700,803,813,818,827,842; 28-700;32-700;35-190,700,701; 36-700,701;39-700;41-710;42-700,710; 43-710;45-710;47-710;48-700; 65-710;67-710; Foundation materials: 35-010,012;39-012;	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25µm per coat	1	--	--	--	--	--	25
3 PS19C3	Buck stays 08-001,003,006,007,111,380,382,501,503; 08-901,907,910; Boiler supporting structures, Columns, Girders, Bracings 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; 35-371,372,374,375, 381 to 388; 35-390, 441 to 448 35- 451 to 458, 511 to 518 35- 521 to 528; 531 to 538	Blast cleaning to SA2 ½ (Near white metal)/ SSPC-SP10 with surface profile 35-50 µm	Inorganic Zinc Silicate Primer to IS14946 DFT = 75µm	1	Epoxy based MIO pigmented intermediate coat DFT/coat = 75µm	2	#Aliphatic acrylic Polyurethane paint to IS 13213 (latest) DFT = 35µ	#1	Dark Admiralty Grey Shade No: 632 of IS 5	260

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 PS19C3 (Contd.)	<u>Galleries, Stair-ways & inter connecting Walkways</u> 36-110,150,311,312,313,314,315,316,321,322; 36-323,324,325,326,331,332,333,334,335,336; 36-337,341,342,343,344,345,346,347,351,352; 36-353,354,355,356,361,362,363,364,365,366; 36-371,372,373,374,375,376,391,392,393,394; 36-395,610,620,621,740;38-210,299,310,381; 38-410,510,610,611,710; <u>ID system structures.</u> 39-101,102,141,142,150,299,300,301; 39-304,305,306; <u>Duct supports</u> 48-015,115,145,205,225, 265,345,355,365; 48-385,435,465,485,495,665;	Blast cleaning to SA2 ½ (Near white metal)/ SSPC-SP10 with surface profile 35-50 µm	Inorganic Zinc Silicate Primer to IS14946 DFT = 75µm	1	Epoxy based MIO pigmented intermediate coat DFT/coat = 75µm	2	#Aliphatic acrylic Polyurethane paint to IS 13213 (latest) DFT = 35µm	#1	Dark Admiralty Grey Shade No: 632 of IS 5	260
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; 07-102,110,125,223,231,232,317; 10-135,174,178,191,195,235,274,278,283; 10-284,285,291,295,315,687;12-178,850,852; 12-900;15-136,178,236,278;17-476; 18-001,002,010,701;19-701,702,903; 21-600;24-811,824,828,836,837; 42-020,030,070,120,128,150,158;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	No paint	No paint	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: 48-202,204,207,208,212,214,222,224; 48-262,264,662,664,667; Flue Gas: 48-342,344,352,354,362,364,372,382,386,384,432, 48-434,462,464,482,484,492,494;	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm	2	--	--	No paint	No paint	Red oxide	60
5 PS9B1	Components uninsulated other than components coming in gas path. Temp: >95°C & <400°C 20-511; 24-807,820,860,865,867; 42-200,300; Instrument tappings, doors 48-200,915;	Blast cleaning to SA2 ½ (Near white metal)/ SSPC-SP10 with surface profile 35-50 µm	Inorganic ethyl Zinc Silicate Primer to IS14946 DFT = 75µm	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr. II DFT= 20µm per coat	2	Aluminium	115
6 PS10	Components uninsulated other than components coming in gas path. Temp: >400°C & <600°C 09-003,004,005; 28-220;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT= 20µm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.I DFT= 20µm per coat	1	Aluminum	40
7 PS2	Loose tubes, SH, RH & Eco. coils 11-074,078,095,374,378,395,406,467,469,474; 11-487,491,494,606,608,684,694,716,717,718; 11-767,768,769,787,791,916,917,918,967,968; 11-969,987,991;12-179,181,184,187,368,395,403, 12-405,495,514,515,517,524,528,544,548,554 ; 12-568,619,800,803,805,903,914,917,924; 12-927,928,944,948,954,968; 16-079,201,202,203,270,379; 19-092,814,824,914,924;	SSPC – SP3/ Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35µm per coat	1*	--	--	No paint	No paint	Red Oxide	35

