

TENDER SPECIFICATION

BHEL: PSSR: SCT: 1848

FOR

Erection, Testing and Commissioning of Power Cycle Piping and all associated Piping & Insulation works including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints and application of refractory & insulation works as per requirement / as given in the drawings including labeling & flow direction on the piping / over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer etc. for Unit-1 (Package-A) & Unit-2 (Package-B)

at

**2X660MW Ennore SEZ Supercritical Thermal Power Project
at Ash Dyke of NCTPS, Tamilnadu**

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
- Volume-IC : General conditions of Contract
Rev 01 dated 1st June 2012,
Amendment 01 dated 15th April, 2013
- Volume-ID : Forms & Procedures
Rev 01 dated 1st June 2012



BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)

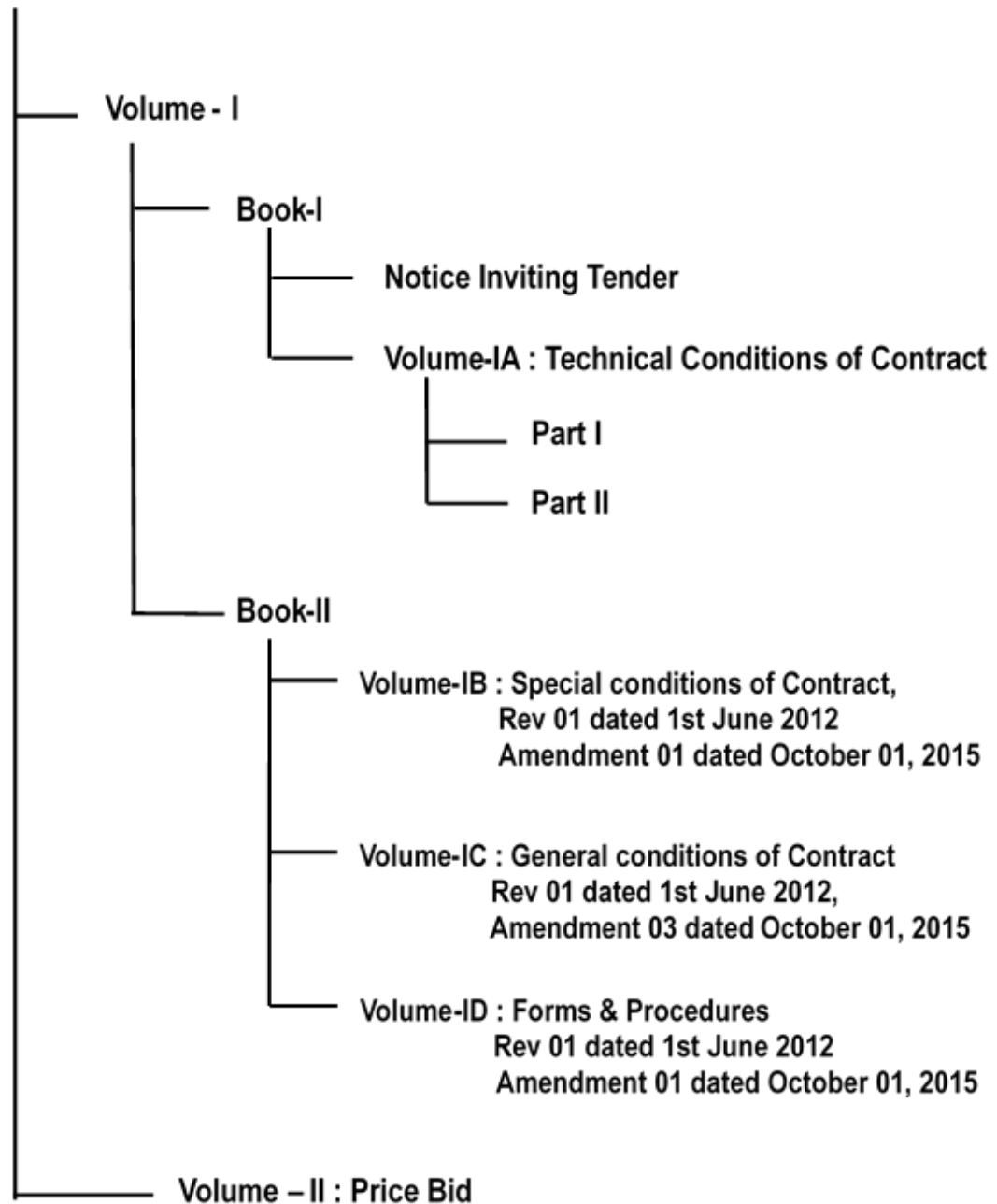
Power Sector – Southern Region

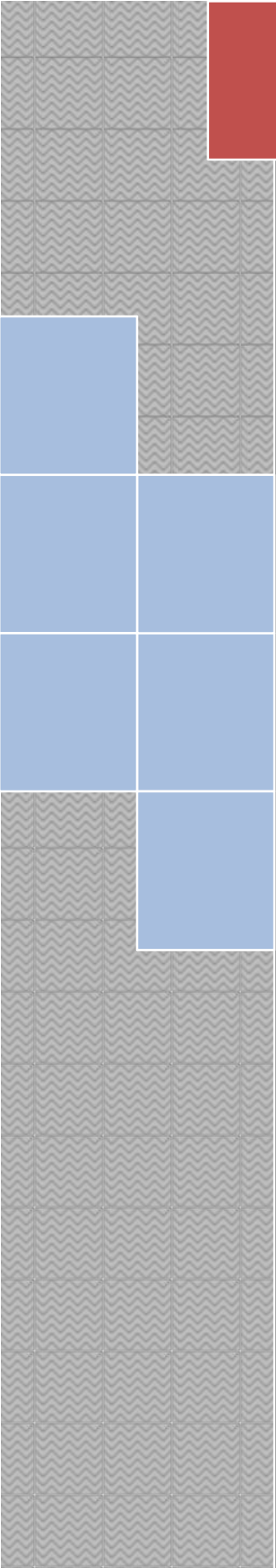
690, Anna Salai, Nandanam, Chennai – 600 035

NOTICE INVITING TENDER

TENDER SPECIFICATION CONSISTS OF

Tender Specification





NOTICE INVITING TENDER

Bharat Heavy Electricals Limited



NOTICE INVITING TENDER

Ref: BHEL: PSSR: SCT: 1848

Date: Aug 22, 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: 1848
ii	Broad Scope of job	Erection, Testing and Commissioning of Power Cycle Piping and all associated Piping & Insulation works including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints and application of refractory & insulation works as per requirement / as given in the drawings including labeling & flow direction on the piping / over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer etc. for Unit-1 (Package-A) & Unit-2 (Package-B) at 2X660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Tamilnadu
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

Tender Specification No.: BHEL PSSR SCT 1848

NOTICE INVITING TENDER

B	Volume-IB	Special Conditions of Contract (SCC) Rev. 01 Dt. 01 Jun 2012 Amendment 01 dated October 01, 2015	Applicable
C	Volume-IC	General Conditions of Contract (GCC) Rev. 01 Dt. 01 Jun 2012 Amendment 03 dated October 01, 2015	Applicable
D	Volume-ID	Forms and Procedures Rev. 01 Dt. 01 Jun 2012 Amendment 01 dated October 01, 2015	Applicable
E	Volume-II	Price Schedule (Absolute value).	Applicable
iv	Issue of Tender Documents	1. This is an E-tender floated online through our E-Procurement Portal https://bhel.abcprocure.com 2. <u>Sale</u> Start: August 24, 2019 3. From BHEL website (www.bhel.com → Tender Notifications): Tender documents for bidder's reference can be downloaded from this website till due date of submission.	Applicable
v	Due Date & Time of Offer Submission	Date : September 13, 2019, Time :15.00 Hrs The bidder should submit their offer online in e-Procurement portal at https://bhel.abcprocure.com Offers are invited in two-parts only. Bidders are requested to upload their offer well in advance in order to avoid last minute congestion at this website. Hard copy bid or bids through E-mail / fax shall not be accepted.	Applicable
vi	Opening of Tender	Date : September 13, 2019, Time :15.30 Hrs Notes: (1) In case the due date of opening of tender becomes a non-working day, tenders shall be opened on next working day at the same time. (2) Bidder may depute representative to witness the opening of tender	Applicable
vii	EMD Amount	Rs 22,90,000/- (Rupees Twenty Two Lakhs Ninety Thousand Only) - Refer Volume-I A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I, Book-I) for	Applicable

NOTICE INVITING TENDER

		mode of payment of Earnest Money Deposit (EMD) - EMD Exemption for MSEs is not applicable for this tender. - One time EMD not applicable for this tender.	
viii	Cost of Tender	Rs 2000/- (Rupees Two Thousand only)	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: September 03, 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	Applicable

NOTICE INVITING TENDER

		2) Shri. Virendra Bahadur Singh, IPS (Retd.) H. No. B-5/ 64, Vineet Khand, Gomti Nagar, Lucknow- 226010 Email: vbsinghips@gmail.com 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	

NOTICE INVITING TENDER

		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), and portal https://bhel.abcprocure.com . These will not be published in any of 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, shall not be entertained.**
- 3.0 Unless specifically stated otherwise, bidder shall remit cost of tender inline with mode of payment applicable to EMD as mentioned in Vol-1A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I, Book-I) under the heading 'Modes of deposit of EMD'.
- 4.0 Unless specifically stated otherwise, bidder shall deposit **Earnest Money Deposit (EMD) as mentioned in Volume IA, Part-II, Chapter-1** of Technical Conditions of Contract (Volume-I Book-I). Please note that 'One Time EMD' shall not be considered. For mode of payment of EMD, bidder shall refer Vol-1A Part-II Chapter-1 of Technical Conditions of Contract (Volume-I Book-I). **It is to be noted that proof of remittance for EMD shall be made available at BHEL PSSR Office prior to tender opening. One time EMD is not applicable.**
- 5.0 **Procedure for Submission of Tenders:** This is an E-tender floated online through our E-Procurement portal <https://bhel.abcprocure.com>. The bidder should respond by submitting their offer online only in our e-Procurement portal

NOTICE INVITING TENDER

at <https://bhel.abcprocure.com>. Hard copy bid or bids through email/ fax shall not be accepted.

I. Pre-requisite for Offer Submission:-

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

The Tenderer should own and use the Digital Signature Certificate (Class 3 – SHA2 – 2048 BIT – Signing & Encryption) (DSC) issued on behalf of their / his - firm/organization/company/proprietor. Tenderer to register with E-Procurement Portal <https://bhel.abcprocure.com> with their DSC.

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

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

II. Digital Signing of e-Tender

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

i) The Requirement:

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

III. Details of E-procurement service Provider:-

The contact details of the service provider are given below:

e-Procurement Technologies Limited (abcProcure),

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

Nr. Gujarat College, Ellis Bridge,

Ahmedabad - 380 006, Gujarat (India)

Timing:

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

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

Contact: +91-79-40270549/560/590

NOTICE INVITING TENDER

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 bid (preferably in pdf format):

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

NOTICE INVITING TENDER

- iii). A tender, which does not fulfil any of the above requirements and / or gives evasive information / reply against any such requirement, shall be liable to be ignored and rejected.
- iv). In case offer is sent through hard copy / fax / telex / cable / electronically in place of e-tender, same shall not be considered.
- v). **Vendors are also requested to go through Bidder Manual for BHEL Bidders available on <https://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.
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.	

NOTICE INVITING TENDER

iii.	Supporting documents / annexure / schedules / drawing etc as required in line with Pre-Qualification criteria. (Technical & Financial) As detailed in Clause No. 25 of NIT, It shall be specifically noted that all documents as per above shall be indexed properly and credential certificates issued by clients shall distinctly bear the name of organization, contact phone no, FAX no, etc.	To be uploaded under the form Techno-commercial Bid.
iv.	All Amendments / Correspondences / Corrigenda / Clarifications / Changes / Errata etc pertinent to this NIT.	
v.	Integrity Pact Agreement (Duly signed by the authorized signatory) (As applicable)	
vi.	Duly filled-in annexures, formats etc as required under this Tender Specification / NIT	
vii.	Notice inviting Tender (NIT)	
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	To be uploaded under the form Techno-commercial Bid.
ix.	Volume – I B : Special Conditions of Contract (SCC)	
x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only ‘QUOTED’ or ‘UNQUOTED’ against each item	
xiii.	Any other details preferred by bidder with proper indexing.	
Caution to Bidders:- The duly signed & stamped copies of Volume – I Book I & Volume I Book-II are to be attached in their respective sections. For any further queries, refer “Bidder Manual for BHEL Bidders” available at https://bhel.abcprocure.com		

	PRICE BID consisting of the following shall be attached as mentioned below	
	Volume II – PRICE BID (Duly Filled in Schedule of Rates – rate / price to be entered in words as well as figures)	To be uploaded under the form Price Bid.

NOTICE INVITING TENDER

Caution to Bidders:- Bidders to note that while uploading/entering price bid document, the “ Type of Forms ” in e-tendering module is selected as “ Price ” and not “ Technical & Commercial ” Any other document uploaded in the price bid, apart from above tender format, shall not be taken into cognizance for evaluation of offer.	

SPECIAL NOTE:

- i. All documents / annexures submitted with the offer shall be properly attached / entered / uploaded in the respective sections. BHEL shall not be responsible for any missing documents.
 - ii. Your offer & documents submitted along with offer shall be signed & stamped in each page by your authorized representative. No overwriting/ correction in tender documents by bidders shall be allowed. However, if correction is unavoidable, the same may be signed by authorized signatory.
- 7.0 Deviation with respect to tender clauses and additional clauses / suggestions / in Techno-commercial bid / Price bid shall NOT be considered by BHEL. Bidders are requested to positively comply with the same.
- 8.0 BHEL reserves the right to accept or reject any or all Offers without assigning any reasons thereof. BHEL also reserves the right to cancel the Tender wholly or partly without assigning any reason thereof. Also BHEL shall not entertain any correspondence from bidders in this matter (except for the refund of EMD).
- 9.0 **ASSESSMENT OF CAPACITY OF BIDDERS:**

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

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

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

Total number of Packages in hand = Load (P)

NOTICE INVITING TENDER

Where 'P' is the sum of all unit wise identified packages (refer table-1) under execution with BHEL Regions as of the cut off month defined above, including packages yet to be commenced, excepting packages which are on HOLD due to reasons not attributable to Bidder.

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

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

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

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

- a) $P_1, P_2, P_3, P_4, P_5, \dots, P_N$ etc. be the packages (under execution / executed during the 'Period of Assessment' in all Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions = P_T (i.e. $P_T = P_1 + P_2 + P_3 + P_4 + \dots + P_N$)
- b) Number of Months ' T_1 ' for which 'Monthly Performance Evaluation' as per relevant formats, should have been done in the 'Period of Assessment' for the corresponding similar package P_1 . Similarly T_2 for package P_2 , T_3 for package P_3 , etc. for the tendered scope. Now calculate cumulative total months ' T_T ' for

NOTICE INVITING TENDER

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

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

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

Aggregate of Performance scores for all similar packages in all the Regions

= -----

Aggregate of months for each of the similar packages for which performance should have been evaluated in all the Regions.

$$S_T$$

$$= \frac{\quad}{T_T}$$

- 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)

NOTICE INVITING TENDER

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

- ii.) Calculation of Overall 'Performance Rating' (R_{BHEL}) in case at least six 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

NOTICE INVITING TENDER

scores' for at least six 'package months' in the order of precedence below:

- a) 'Period of Assessment' i.e. six 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

NOTICE INVITING TENDER

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

ii). Identified Packages (Unit wise)

Table-1

Civil	Electrical & CI	Mechanical
i). Enabling works ii). Pile and Pile Caps iii). Civil Works including foundations iv). Structural Steel Fabrication & Erection	i).Electrical ii). CI iii). Others (Elec & CI)	i).Boiler & Aux (All types including CW Piping if applicable) ii). Power Cycle Piping / Critical Piping iii). 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

NOTICE INVITING TENDER

Civil	Electrical & CI	Mechanical
v). Chimney vi). Cooling Tower vii). Others (Civil)		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 24 months preceding and including the Cut-off month in the online BHEL system for contractor performance evaluation in BHEL PS Regions.

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

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

- iv). Consequent upon applying the criteria of ‘Assessment of Capacity of Bidders’ detailed above on all the bidders qualified against Technical and Financial Qualification criteria, if the number of qualified bidders reduces to less than four, then for further processing of the Tender, BHEL at its discretion reserves the right to also consider the bidders who are “not qualified” as per criteria of ‘Assessment of Capacity of Bidders’ and for this, procedure described in following three options shall be followed:

NOTICE INVITING TENDER

- 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.