*-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.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	**Components < 95° C –Other than components in Sl.No.3.** **Miscellaneous and casing sheets** 07-409,431,460,461,462,502,503,531,560,561; 12-906,907;17-519,919;21-601,604,606; 24-350,351,354,801,804,805,806,808,809; 24-810,815,817,825,826,835,840,841,855,950; 24-955,960;30-233,234;35-995 36-396,611,613;39-302 **Fuel firing:** 41-350,390,500; **Steam blowing piping** 42-001,002,005,010,046,065,152, 42-154,157; 43-004,104,200; 45-200,801,802,804,805,858; 47-261,263,858; **Misc. Duct & plates, expansion joints** 48-018,022,911,912; **Coal feeding** 65-736;67-204,272,276,283,801,802,803 95-088,089,091,485;96-186; 97-585,591,592 **Handling equipments:** 99-100,300, 400, 502,600; **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= 30µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm 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	Components >95° C coming in the gas path ,Headers, Commissioning Spares &erection Materials etc., 05-137,147;06-400,401,431,434,437,441,447; 06-451,453,455,500,501,515,731,732,734,735; 06-737,741,744,745,747,751,752,753,755,759; 07-315,316,318,423,993;10-182,183,184,185; 12-993,994; 17-174,474,504,506,900,903; 19-850,851,852,853;24-822,823,993; 30-103,215,219,223,224,235;31-010,104,993; 32-010,210,810;35-993;37-010;38-993;39-993; 42-858;48-993;65-200;67-200;97-282,590; 99-099;20-988; 21-987,988;24-987,988,989; 41-988;42-988;95-988;99-501	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	No paint	No paint	Red oxide	60
10 PS1B3	Hand rails and posts, ladders / rungs 34-820,850; 35-821,822,823,851; 36-820,851,852,853; 38-820,850;39-820,850;	SSPC-SP3/ Power Tool Cleaning	HB chlorinated rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Dark admiralty Grey Shade No: 632 of IS5	90
11 PS6	Floor Grills, Step treads 34-810;35-811,812; 36-811,812,813,814; 38-810;39-810;	SSPC-SP8/ Acid pickling	Hot dip Galvanizing to a coating weight of 610 g/m^2 (minimum) and to a coating thickness of 85.0 microns (minimum). Immediately after galvanizing post treatment such as chromating shall be applied. 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. The repair of damaged coatings shall be done as per the recommended practice ASTM A780.

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	
12 PS 10	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers, 21-800,825, 24-885; 42-358; Safety valves & ERV 21-850; 24-880,881,883;	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr. I DFT= 20µm per coat	1	--	--	Heat Resistant Aluminium Paint to IS 13183Gr. I DFT= 20µm per coat	1	Aluminum	40
	Forged valves	Phosphating	To a coating weight of 1500 mg per Sq.ft.	--	--	--	--	--	-	--
13 1AS1	Soot Blower components 20-051,054,201,204,794,962;	SSPC-SP3/ Power Tool Cleaning	HB chlorinated rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Verdigris Green Shade No. 280 of IS5	90

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	
14 PS15	<u>For CLH & VLH*</u> PGs 07,08,12,17,19,21,24,47,48 &80 07-402,403,405; 17-904,906; 19-506,507,906,907; 24-353; 48-206,395;	Blast cleaning to SA2 ½ (Near white metal)/ SSPC-SP10 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
15 PS31A1	<u>Components > 95°C & <200 °C, un-insulated Fuel pipes</u> 47-200, 269;	Blast cleaning to SA2 ½ (Near white metal)/ SSPC-SP10 with surface profile 30-35 µm	Epoxy zinc phosphate primer to IS13238 DFT = 35µm/ coat	2	--	--	Epoxy finish Coat to IS 14209. DFT= 35µm/ coat	2	Smoke Grey Shade No: 692 of IS5	140

*- For components other than CLH (constant load hanger) & VLH (varying load hanger), 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, Splice/cover plate/gusset plate/rest plate and metal contact area usually bolted at site to enhance the load transfer by friction grip 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 tender/ approved painting schedule.

5. 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.

6. This painting Schemes is valid for only Customer No: U8-1821/22, TANGEDCO UPPUR TPS - 2X800 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 painting of damaged areas shall be carried out as per clause 4.3, Page 97, Vol. II, Chapter-6, BID Specification, – Uppur TPP, (2x800MW).