NOTICE INVITING TENDER

- 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

NOTICE INVITING TENDER

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 names and other details of Independent External Monitor (IEM) for the subject tender is as given at point (1) above.**
- 17.0 The Bidder has to satisfy the Pre-Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the pre-qualification criteria specified in this NIT as per Annexure-1 (as applicable) past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right NOT to consider offers of parties under HOLD.
- 18.0 In case BHEL decides on a 'Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful / Disqualified bidders under intimation to the respective bidders.
- 19.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise.

NOTICE INVITING TENDER

- 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

NOTICE INVITING TENDER

- 24.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.
- 25.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements' duly self-certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents / proofs, these shall be submitted immediately.
- 26.0 The bidder may have to produce original document for verification if so decided by BHEL.
- 27.0 The offers of the bidders who are under suspension as also the offer of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site "<http://www.bhel.com> → tender notification".
- 28.0 It may be noted that guidelines / rules in respect of 'Suspension of Business dealings' available on BHEL web site "<http://www.bhel.com> → Supplier Registration", 'Vendor evaluation format', Quality, Safety & HSE guidelines', etc. may undergo change from time to time and the latest one shall be followed.
- 29.0 The Bidder along with its associate / collaborators / sub-contractors / sub-vendors / consultants / service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website <http://www.bhel.com> and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice.
- 30.0 Integrity commitment, performance of the contract and punitive action thereof:
- 30.1 Commitment by BHEL:
BHEL commits to take all measures necessary to prevent corruption in connection with the tender process and execution of the contract. BHEL will during the tender process treat all Bidder(s) in a transparent and fair manner, and with equity.
- 30.2 Commitment by Bidder / Supplier / Contractor:
- 30.2.1 The bidder / supplier / contractor commit to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.
- 30.2.2 The bidder / supplier / contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of

NOTICE INVITING TENDER

the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.

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

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

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

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

32.0 The 'Mode of Award' of work shall be as under:

32.1 The entire scope of work is being split into two equal packages (Package-A and Package-B) and will be awarded to two bidders as far as possible. BOQ/Rate Schedule enclosed is applicable for each of the packages.

32.2 The successful bidder against this quote will be awarded the contract for Package A.

32.3 BHEL may award the contract for Package B on the same terms and conditions of tender to the next lowest bidder in the order of competitiveness (i.e., L2, L3 and so on till H1 in that order) if they match their total amount quoted with the total amount as accepted by BHEL for awarded Package A.

32.4 In case, Package B is not awardable by the process above, BHEL may offer Package B also to the successful bidder to whom Package A has been awarded.

NOTICE INVITING TENDER

32.5 However, BHEL also reserves the right to not award Package B in this manner as in 32.3 and 32.4 above, at its sole discretion, without furnishing any reason to the Bidders.

32.6 Each package will be treated as a separate contract.

33.0 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 dated October 01, 2015
- f. General Conditions of Contract (GCC) —Volume-1C
Rev.01 Dt. 01 Jun 2012; Amendment 03 dated October 01, 2015
- g. Forms and Procedures —Volume-1D
Rev. 01 Dt. 01 Jun 2012, Amendment 01 dated October 01, 2015

For and on behalf of BHARAT HEAVY ELECTRICALS LTD

Additional General Manager / SCT

Enclosure

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

NOTICE INVITING TENDER

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	Erection, Testing and Commissioning of Power Cycle Piping and all associated Piping & Insulation works including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning/ pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints and application of refractory & insulation works as per requirement / as given in the drawings including labeling & flow direction on the piping / over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer etc. for Unit-1 (Package-A) & Unit-2 (Package-B) at 2X660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Tamilnadu
Tender No.	BHEL: PSSR: SCT: 1848

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 Power Cycle piping of one unit of 400 MW or above, in the last seven years ending on the latest Date of Bid Submission. Note: The term Executed in Technical PQR means 'Steam Blowing Completion'.	Applicable	To be filled in Annexure-4

NOTICE INVITING TENDER

C: C-1	<u>FINANCIAL</u> Turnover Bidders must have achieved an average annual financial turnover (Audited) of Rs.3,85,00,000.00 (Rs. Three Crores Eighty Five Lakhs) or more over last three Financial Years (FY) i.e, 2015-16, 2016-17 and 2017-18.	Applicable	To be filled in Annexure-4
C-2	Networth 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 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	

NOTICE INVITING TENDER

	<u>Explanatory Notes for the PQR (unless otherwise specified in the PQR):</u> 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 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 year of last 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. Completion date for achievement of the technical criteria specified in the Common QR should be in the last 7 years ending on the 'latest date of Bid Submission' of Tender irrespective of date of start of work. 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. 10. For the purpose of evaluation of the PQR, one MW shall be considered equivalent to 3.5 TPH where ever rating of HRSG / BOILER is mentioned in MW. Similarly, where ever rating of Gas Turbine is mentioned in terms of Frame size, ISO rating of the same in terms of MW shall be considered for evaluation. 11. Scope for Capital overhaul of STG shall cover Bearing Inspection work and overhauling of all cylinders of the Turbine. 12. In case the Experience/PO/WO certificate enclosed by bidders do not have separate break up of prices for the E&C portion for Electrical and C&I works (i.e. the certificates enclosed are for composite order for supply and erection of Electrical and C&I and other works if any), then value of Erection & Commissioning for the Electrical and C&I portion

NOTICE INVITING TENDER

	shall be considered as 15% of the price for supply & erection of Electrical and C&I.

Note to Bidder:

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

No consortium bid is allowed for this Tender. However, for the purpose of qualification, after successful execution of two similar works in consortium with the same consortium partner(s) under direct orders from BHEL, the prime bidder in such contracts shall be eligible for becoming a standalone bidder for this tender work, subject to certification from end user / purchaser about the active involvement of the prime bidder for satisfactory execution of works in such contracts.

NOTICE INVITING TENDER

ANNEXURE - 2

CHECK LIST

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

1	Name and Address of the Tenderer		
2	Details about type of the Firm/ Company		
3a	Details of Contact person for this Tender: Name: Mr. / Ms. Designation: Telephone No: Mobile No: Fax No: E-mail ID:		
3b	Details of alternate Contact person for this Tender: Name: Mr. / Ms. Designation: Telephone No: Mobile No: Fax No: E-mail ID:		
4	EMD DETAILS (Remittance of EMD should be in line with Mode of Deposit as detailed in Volume-1A, Part-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

Tender Specification No.: BHEL: PSSR: SCT: 1848

NOTICE INVITING TENDER

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)

NOTICE INVITING TENDER

ANNEXURE-3

VOID

NOTICE INVITING TENDER

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	Remarks
1	<u>Technical B.</u>	The Bidder should have executed the Erection and Commissioning of Power Cycle piping of one unit of 400 MW or above, in the last seven years ending on the latest Date of Bid Submission. Note: The term Executed in Technical PQR means 'Steam Blowing Completion'.					
2	<u>Financial C1</u>	Turnover Bidders must have achieved an average annual financial turnover (Audited) of Rs. Rs.3,85,00,000.00 (Rs. Three Crores Eighty Five Lakhs only) or more over last three Financial Years (FY) i.e, 2015-16, 2016-17 and 2017-18.					

NOTICE INVITING TENDER

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	Remarks
3	<u>Financial C2</u>	Networth Net worth of the Bidder based on the latest Audited Accounts as furnished for 'C-1' above should be positive.					
4	<u>Financial C3</u>	Profit Bidder must have earned profit in any one of the three Financial Years as applicable in the last three Financial Years defined in 'C-1' above based on latest Audited Accounts.					
5	<u>Financial C4</u>	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.					