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-30µ and 2 coats of Synthetic Enamel paint (Long Oil Alkyd) to IS 2932-DFT-2X20µ Shade Yellow –Shade No. 356 of IS 5- Total DFT 70µ. These are to be cut & removed at site after erection. (It excludes components covered under Sr. No. 3 & 11 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 up to 425 deg. C shall be applied with two coats of HR aluminum paint conforms to IS13183 Gr.I and total DFT 40microns.

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 <=5mm, surface preparation can be power tool cleaning to St3 and painting shall be in line with Sl. No. 8.

23. Handrails of PGMA under Sl. No. 3 need to be painted 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. For DD items, DUs other than threaded/ machined surfaces shall be painted as per scheme of Sl. No. 8, PS1A.

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	8	2	35	50	Grey	--	Spray	24
2	Aliphatic acrylic polyurethane paint to IS 13213	13	2	40	30	Phirozi Blue/ Dark admiralty grey	176/ 632	Spray	24
3	Heat resistant Aluminium paint to IS 13183 Grade I/II	10	1	-	20	--	--	Brush / Spray	24
4	Red oxide zinc phosphate primer paint to IS 12744	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	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	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	Inorganic ethyl zinc silicate primer to IS14946	8	2	60	75	Grey	--	Spray only	16
11	Epoxy based polyamide cured MIO pigmented intermediate coat.	8	2	50	75	Brown	--	Spray	24
12	Epoxy based polyamide cured finish paint to IS14209.	13	2	40	30	Smoke grey	692	Spray	24
13	Epoxy based zinc phosphate primer to IS13238	11	2	40	35	Grey	--	Spray	24

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.

BHARAT HEAVY ELECTRICALS LIMITED
HPVP UNIT - VISAKHAPATNAM - 530012

M/S. TANGEDCO-2x800MW UPPUR SUPER CRITICAL THERMAL PEWER PROJECT
UPPUR, 1x75 TPH - AUXILLIARY BOILER PACKAGE
HPVP S.O. No. 7792
PAINTING SCHEDULE

Prepared by	S Sankara Rao Engineer (HT-Engg.)		Document No: PS/ HPVP S.O. No. 7792
Reviewed by	S Vijay Sr Engineer (HT-Engg.)		
Approved by	L RAJASEKHAR Sr Manager (HT-Engg.)	12.05.18	
			Sheet No. 01 of 11.

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00		New	

SL.No.	PGMA / Description	Surface Prepa-ration & 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= 30µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	International orange Shade no: 592 of IS 5	70
2	Drum Internals, foundation materials & Dd items 04-114, 210, 07-989 35-010; 21-602; 21-700, 24-352, 603,627,642, 42-700, 48-700, 911, 81-325	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25µm per coat	1	--	--	--	--	--	25
3	Boiler supporting structures, Columns, Girders, Bracings 35 – 110, 410, 510, 610 Galleries, Stair-ways & inter connecting walkways 36– 310 ID system structures 48 - 200, 335 Buck stays 08-100 Uninsulated piping components (Spray water/condensate lines/Tanks & Vessels. 80-366,473,600, 601, 612, 616, 650, 81-127, 128, 81-034, 81-318	Blast cleaning to SA21/2 (Near white metal)/SSPC-SP10 with surface profile 35-50µm	Inorganic Zinc Silicate Primer to IS 14946 DFT=75µm	1	Epoxy based MIO pigmented intermediate coat. DFT/Coat=75 µm	2	#Aliphatic acrylic Polyurethane paint to IS 13213 (latest) DFT= 35µm	#1	Dark admiral Grey Shade No: 632 of IS5	260 (225 at shop+35 at site)

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	Components >95° C Insulated other than components in Sl.No.6 &8 Ring Headers, Down Comers, Hot air Headers outside the gas path etc. 05-137, 147, 231, 241. 06-609, 614, 616, 630, 640, 657. 07-200,201, 202, 204,211,214; 601, 993. 10-170,270. 12-850,851, 900;993, 18-001; 21-600, 602, 603, 604; 24-600, 993. 48-207,332, 334,993 80-300, 345,417,420,421,446,450, 451, 453, 81-005,81-026	SSPC-SP3/ Power Tool Cleaning SIS 055900 Grade: ST3	Red Oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	--	--	Red oxide	60
5	Components >95° C uninsulated other than components coming in gas path. 09- 001,002,003; 21-800; 24-620, 624, 627, 628, 660,665,680,685,21-800, 28-220; 42-200, 300; 48-915	SSPC-SP3/ Power Tool Cleaning SIS 055900 Grade: ST3	Heat resistant Aluminum paint to IS 13183 Gr I, DFT= 20µm/coat.	1	--	--	Heat resistant Aluminum paint to IS 13183 Gr I, DFT= 20µm/coat	--	1	40

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 19-850,993	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	60
7	Components < 95° C (uninsulated) – Other than components in Sl.No.3. 07-431, 601; 24-350, 351, 352, 353, 601,603, 604, 625, 626, 635, 640, 641;642 41- 200, 500 42-001,002,005,010, 152; 48-082,084,911; 80-418 97-590	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 coats	Shade	
8	Components >95° C coming in the gas path ,Headers, Commissioning Spares & erection Materials etc., 04-988; 24-987,988,989 30-215; 31-010,301; 32-010; 37-010, 810; 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	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	---	---	Synthetic Enamel paint (Long oil Alkyd) to IS 2932) DFT: 20µm per coat	2 1	Dark admiral grey Shade no :632 of IS 5	90
10	Floor Grills, Step treads 36-811	SSPC-SP8/Acid Pickling	Hot dip Galvanizing to a coating weight of 610 g/m^2 (minimum) and to a coating thickness of 85 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 Prepa-ration & 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	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers 21-800, 673, 680, 685,80-901	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I, DFT=20µm/ coat.	1	--	--	Heat Resistant Aluminium Paint to IS 13183 Gr.I, DFT=20µm/ coat.	1	Aluminium	40
	Forged valves	Phosphating	To a coating weight of 1500 mg per sq.ft.	--	--	--	--	--	–	--
	Soot Blower components 20-301,304, 621, 801,803, 988	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated rubber based zinc phosphate primer, DFT= 50µm per coat	1	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm 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, DFT=20µm per coat	2	--	--	--	--	Aluminium	40

SL.No.	PGMA / Description	Surface Prepa-ration & 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	For CLH & VLH*** PGs 07,08,12,17,19,21,24,47,48 &80 12-901 24-351,353; 80-920, 80-921, 80-922, 936	Abrasive blast cleaning to Sa 2 ½ (Near white metal) SSPC-SP10 with surface profile 35- 50 microns	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

***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:7792 of TANGEDCO-UPPUR SUPER CRITICAL THERMAL POWER PROJECT-AUXILIARY BOILER- 1X75TPH.
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, 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. 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 & 9 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.

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 Oxaluminate 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 Prepa-ration	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, 2,3,4,5,6,7,8,9,11.	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

CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CONSULTANT: TRACTEBEL ENGIE	TRACTEBEL ENGINEERING PVT. LTD.
PROJECT:	2x800 MW UPPUR STPP(UNIT#1&2) IN RAMNATHAPURAM DISTRICT, TAMILNADU
BHEL	BHARAT HEAVY ELECTRICAL LTD BOILER AUXILIARIES PLANT, RANIPET

DEPT CODE		NAME	SIGN	DATE
	PRPD	Rajamanickam.M		21.10.2017
	CHD APPD	R.Arunachalam		21.10.2017

2X800MW UPPUR STPP (UNIT# 1&2)

TITLE: **PAINTING SCHEDULE FOR APH, FANS, ESP, Gates & Dampers, Aux. boiler chimney**

DOCUMENT NO: RPT-PS:UPPU:EPC:R837-R838& R4N5 | **REV: 04** | **Date: 21/10/2017**

RECORD OF REVISION

REV No	Effective date	Remarks
00	31/05/2016	Original Issue
01	01/04/2017	Revised as per customer comments
02	19/06/2017	Revised as per customer comments
03	20/07/2017	Revised as per customer comments
04	21/10/2017	Revised as per customer comments

RANIPET	**Bharat Heavy Electricals Limited** **Boiler Auxiliaries Plant** **Ranipet – 632 406** ***Vellore Dist. Tamil Nadu***	**BHEL DOC NO.**	**RPT-PS:UPPU:EPC:R837-R838& R4N5**
		REVISION NO.	**04**
		DATE	**21-10-2017**

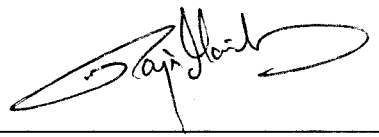
UPPUR TPP (2X800MW)