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

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

Tender Schedule

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

Note:

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

NOTICE INVITING TENDER

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



TECHNICAL CONDITIONS OF CONTRACT (TCC)

CONTENTS

Sl. No.	DESCRIPTION	Chapter	No. of Pages
Vol. IA	Part-I:		
1	Project Information	Chapter-I	02
2	Scope of works	Chapter-II	03
3	Facilities in the scope of Contractor / BHEL (Scope Matrix)	Chapter-III	08
4	T&Ps and MMEs to be deployed by Contractor	Chapter-IV	04
5	T&Ps and MMEs to be deployed by BHEL on sharing basis	Chapter-V	03
6	Time Schedule	Chapter-VI	02
7	Terms of Payment	Chapter-VII	03
8	Taxes and other Duties	Chapter-VIII	02
9	Bill of Quantity	Chapter-IX	09
10	General	Chapter-X	08
11	Progress of work	Chapter-XI	02
12	Foundation, Grouting and Civil works	Chapter-XII	03
13	Material Handling, Transportation and Site Storage	Chapter-XIII	03
14	Erection	Chapter-XIV	15
15	Welding, Heat Treatment and Non-Destructive Testing	Chapter-XV	10
16	Hydraulic Testing, Pre-Commissioning, Commissioning and Post Commissioning	Chapter-XVI	08
17	Painting	Chapter-XVII	03
Vol. IA	Part-II:		
1	Corrections / revisions in special conditions of contract, general conditions of contract and forms & procedures	Chapter-1	13
2	Field / Erection Welding Schedule	Chapter-2	94
3	Painting scheme	Chapter-3	2
4	Hire charges on issue of Capital Tools & Plants (Only corresponding charges)	Chapter-4	14
5	Health, Safety and Environment Plan for Site Operation By Subcontractors" (Doc. No. HSEP:14 Rev 00)	Chapter-5	72
6	Procedure 2.3 of Arbitration & Conciliation	Chapter-6	11
7	Guidelines for Welding	Chapter-7	98
8	Guidelines for Heat treatment	Chapter-8	18
9	General Guidelines for Insulation works	Chapter-9	54
10	Format for Form no.: F-14 (Rev 01); Monthly Plan & Review with Contractor	Chapter-10	5
11	Format for Form no.: F-15 (Rev 02); Monthly Performance-Evaluation of Contractor	Chapter-11	6
12	Proforma of Bank Guarantee for Earnest Money	Chapter-12	3
13	Proforma of Bank Guarantee for Security Deposit	Chapter-13	3
14	Integrity Pact (IP)	Chapter-14	5

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER-I **PROJECT INFORMATION**

1.1	Project Title	:	Ennore SEZ project of 2 x 660 MW Coal Based Super Critical Thermal Power Project at Ash Dyke of NCTPS
1.2	Plant capacity	:	1320 MW (2 units of 660 MW each)
1.3	Type of project	:	Green field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Consultant	:	DESEIN, New Delhi
1.6	Plant site location	:	Ash dyke of North Chennai Thermal Power Station (NCTPS)
1.7	Location co-ordinates	:	80° 18' E to 80° 19' E Longitude 13° 17' N to 13° 18' N Latitude
1.7	Nearest Village	:	Vayalur
1.8	Nearest Town & City	:	Chennai (35 Km)
1.9	State Capital	:	Chennai (35 Km)
1.10	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai – Vijayawada Line
1.11	Nearest Airport	:	Chennai (~ 60 Km)
1.12	Nearest Seaport	:	Ennore (~ 3 Km)
1.13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiur – Ponneri highway
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	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	32 °C
b.	Annual Minimum Mean Temperature	:	24 °C
c.	Design ambient temperature	:	35 °C

TECHNICAL CONDITIONS OF CONTRACT (TCC)

2.4	Relative Humidity		
a.	Maximum	:	100 %
b.	Minimum	:	36 %
c.	Design	:	75 %
2.5	Annual Rainfall		
	Maximum	:	2540 mm
	Average	:	1600 mm
	Minimum	:	1175 mm
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
2.8	Design ambient temperature for Electrical equipment	:	50 °C

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – II

SCOPE OF WORKS

(Applicable for Package A & Package B)

The scope of 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.)

1.2.1 The contractor's scope of work includes but not limited to:

Erection, Testing and Commissioning of Power Cycle Piping and all associated Piping & Insulation works including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints and application of refractory & insulation works as per requirement / as given in the drawings including labeling & flow direction on the piping / over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer and supply & application of final painting, etc. for Unit-1 (Package-A) & Unit-2 (Package-B) at 2X660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Tamilnadu.

1.2.2 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.

1.2.3 Receipt of materials from all the BHEL Stores and Transportation to Erection site, stacking, storage and preservation.

1.2.4 Erection and Commissioning of piping including pipes, valves, flanges, fittings, fasteners etc. as required, making the system complete in all respects.

1.2.5 Erection Testing and commissioning of CBD, IBD, and miscellaneous tanks.

1.2.6 Pre assembly, installation, testing and commissioning Trial operation of the erected equipment along with accessories.

1.2.7 Lifting, laying, bolt tensioning, bolt torque tightening, supporting and installation, pre and post weld heat treatment, inspection, non-destructive testing including radiography and hydro test, water/ steam flushing, cardboard blasting, air drying,

TECHNICAL CONDITIONS OF CONTRACT (TCC)

argon/ nitrogen purging and other testing of piping installations, above and below ground.

- 1.2.8 Fabrication and installation, setting and commissioning of pipe supports, guides, anchors and spring supports as required
- 1.2.9 Obtain necessary Statutory clearances and approvals, co-ordination with all applicable statutory / Government agencies e.g. IBR, Electrical Inspectorate, Labour Inspectorate etc.
- 1.2.10 Installation and dismantling of temporary piping.
 - 1.2.10.1 Temporary lines for chemical cleaning 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 has to be arranged by the contractor at the rates specifically quoted / accepted for this work. After the successful completion of chemical cleaning, 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.
 - 1.2.10.2 Temporary lines for Steam blowing of Power Cycle 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 has to be arranged by the contractor at the rates specifically quoted / accepted for this work. After completion of steam blowing, all the temporary lines to be dismantled and restoration of piping to be carried out, within the quoted rates.
 - 1.2.10.3 Apart of clause 1.2.10.1 & 1.2.10.2 any temporary piping to be carried for commissioning of any equipment is within the quoted rates.
- 1.2.11 Installation of any necessary blind or additional valves to isolate lines to facilitate phased commissioning and start-up
- 1.2.12 Execute all mechanical jobs identified during owner / Licensors check list, Technical audits, pre-commissioning and commissioning, including additional supports required to restrain pipe movement avoiding interference with nearby structural / piping
- 1.2.13 Installation of all valves and other miscellaneous in line / on line items is also included. Open ends of piping valves shall be protected with wooden blanking plates securely fastened with wire or by plastic insert plugs.
- 1.2.14 Cleaning, pickling, if required, water / steam flushing, air drying, disposal of fluids offsite, reinstatement, preservation of piping and miscellaneous items following

TECHNICAL CONDITIONS OF CONTRACT (TCC)

hydro test, nitrogen purging, cleaning, chemical cleaning, painting, insulation, as per specifications.

1.2.15 Insulation of TDBFP Drive turbine piping (drains, vent lines, seal steam pipelines, etc.), Heat exchangers (HP Heaters, LP Heaters, Dearator, Drain cooler, etc.), Flash tanks, MDBFP, TDBFP pumps, etc along with associated piping and insulation of all the piping covered under this scope of works are also included in the scope of this work within the quoted rates.

1.2.16 Testing of welds/ flanged joints.

1.2.17 Execute painting and labelling including supply of paints, painting of all equipments, piping (including small bore piping), and structures like platform, supports etc.

1.2.18 Preparation of As-Built Drawings.

Note to Chapter-II

- i) The following materials that will go as a part of the permanent system of the plant will be supplied by BHEL at free of any charges: Pipes, valves, flanges, fittings, fasteners.
- ii) The number of joints indicated in the welding schedules is approximate only and liable for variation, as per site conditions and also design consideration of manufacturing unit.
- iii) The welding process, weld joint and material specification indicated in the welding schedules may change to suit site requirement.
- iv) Consumables are within the scope of contractor for both temporary and main piping except those which are in BHEL scope. Please refer to SCC Rev-01- Clause 4.1.1 for further details.

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME- I A PART-I CHAPTER – III **FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL** **(SCOPE MATRIX)** **(Applicable for Package A & Package B)**

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

S.no	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
1.3.1.2.2.2	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	Calibration certificate to be provided
1.3.1.2.2.3	Duties and deposits including statutory clearances for the above		Yes	
1.3.1.2.2.4	Demobilization of the facilities after completion of works		Yes	
1.3.1.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc. on the above lines.(in case BHEL provides this facility, the scope should be given without ambiguity)		Yes	
1.3.1.3	WATER SUPPLY			
1.3.1.3.1	For construction purposes:			Chargeable basis
1.3.1.3.1.1	Making the water available at single point	Yes		Refer clause 1.3.5
1.3.1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc.			
1.3.1.3.2.1	Making the water available at single point		Yes	
1.3.1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4	LIGHTING			
1.3.1.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site /area		Yes	
1.3.1.4.2	For construction work (Execution of the lighting work / arrangements) At office storage area		Yes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

S.no	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
	At the preassembly area At the construction site /area			
1.3.1.5	COMMUNICATION FACILITIES for site operations of the bidder	-		
1.3.1.5.1	Telephone, Fax, internet, intranet, email etc.		Yes	
1.3.1.6	COMPRESSED AIR SUPPLY			
1.3.1.6.1	Supply of Compressor and all other equipment required for compressor & compressed air system including pipes, valves, storage systems etc.	-	Yes	
1.3.1.6.2	Installation of above system and operation & maintenance of the same	-	Yes	
1.3.1.6.3	Supply of the all the consumables for the above system during the contract period		Yes	
1.3.2	PART-II			
1.3.2.1	ERECTION FACILITIES			
1.3.2.1.0	Engineering works for construction			In consultation with BHEL
1.3.2.1.1	Providing the erection drawings for all the equipment 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	In consultation with BHEL
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	
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	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

S.no	Description	Scope to be taken care by		Remarks
		BHEL	Bidder	
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	For daily monitoring meeting at site
1.3.2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works 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 OPEN SPACE:

- 1.3.3.1 Minimum Open space as provided 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.

1.3.4 ELECTRICITY:

- 1.3.4.1 Construction power will be provided to the contractor at one point within plant area by BHEL on chargeable basis at the applicable rate of TANGEDCO under LT tariff VI at the nearest substation. The present LT tariff VI rate of TANGEDCO is
- Consumption charges at Rs.12.00 per unit
 - Fixed charges as applicable per month
 - Electricity Tax on total amount
- The TANGEDCO tariff and tax may vary from time to time. The required Energy meter for measuring the consumption shall be provided and installed by the contractor. Any dispute regarding consumption, the BHEL engineer's decision is final. The contractor shall make his own arrangement for further distribution

TECHNICAL CONDITIONS OF CONTRACT (TCC)

with necessary isolator/LCB etc.

- 1.3.4.1 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.
- 1.3.4.2 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.
- 1.3.4.3 The required energy meter for measuring power consumption shall be arranged and installed and taken care by the contractor.
- 1.3.4.4 Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
- 1.3.4.5 Electricity for labour colony shall be arranged by the bidder at his cost.
- 1.3.4.6 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.

1.3.5 CONSTRUCTION WATER

- 1.3.5.1 Water required for construction purposes (including Hydraulic Test) will be provided at one single point within the plant area on chargeable basis from the nearest storage tank located inside the plant area at the prevailing rates of TANGEDCO / Metro water. The required water meter for measuring the consumption shall be provided and installed by the contractor. The required pumps & accessories, pipes for drawing water from the storage tank and further distribution will be arranged by the contractor at their cost.
- 1.3.5.2 The water charges may vary from time to time as per TANGEDCO / Metro water conditions, however the prevailing water charge is Rs.174.00 per 1000 litres. Any dispute regarding consumption, the BHEL engineer decision will be final. In case of non-availability of water, the contractor shall make his own arrangements of water suitable for construction to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.
- 1.3.5.3 Incase non-availability of water, the contractor shall make his own arrangements of **water suitable for construction purpose** to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

1.3.6 DRINKING WATER

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

1.3.7 ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM [SCMS]:

Two Nos of computers and printers of latest configuration (preferably i5 processor, 8 GB Ram, 1 TB Hard disk, with internet provision on all the computers), along with one data entry operator per computer to be arranged by contractor for reporting of daily progress, billing, updating details in online SCMS package of BHEL, etc., within the quoted rate.

1.3.8 CONSUMABLES

1.3.8.1 Any special welding electrodes / consumables as provided by manufacturing units for Power Cycle Piping, will be supplied by BHEL free of cost. All other electrodes including stainless steel electrodes required shall be arranged by the contractor at his cost. The Contractor shall use the BHEL / Customer approved quality electrodes only. The utilization of the welding electrodes 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 electrodes is more than the actual requirement by improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor

1.3.8.2 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 wrap cloth, tapes, jointing compound, grease, lubricants, 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.

1.3.8.3 All consumables to be used for the job shall have to be approved by BHEL prior to use.

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

1.3.8.5 In the event of failure of contractor to bring necessary and sufficient

TECHNICAL CONDITIONS OF CONTRACT (TCC)

consumables, BHEL shall arrange for the same at the risk and cost of the contractor. The entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.

1.3.9 GASES

- 1.3.9.1 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.
- 1.3.9.2 BHEL reserves the right to reject the use of any gas in case required purity is not maintained.
- 1.3.9.3 The contractor shall submit weekly/ fortnightly/ monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.3.9.4 The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.

1.3.10 ELECTRODES SUPPLY AND STORAGE

- 1.3.10.1 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.
- 1.3.10.2 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.
- 1.3.10.3 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.
- 1.3.10.4 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.
- 1.3.10.5 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.
- 1.3.10.6 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

type of electrodes etc. It shall be the responsibility of the contractor to replace at his cost without loss of time.

1.3.11 MATERIAL SUPPLY

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.

1.3.12 POSSESSION OF GENERATORS

As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the tenderer / contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have at least 2 diesel operated welding generator sets to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting.

1.3.13 LIGHTING FACILITY

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

1.3.14 OTHER FACILITIES

Adequate water less urinals [at least 2 nos. per level] shall be arranged by the contractor within quoted rates, with proper disposal arrangement.

1.3.15 CONTRACTOR'S OBLIGATION ON COMPLETION

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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – IV **T&Ps and MMEs to be deployed by contractor** **(Applicable for Package A & Package B)**

- 1.4.1 The following minimum major Tools & Plants (T&P) shall be arranged by the Contractor within the quoted rate for execution of this contract.

Sl. No.	Description	Qty.
01	Trailer (20 T/ 30 T)	As required
02	Diesel Generator (1 or more numbers as mentioned below) providing a rated capacity of 500 KVA as standby for P91 welding	1 set **
03	Fill pump	As required
04	HT pump for hydro test (up to 50 Kg/Sq.cm) of LP piping	As required
05	Ultrasonic Hardness Testing Machine [Ultrasonic contact impedance (UCI)]	1 No

** Back-up power capacity as mentioned in Sl no 2 above can be achieved by deploying either a single DG set of 500 KVA capacity or a combination of 250 KVA or above capacity machines

- 1.4.2 All the tools and plants required for this scope of work, except the Tools & Plants provided by BHEL are to be arranged by the contractor within the quoted rates.
- 1.4.3 T&Ps mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity / numbers as mutually agreed at site for major T&Ps, have to be adhered to. Numbers / time of requirement of T&Ps will be reviewed time to time by BHEL site and contractor will provide required T&Ps / equipments to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation and certification regarding capacity etc. prior to dispatch of heavy equipments. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P's during the contract period will be mutually agreed in line with construction requirement.

1.4.4 Facility to be provided by Contractor for P 91 Welding

- 1.4.4.1 Diesel Generator, as standby supply for P 91 Welding (along with required cables, switches, fuel and operator) has to be arranged by the contractor within the quoted rates. In the eventuality of contractor not making necessary arrangements to ensure availability of DG set as per requirement at site, BHEL will arrange the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

same at the contractor's risk and cost. All the necessary certificates and licenses required to operate the DG set are to be arranged by the contractor then and there at his cost.