PAINTING SCHEDULE FOR APH, FAN, ESP, GATE&DAMPER, &CHIMNEY(AUX.BLR)

BHEL RANIPET Customer No(s).: R837 – R838 & R4N5

RECORD OF REVISION

REV NO	EFFECTIVE DATE	DETIALS OF REVISION MADE
00	31.05.2016	Original issue – first submission
01	01.04.2017	Revised issue – As per Compliance report in line with customer comments
02	19.06.2017	Revised issue – As per Compliance report in line with customer comments
03	20.07.2017	Revised issue – As per Compliance report in line with customer comments
04	21.10.2017	Revised issue – As per Compliance report in line with customer comments

Prepared By	Reviewed &Approved By
	
(Rajamanickam.M)	**(R. Arunachalam)**

Sl 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)	Heat exchanger Coils coming in the gas path	Power Tool Cleaning to St3 (SSPC-SP3)	One coat of dip-coat paint –Red-oxide Zinc phosphate primer **35µ.**	35	NIL	NIL	35
		Other uninsulated	Blast Cleaning to SA 2 ½ (Near white metal) with surface profile 35 – 50 µm SIS 05 5900 *	1 coat of Inorganic ethyl zinc silicate - DFT 75µ. Total DFT = 75 µ.	75			75
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	20	NIL	NIL	20
		Seals		Temporary rust preventive oil	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	20	NIL	NIL	20
08	Bypass seals (Flue gas swept surface)		Power Tool Cleaning to St3 (SSPC-SP3)	Temp. Rust Preventive Oil	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

Sl No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
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 *	1 coat of Inorganic ethyl zinc silicate - DFT 75µ.	75	NIL	NIL	75
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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : sky blue,, 101 of IS-5), DFT 50 microns per coat				

Sl 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*	**Shop coat(two(2) coats):** **b) Primer: *One coat of Inorganic Zinc Silicate Primer - DFT 75µ.** **C) Intermediate coat: one coat of Epoxy MIO intermediate paint-DFT75 µ/coat.** **After erection(two coats):** **d) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75µ/coat.*** **e) Finish coat: One coat of polyurethane top coat - 35µ. Color: Light Grey 631 of IS-5** **Total DFT = 260µ.**				
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)						

Sl No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
	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
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	Synthetic Enamel to IS 2932 Grey shade 692 of IS 5 (Two coats)	40	100
	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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Light Grey, 631 of IS-5), DFT 50 microns per coat				
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 Coat :** Inorganic Ethyl Zinc Silicate Primer DFT = 75 µm per coat **Intermediate Coat:** Epoxy based MIO / Ti O2 pigmented Intermediate coat DFT = 75 µm per coat	75 75	Epoxy finish Coat, DFT = 35 µm per coat (Two Coats) - Shade Grey RAL 9002 + Ali Acrylic PU Paint DFT = 30 µm per coat – color:410 of IS 5(Light brown)	75 35	260
09	**Silencer for FD & PA FAN & 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	Synthetic Enamel to IS 2932 Grey shade 692 of IS 5 (Two coats)	40	100
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	Synthetic Enamel to IS 2932 Grey shade 692 of IS 5 (Two coats)	40	100

Sl No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
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

3. GATES & DAMPERS

01	Gates & Dampers > 95° C Insulated Surfaces	Power tool cleaning to St3 (SSPC-SP3)	HR Aluminium Paint to IS: 13183 Gr. II (up to 400 ° C) – Two Coats	40	--	--	40
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	Synthetic enamel to IS 2932 grey shade 692 of IS 5 (Two coats)	40	100
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) * Surface preparation: Acid Pickling SSPC SP 08 and Post treatment:Chromating applicable for gratings and step threads galvanizing					
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					

Sl 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 / Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3	Two coats of Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coast)	60	NIL	NIL	60
03	Chimney Duct	Insulated Side / Flue Gas Swept Surface	Power Tool Cleaning to st3 (SSPC-SP3	Two coats of Red Oxide Zinc Phosphate Prime to IS: 12744 (Two coast)	60	NIL	NIL	60
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 Shop coat(two(2) coats): b) Primer: *One coat of Inorganic Zinc Silicate Primer - DFT 75µ. C) Intermediate coat: one coat of Epoxy MIO intermediate paint-DFT 75 µ/coat. After erection(two coats): d) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75µ/coat.* e) Finish coat: One coat of polyurethane top coat - 35µ. Color 632 of IS 5 Total DFT = 260µ.					
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) *Surface preparation: Acid Pickling and Post treatment: Chromating applicable for gratings step threads, galvanising					
06	Other than sl.no.05 of platform structural items		Power tool cleaning to St3(SSPC-SP3	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two Coats)	60	Synthetic enamel to IS 2932 grey shade 692 of IS 5 (Two coats)	40	100