- 1.4.4.2 Required number of operators / Technician / Electrician for installation, Commissioning & Operating continuously.
- 1.4.4.3 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.
- 1.4.4.4 GE or Kraut Kramer or Microdur make or reputed branded ultrasonic hardness testing machine (Ultrasonic Contact Impedance (UCI))
- 1.4.4.5 MPI / LPI kits with consumables.
- 1.4.4.6 Only One set of Annealing cable will be supplied by BHEL irrespective of number of Induction Heating Equipment deployed by BHEL. Additional sets of annealing cables have to be arranged by the contractor within the quoted rates.
- 1.4.4.7 Gas Burners arrangement with required gas for maintaining temperature in the event of power failure.
- 1.4.4.8 Digital Temperature Indicator.
- 1.4.4.9 Consumables
 - i). Glass Fibre Cloth -1mmx1000mm–Temp Rating 1260°C.
 - ii). Glass fibre cord Dia 3mm (twisted)- Temp Rating 1260°C.
 - iii). Ceramic Fibre Blanket -RT Grade, density 96 kg/m³ –Temperature rating 1260°C.
 - iv). Ceramic fibre rope- Fibre Glass Braided, Dia 12 mm –Temperature rating 1260°C.
 - v). K Type Thermocouple- 0.5 mm Dia Single Strand individual fibre glass insulated.
 - vi). Heavy Duty TC connectors for K Type Thermocouple.
 - vii). All other consumables / equipment to carry out the work.
- 1.4.5 The contractor to furnish a list of Tools and plants including cranes, tractors / trailers / trucks etc. which contractor proposed to deploy for this work.
- 1.4.6 Fill pumps shall be arranged by the contractor, wherever required.
- 1.4.7 For testing LP lines necessary Hydraulic Test pumps/ Hand pumps are to be arranged by the contractor.
- 1.4.8 For handling at store and transportation, contractor shall make his own arrangement.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.4.9 For transportation, material handling, loading & unloading of all components / equipments, 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. All necessary T&P such as, Trailers, Cranes Winches, Welding generators, Slings, Jacks, Sleepers, Rails etc. are to be arranged by the contractor.
- 1.4.10 All the T & P, lifting tackles including wire ropes, slings, shackles and electrically operated equipment shall be got approved by BHEL Engineer before they are actually put on use. Test certificates obtained from the statutory authority should be submitted before their usage.
- 1.4.11 **Required HYDRA / Crane for completion of piping system has to be arranged by contractor.** The age of the contractor deployed cranes upto 150 T 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.
- 1.4.12 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-4 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).
- 1.4.13 All the T & P arranged by contractor including electrical connections wherein required shall be reliable / proven / tested with necessary test certificate.
- 1.4.14 All instruments, measuring tools etc. are to be calibrated periodically as per the requirement of BHEL and necessary calibration certificates are to be submitted to BHEL before use.
- 1.4.15 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.4.16 Also Refer clause no 1.5.6 to 1.5.8 in connection with BHEL T&Ps in chapter V of this booklet.
- 1.4.17 Other Relevant clauses shall be referred in Special Conditions of Contract (SCC) published in Volume IB of Book II.
- 1.4.18 Also refer clause 1.3.7 on providing computers in chapter-III of Technical Conditions of Contract (VOLUME-IA PART- II) of this booklet.

Note to Chapter-IV :

- i) The induction heating equipment and other equipment shall be drawn from BHEL stores, transported and installed & commissioned wherever required. For routine

TECHNICAL CONDITIONS OF CONTRACT (TCC)

maintenance & attending all type of break-down maintenance, contractor shall deploy sufficient manpower, tools and plant within the quoted rate.

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - V **T&Ps and MMEs to be provided by BHEL** **(Applicable for Package A & Package B)**

- 1.5.1 List of Tools & Plants to be made available by BHEL to contractor on free of hire charges on sharable basis

Sl. No.	Description	Qty.
01	EOT Crane at TG Hall without operator	1 No.
02	Induction Heating Machines	As Required
03	Spot Welding Machine	1 No.
04	Chemical Cleaning Pumps with accessories	As Required
05	Suitable capacity Hydro Test pump for HP lines	1 No.

- 1.5.2 All the T&Ps mentioned in clause 1.5.1 above shall be issued to contractor on shareable basis and the allotment is made by BHEL on need basis for erection / pre-commissioning activities only.
- 1.5.3 Apart from the above mentioned T&Ps, any other Tools and Plants required for satisfactory completion of the work has to be arranged by the contractor.
- 1.5.4 EOT Crane – Allotment will be made only on need basis. Trained operators are to be arranged by the contractor within the quoted rates. Contractor has to plan the activities on item wise where the EOT crane is required to be used and submit to BHEL site for approval. In case the erection can be carried out by using other T&Ps, contractor shall make his own arrangement. The decision of BHEL Site I/c on this will be final and binding.
- 1.5.5 Providing manpower assistance required for free movement of trailing cable of EOT Crane is included in the scope of this contract.
- 1.5.6 BHEL will not provide crane operators for EOT cranes. Trained operators for EOT crane to be arranged by the contractor at his cost.

1.5.7 P 91 WELDING

- 1.5.7.1 Facility and Consumables to be provided by BHEL for P91 Welding free of any charges:
- Required no. of Induction heating machine.
 - Spot Welding machine for fixing thermocouple
 - Compensating cables.
 - Only One set of Annealing cable will be supplied by BHEL irrespective of number of Induction Heating Equipments deployed by BHEL.**

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Additional sets of annealing cables have to be arranged by the contractor within the quoted rates.

- e) Filler wire and Welding Electrodes for P 91 Welding as supplied by manufacturing units.
- 1.5.7.2 For P91 welding, BHEL will only provide the facility and Consumables as indicated in TCC. Other consumables and facility required to complete the work shall be arranged by the contractor with in the quoted rate.
- 1.5.8 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
- 1.5.9 Necessary electrical / water / air connection required for operation of any of the above equipment shall be Contractor's account.
- 1.5.10 The Contractor shall be responsible for the safe and proper use of the above equipment issued to his. Day-to-day maintenance and operation of equipment's shall be the contractor's responsibility and shall be as per instructions / standard practice of BHEL Engineer
- 1.5.11 In case of non-availability of the above, due to any unavoidable reason, like breakdown, overhaul etc., the contractor shall make arrangement at his own cost to meet the erection schedules. No extra claim will be admitted due to the non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.
- 1.5.12 The contractor shall return the T & P issued to him by BHEL in good working condition as and when so desired by BHEL. (Completion or reduction in work load) for diversion for other work. If such return is delayed by contractor due to his fault without written consent of BHEL, hire charges as applicable according to BHEL policy will be levied from such time it was requisitioned by BHEL to the time of actual return and the amount so decided and arrived at, will be recovered from the contractor's bill.
- 1.5.13 Contractor shall have at all times experienced operators and technicians for routine and breakdown maintenance of the equipment. Any delay in rectification of defects will warrant BHEL rectifying the defect and charging the cost to the contractor.
- 1.5.14 If at any time it is noticed that contractor is not using any of the T & P or equipment properly according to the instructions of BHEL, BHEL will have the right to withdraw any and all such equipment and any cost due to this shall be contractor's account.
- 1.5.15 All the T & P would be issued only at BHEL stores and it shall be the responsibility of the contractor to take delivery from BHEL stores, transport the same to site and return the same to BHEL stores in good condition after use.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.5.16 Contractor shall make good any loss or damage to the equipment supplied to him and day to day maintenance and operations of equipment shall be borne by the contractor including all consumables like petrol, oil and air filters etc.
- 1.5.17 Any Loss / Damage of tools by the contractor, the same shall have to be replaced by the contractor or otherwise cost thereof shall be recovered from the contractor.
- 1.5.18 Any loss / damage to any or part of the above equipment shall be to contractor's account and the expenditures on these account will be recovered from contractor's bills in case contractor fails to make good the loss

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER-VI **TIME SCHEDULE**

(Applicable for Package A & Package B)

1.6.1. TIME SCHEDULE

- 1.6.1.1. The entire work of erection, testing and commissioning of Power Cycle Piping and all associated piping, application of Insulation work including Supply & Application of Final Painting as detailed elsewhere in the Tender Specification shall be completed within **15 (Fifteen)** 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.
- 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 of the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.
- 1.6.1.4. The contractor is required to refer Form 15 in Volume-I Book-II for all the instructions to be taken immediately after receipt of LOI. Please note that the Monthly Performance Evaluation of Contractor Form -15 in the Vol 1D - Forms and Procedures is revised. For details please refer Sl.No.15 of Part-II, Chapter-1 of Technical Conditions of Contract (VOLUME-IA PART- II) of this booklet

1.6.2 COMMENCEMENT OF CONTRACT PERIOD

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

1.6.2 MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING 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:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

1.6.3.3. TENTATIVE MILESTONES:

Milestone Activity	Milestone Month
Start of Erection	1 st Month
Readiness for Boiler Light Up	7 th Month
Readiness for Steam Blowing	8 th Month
Readiness for Synchronisation	10 th Month
Readiness for Trial Operation & Full Load	12 th Month
Completion of Contractual Obligations	15 th Month

The start of work will be tentatively in September 2019.

1.6.3.4. 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 CONTRACT PERIOD

The contract period for completion of entire work under scope of each package shall be **15 (Fifteen) 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 Twenty Four (24) months for each package shall commence from the

- a) The date of handing over of the respective Unit to Customer
- or
- b) Six (06) months from completion of synchronization of the respective unit

whichever is earlier. (Provided all erection, testing, and commissioning works are completed in all respects).

1.6.6 INTERMEDIATE MILESTONES:

Sl. No.	Description	Month	Intermediate Milestone
1	Readiness for Steam Blowing	8 th Month	M1
2	Readiness for Synchronisation	10 th Month	M2

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER-VII

TERMS OF PAYMENT

(Applicable for Package A & Package B)

1.7.0 Terms of Payment

1.7.1 The progressive payment for erection, testing and commissioning on accepted price of contract value will be released as mentioned below.

1.7.2 Progressive payment against monthly running bills will be made up to 85% of the value of the erected tonnage pro rata as per Cl. 1.7.2.1 to 1.7.2.13 of the following table.

Cl. No.	Description	Piping				Insulation
		1) P 91 2) HP 3) LP 4) SS	1) H&S 2) Others	1) Tanks	1) Temp Piping Steam blowing/ Chemical cleaning	1) Fixing components 2) Mineral wool 3) Aluminum 4) Sealing compound
	Pro rata payments (85%)					
1.7.2.1	On pre assembly where ever applicable (if not applicable this portion shall be clubbed with placement in position)	20	15	-	-	-
1.7.2.2	Placement in position	20	25	-	-	50
1.7.2.3	Alignment	10	15	-	-	15
1.7.2.4	Welding/ Bolting/ Fixing	15	30	-	-	20
1.7.2.5	Completion of NDT (if not applicable , then this portion to be paid along with welding)	5	-	-	-	-
1.7.2.6	Installation of temp. piping	-	-	-	60	-
1.7.2.7	Dismantling of temp. piping, edge preparation and return to BHEL stores, area cleaning	-	-	-	25	-
1.7.2.8	Hangers & Supports etc. wherever necessary as per drawing	10	-	-	-	-
1.7.2.9	Hydraulic test / Pneumatic test	3	-	-	-	-

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Cl. No.	Description	Piping				Insulation
		1) P 91 2) HP 3) LP 4) SS	1) H&S 2) Others	1) Tanks	1) Temp Piping Steam blowing/ Chemical cleaning	1) Fixing components 2) Mineral wool 3) Aluminum 4) Sealing compound
1.7.2.10	Floating of lines, final adjustment of supports for cold & hot values (if not applicable, this portion to be clubbed along with hydraulic test/ pneumatic test)	2	-	-	-	-
1.7.2.11	Erection of tanks and vent silencers	-	-	30	-	-
1.7.2.12	Alignment of tanks & vent , silencers and their associated approach plat form with ladders etc.	-	-	40	-	-
1.7.2.13	Testing & commissioning of Tanks & Vent silencers	-	-	15	-	-
	Total for pro rata payments (85%)	85	85	85	85	85

1.7.3 Further 15% payment on pro-rata basis common to all PG shall be released on achievement of the following stage/mile stones events (as per the following table) for the tonnage erected

Cl. No.	Description	Piping				Insulation
		1) P 91 2) HP 3) LP 4) SS	1) H&S 2) Others	1) Tanks	1) Temp Piping Steam blowing/ Chemical cleaning	1) Fixing components 2) Mineral wool 3) Aluminum 4) Sealing compound
	Stage/ Milestone payments (15%)					
1.7.3.1	Boiler light up	1	1	1	-	1
1.7.3.2	ABO/Chemical cleaning	1	1	-	-	1
1.7.3.3	Steam blowing	1	1	2	-	1
1.7.3.4	Safety Valve Floating	1	1	1	-	1
1.7.3.5	Rolling and synchronization	-	1	2	-	-
1.7.3.6	Coal firing	-	1	1	-	1

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Cl. No.	Description	Piping				Insulation
		1) P 91 2) HP 3) LP 4) SS	1) H&S 2) Others	1) Tanks	1) Temp Piping Steam blowing/ Chemical cleaning	1) Fixing components 2) Mineral wool 3) Aluminum 4) Sealing compound
1.7.3.7	Full load	1	1	1	-	1
1.7.3.8	Trial operation of Unit	2	2	1	-	2
1.7.3.9	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	2	-	1	-	-
1.7.3.10	Painting	2	1	2	-	-
1.7.3.11	Area cleaning, temporary structures cutting/removal and return of scrap	1	2	-	-	3
1.7.3.12	Punch list points/pending points liquidation	1	1	1	-	1
1.7.3.13	Submission of as built drawings	-	-	-	-	-
1.7.3.14	Material reconciliation	1	1	1	15	2
1.7.3.15	Completion of contractual obligation	1	1	1	-	1
	Total for stage/ milestone payments (15%)	15	15	15	15	15

1.7.4 Extra work rates for welding:

If the total no of equivalent joints in each category exceeds 25% of the total equated joints in that category contractor extra as per the rate indicated below:

- a) One extra equated joint (CS)= Rs. 254.00
- b) One extra equated joint (AS)= Rs. 561.00.

NDT and SR if applicable shall be carried out by the contractor within these rates.

Notes to Terms of payment:

Please Refer Part-II, Chapter-1 of Technical Conditions of Contract for PVC, ORC, RA Bill Payment, Performance Security Deposit.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER VIII **TAXES AND OTHER DUTIES** **(Applicable for Package A & Package B)**

1.8.1 Goods and Service Tax (GST) & Cess

- 1.8.1.1 The successful bidder shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work.
- 1.8.1.2 Contractor's price/rates shall be exclusive of GST & Cess (if applicable) (herein after termed as GST). Contractor shall submit to BHEL the GST compliant tax invoice/debit note/revised tax invoice on the basis of which BHEL will claim the input tax credit in its return. Since this is a works contract, the applicable rate shall be @ 18% GST, as applicable presently.
- 1.8.1.3 Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules wherein the 'Bill To' details will be as below:
BHEL GSTN - 33AAACB4146P2ZL,
NAME - BHARAT HEAVY ELECTRICALS LIMITED,
ADDRESS - BHEL SITE OFFICE, 2 X 660 MW ENNORE SEZ STPP, VAYALUR
BR PO, MINJUR PO, TAMILNADU – 601203
- 1.8.1.4 GST charged in the tax invoice/debit note/revised tax invoice by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return.
- 1.8.1.5 In case BHEL has to incur any liability (like interest / penalty etc.) due to denial/reversal / delay of input tax credit in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.
- 1.8.1.6 Further, in case BHEL is deprived of the Input tax credit due to any reason attributable to contractor, the same shall not be paid or Recovered if already paid to the contractor.
- 1.8.1.7 Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

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

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

1.8.2 All taxes and duty other than GST & Cess

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

1.8.3 Statutory Variations

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

1.8.4 New Taxes/Levies –

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

1.8.5 Direct Tax

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART – I CHAPTER - IX BILL OF QUANTITY (BOQ) (Applicable for Package A & Package B)

1.9.1 Tentative Weight Schedule- Summary: -

Sl No.	Description	Weight [MT]	Ref. No. in Price Bid
1	P91 Piping	734.765	1A
2	HP Piping	1496.582	1B
3	LP Piping	604.691	1C
4	SS Piping	13.391	1D
5	Hangers and Supports including Tanks, Vessels, Pumps etc	750.053	1E
6	Temporary Piping - Acid Cleaning	124.016	2A
7	Temporary Piping - Steam Blowing	117.152	2B
8	Fixing Components	33.797	3A
9	Mineral Wool	449.809	3B
10	Aluminium Sheets	109.306	3C
Total Weight of Insulation in MT		4433.562	