Sl 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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admirality Grey, 632 of IS-5), DFT 50 microns per coat				
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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admirality Grey, 632 of IS-5), DFT 50 microns per coat				
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					
12	Lifting Beam for Collecting Electrode 7X - X20	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100

Sl No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm min.)	
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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admirality Grey, 632 of IS-5), DFT 50 microns per coat				
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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admirality Grey, 632 of IS-5), DFT 50 microns per coat				
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
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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Dark admiralitty Grey, 632 of IS-5), DFT 50 microns per coat				
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

Sl 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

Sl 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	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
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)		Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100
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 *	Prime coat: 2 coats of zinc phosphate epoxy, total DFT 75 microns Intermediate coat: 1 coat of 2 pack high build epoxy polyamide MIO, DFT 100 microns Finish coat: 2 coats of chlorinated rubber paint (Color : Light Grey, 631 of IS-5), DFT 50 microns per coat				
34	Water Washing System (7X - X66)		Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100
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.					
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) *Surface preparation: Acid Pickling SSPC SP8 and Post treatment: Chromating applicable for gratings step threads, galvanising					
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	Synthetic Enamel to IS 2932 Smoke Grey Shade No. 692 of IS 5 (Two Coats)	40	100

Sl 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 *	**Shop coat(Two (2) coats):** **a) Primer: *One coat of Inorganic Zinc Silicate Primer – DFT 75µ.** **b) Intermediate coat: one coat of Epoxy MIO intermediate paint-DFT 75 µ/coat.** **After erection(two coats):** **c) Intermediate coat: One coat of Epoxy MIO intermediate paint-DFT 75µ/coat.** **d) Finish coat: One coat of polyurethane top coat - 35µ.** color 632 of IS-5(Dark admirality grey). **Total DFT = 260µ.**			
40	Supporting Structure for ESP (Refer note 5 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)						

Sl No	SURFACE LOCATION	SURFACE PREPARATION	PRIMER		FINISH		TOTAL DFT IN (µm min.)
			PAINT	DFT (µm min.)	PAINT	DFT (µm 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
Any area where paint got damaged	As given in respective scheme(Derusting of all mechanical damages)	Primer and Finish : As given in respective scheme

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.

	TRACTEBEL ENGIE	Project : 2x800 MW UPPUR STPP (STAGE -I , Unit 1 & 2) - BTG Package Owner : Tamilnadu Generation and Distribution Corporation Limited, TN Consultant: TRACTEBEL ENGINEERING pvt. ltd.	TANGEDCO
	Document Name : PAINTING SCHEDULE FOR BOWL MILLS	**Comments Prepared by : AD**	**BHEL Receipt Transmittal No. & Date : NIL & 13.02.2017**
	Document No. / Revision : HY-BM-BA-PS-UPPUR-00 Rev 00	**Comments Checked by : SDG**	**TE Transmittal No. & Date :P.010210/TANGEDCO/2X800MW-UPPUR TPP/155 Dated 06.06.2017**
		TE / TANGEDCO Comment dated 26.05.2017	**Document No. / Revision : HY-BM-BA-PS-UPPUR-00 Rev 01**

Sl. No.	Ref. of document/drawings	Review Category : 3	BHEL Reply dated 24.07. 2017
1		Document number indicated in the drawing is not matching with the number indicated in list. Please check and reconcile.	Complied
2	Section 3: Exterior surfaces: Components with surfaces greater than 95 deg C	Please indicate the surface preparation before application of primer.	Complied
3	Section 4: Exterior surfaces: Components with surfaces greater less 95 deg C	Please indicate the surface preparation before application of primer.	Complied
4	Section 4: Exterior surfaces: Components with surfaces greater less 95 deg C D) Finish –Fish coat (after erection)	The DFT shall be 50 micro instead of 25 micron, Please check and reconcile.	Complied
5	Section 6: Paint Schedule Sl no. 2	Please clarify how the shade Gray RAL 9006 will appear without the finish paint.	The intermediate paint 'Aluminum Silicone' is a High temperature paint and comes in aluminium shade. RAL 9006 shade is deleted. Inconvenience is regretted.
6		The name of the customer's consultant Lahmeyer International(India)Pvt Ltd is changed to Tractebel Engineering Pvt Ltd.You are requested to change the name & Logo of the customer's consultant accordingly at all relevant places .	Complied

Approval categories :
1. Category 1: Approved.
2.Category 2 : Approved with Comments.
3. Category 3: Not Approved.
4. Category 4: Information Category.

BHARAT HEAVY ELECTRICALS LIMITED

RAMACHANDRAPURAM: HYDERABAD: 502032

PULVERISERS ENGINEERING

HP 1103 BOWL MILLS (DYNAMIC CLASSIFIER) – 9 NOS. / BOILER

PAINTING SCHEDULE FOR BOWL MILLS

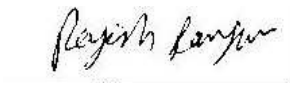
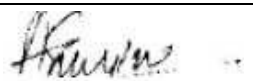
PREPARED BY	RAJESH RANJAN		TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED
REVIEWED BY	AMAN SURIN		TRACTEBEL ENGINEERING PVT. LTD.
APPROVED BY	SATISH GHATGE		2X800MW UPPUR STPP (UNIT#1&2) IN RAMANATHAPURAM DISTRICT, TAMILNADU
JOB NO. 425 STATUS: CONTRACT			Record of Revisions: Rev 00: Initial Submission Rev 01: Revised as per Customer comment dated 26.05.2017. Reply sheet attached.
DOCUMENT NO: HY-BM-BA-PS-UPPUR-00 REV. NO: 01 DATED: 24.07.2017			

TABLE OF CONTENTS

SECTION 1: SCOPE

This painting schedule covers all parts and assemblies of HP 1103 Pulverisers manufactured by BHEL and its sub-vendors including Sister Units for 2X800MW UPPUR STPP (UNITS#1&2) 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: 1) *Oil resistant paint (AA5610032563) application is envisaged on the inside of the Planetary Gear Box Housing.*
2) No primer application is envisaged on the inside of 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) **Surface preparation**: Commercial Blast SSPC-SP 10 (Swedish Std SA 2.5) with inorganic ethyl zinc silicate primer Minimum DFT 15 microns.

B) **Primer**: High temperature Inorganic Zinc Silicate primer & Aluminium Silicone paint (additional). Total DFT 100 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 temperature Less Than 95 C:

All mill components, except the Mill Side Housing Assembly and Bowl and Bowl Hub Assembly.

A) **Surface preparation**: Commercial Blast SSPC-SP 10 (Swedish Std SA 2.5) with inorganic ethyl zinc silicate primer Minimum DFT 15 microns.

B) **Primer** : Zinc phosphate epoxy primer Minimum DFT 75 microns.

C) **Intermediate Coat**: Polyamide cured pigmented titanium dioxide (TiO2) or Micaceous iron oxide (MIO) epoxy based paint. (solids by volume 60% min) Minimum DFT 100 microns. Paint applied by airless spray technique.

D) **Finish Coat (Shop)**: Chlorinated Rubber base paint minimum DFT 50 microns.

E) **Finish –Finish Coat (After Erection)**: of 50 micron DFT (minimum) of Chlorinated Rubber base paint.

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 primer Min DFT 15 µm.)	Inorganic Zinc Silicate (High temperature primer)	1-2 coats 60 µm DFT Total	Aluminum Silicone (High temperature paint)	2 coats 25 µm Min DFT Total	NA			100 µm DFT Total

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 primer Min DFT 15 µm.)	Zinc Phosphate Epoxy Primer	2 coats 75 µm min DFT total	Polyamide cured pigmented titanium dioxide (TiO2) or Micaceous iron oxide (MIO) epoxy based paint	1-2 coats 100 µm min DFT total	Finish (Shop) Chlorinated Rubber base paint (AA5610036003) ---------- Finish (after erection) Chlorinated Rubber base paint (AA5610036003)	1 coat 50 µm min DFT Total ------ 1 coat 50 µm min DFT	Light Grey 631 (IS:5)	240 µm DFT min. ---------- 290 µm DFT min. (total after erection paint)