1.9.2 Tentative Weight Schedule- Detailed: -

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80300	MS FROM SUPERHEATER TO BOILER STOP VALVE	54.625	P91 PIPING	1A
80301	MS FROM BOILER STOP VALVE TO ESV	240.757	P91 PIPING	1A
80303	MS HEADER TO AUX PRDS	4.438	P91 PIPING	1A
80304	MS HEADER TO HPBP VALVE	23.092	P91 PIPING	1A
80307	HP AND LP BYPASS WARM UP	0.136	P91 PIPING	1A
80310	HRH FROM REHEATER TO INTERCEPTOR VALVE	335.557	P91 PIPING	1A
80312	LPBP VALVE UPSTREAM AND DOWNSTREAM	71.767	P91 PIPING	1A
80913	POWER CYCLE PIPING VALVES	1.194	P91 PIPING	1A
80914	ROOT VALVES	1.489	P91 PIPING	1A
80919	TURBINE INTEGRAL PIPING VALVES	1.710	P91 PIPING	1A
	TOTAL (P91 PIPING)	734.765		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80320	CRH FROM TURBINE TO REHEATER	188.453	HP PIPING	1B
80321	HPBP VALVE TO CRH PIPING	11.620	HP PIPING	1B
80322	CRH PIPING TO DEAERATING HEATER	10.177	HP PIPING	1B
80323	STEAM TO BFP DRIVE TURBINE	7.894	HP PIPING	1B
80324	CRH HEADER TO AUX.PRDS	0.749	HP PIPING	1B
80329	EXTRACTION STEAM TO BFP DRIVE TURBINE	14.641	HP PIPING	1B
80331	EXTRACTION STEAM TO LP HEATER-2	8.866	HP PIPING	1B
80332	EXTRACTION STEAM TO LP HEATER-3	6.916	HP PIPING	1B
80334	EXTRACTION STEAM TO LP HEATER-4	10.997	HP PIPING	1B
80335	EXTRACTION STEAM TO DEAERATING HEATER	15.549	HP PIPING	1B
80336	EXTRACTION STEAM TO HP HEATER NO.1	3.131	HP PIPING	1B
80337	EXTRACTION STEAM TO HP HEATER-2	3.988	HP PIPING	1B
80338	EXTRACTION STEAM TO HP HEATER-3	5.017	HP PIPING	1B
80339	AUX STEAM TO BFD TURBINE	3.565	HP PIPING	1B
80340	AUX STEAM HEADER	5.018	HP PIPING	1B
80341	AUX STEAM HEADER INTERCONN BETWEEN UNITS	7.051	HP PIPING	1B
80342	AUX STEAM TO SCAPH	11.191	HP PIPING	1B
80343	AUX STEAM TO AH SOOT BLOWERS	5.109	HP PIPING	1B
80344	AUX STEAM TO FO SYSTEM TP	33.742	HP PIPING	1B
80345	AUX STEAM TO DEAERATING HEATER	5.623	HP PIPING	1B
80349	AUX STEAM TO GLAND SEALS - TG SCOPE	0.741	HP PIPING	1B
80351	AUX STEAM TO UNLISTED USERS - SG SCOPE	19.532	HP PIPING	1B
80395	AUX STEAM TO FUEL OIL ATOMISING	0.254	HP PIPING	1B

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80418	ERECTION MATERIALS FOR INSTRUMENTS	0.509	HP PIPING	1B
80419	DEAERATOR SAFETY VALVE EXHAUST TO ATM	5.211	HP PIPING	1B
80420	BOILER FEED PUMP SUCTION	24.680	HP PIPING	1B
80421	BOILER FEED PUMP RECIRCULATION	43.059	HP PIPING	1B
80423	BOILER FEED PUMP TO HPH INCLUDING BYPASS	233.922	HP PIPING	1B
80424	BFD BETWEEN HTRS AND GROUP PROTECTION	126.403	HP PIPING	1B
80425	BFD FROM FINAL HPH TO SG TP	87.350	HP PIPING	1B
80430	SPRAY WATER TO HPBP	8.856	HP PIPING	1B
80431	SPRAY WATER TO AUX PRDS	0.915	HP PIPING	1B
80433	SPRAY WATER FROM BFP INTERSTAGE	20.418	HP PIPING	1B
80451	BOILER INTEGRAL PIPING DRAINS	14.362	HP PIPING	1B
80452	HP PIPING DRAINS - SG SCOPE	42.859	HP PIPING	1B
80454	SCAPH DRAINS	1.815	HP PIPING	1B
80650	FUEL OIL SUPPLY AND RETURN PIPING	58.875	HP PIPING	1B
80901	SUB DELIVERY VALVES FOR LIGHT UP	9.822	HP PIPING	1B
80992	IMPORTED ELECTRODES	12.170	HP PIPING	1B
80993	MISC ERECTION MATLS	0.455	HP PIPING	1B
XXX	ME BELLOWS, STEAM TRAPS	41.200	HP PIPING	1B
XXX	AUXILIARY PRDS SYSTEM	2.900	HP PIPING	1B
80277	LOW PRESSURE PIPING VALVES	26.717	HP PIPING	1B
80279	BFP DRIVE TURBINE INTEGRAL SYSTEM VALVES	3.849	HP PIPING	1B
80290	AUXILIARY BOILER PIPING VALVES	4.287	HP PIPING	1B
80905	SG INTEGRAL PIPING VALVES	17.043	HP PIPING	1B
80913	POWER CYCLE PIPING VALVES	269.270	HP PIPING	1B
80914	ROOT VALVES	2.856	HP PIPING	1B
80917	ACID CLEANING VALVES	19.838	HP PIPING	1B

Tender Specification No. BHEL: PSSR: SCT: 1848

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80918	QCNRV (EXTRACTION LINE NRVs)/CRHNRV	30.070	HP PIPING	1B
80919	TURBINE INTEGRAL PIPING VALVES	7.049	HP PIPING	1B
	TOTAL (HP PIPING)	1496.582		
80363	EXHAUST STEAM FROM PRIME MOVERS-TG SCOPE	35.415	LP PIPING	1C
80371	DRAIN FLASH TANK VENT TO CONDENSER	3.085	LP PIPING	1C
80373	AUX STEAM HEADER SV EXHAUST	5.853	LP PIPING	1C
80375	UNLISTED SV EXHAUSTS - TG SCOPE	4.234	LP PIPING	1C
80379	HPH SV EXHAUST TO FLASH TANK	5.448	LP PIPING	1C
80381	HP HEATER VENTS - TG SCOPE	2.113	LP PIPING	1C
80382	LP HEATER VENTS	2.041	LP PIPING	1C
80385	VENT FROM UNLISTED PPG/EQPT TO COND	8.520	LP PIPING	1C
80388	CONDENSER AIR EVACUATION PIPING	4.045	LP PIPING	1C
80400	CONDENSATE SUCTION	10.764	LP PIPING	1C
80401	CD FROM PUMP TO LPH1/DC INLET TEE AND RE	35.983	LP PIPING	1C
80402	CD FROM LPH1/DC INLET TEE TO TG TP	25.622	LP PIPING	1C
80403	CD FROM TG TP TO DEAERATING HEATER	14.558	LP PIPING	1C
80407	CONDENSATE FOR SEALING OF VACUUM	3.158	LP PIPING	1C
80408	CONDENSATE DUMP FROM HEADER	2.835	LP PIPING	1C
80436	SPRAY WATER TO LPBP DESH	4.322	LP PIPING	1C
80439	TURBINE FLASH TANK DRAIN TO CONDENSER	0.250	LP PIPING	1C
80442	GLAND STEAM COOLER DRAINS	0.540	LP PIPING	1C
80443	LP HEATER-1 TO CONDENSER	9.756	LP PIPING	1C

Tender Specification No. BHEL: PSSR: SCT: 1848

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80444	LP HEATER-2/3/4/5 DRAINS AND DRIP PUMP I	12.716	LP PIPING	1C
80446	DEAERATING HEATER OVER FLOW AND DRAIN	3.971	LP PIPING	1C
80447	HP HEATER DRAINS	23.486	LP PIPING	1C
80448	DRAIN FROM UNLISTED EQPT/VESSEL-TG SCOPE	0.692	LP PIPING	1C
80449	TG CYCLE PIPING DRAINS AND VENTS	14.342	LP PIPING	1C
80453	LP PIPING DRAINS - SG SCOPE	26.548	LP PIPING	1C
80455	DRAIN FROM UNLISTED EQPT/VESSEL-SG SCOPE	21.062	LP PIPING	1C
80457	MANIFOLDS FOR HP FLASH BOX AND CONDENS	0.970	LP PIPING	1C
80459	HP FLASH TANK DRAIN TO CONDENSER	2.175	LP PIPING	1C
80460	SG AUX COOLING WATER UNIT SYSTEM	48.767	LP PIPING	1C
80463	TG AUX COOLING WATER	84.667	LP PIPING	1C
80471	BOILER WATER WASH TO AND FROM UNIT	19.553	LP PIPING	1C
80477	SERVICE WATER PIPING	16.310	LP PIPING	1C
80478	DRINKING WATER PPG	4.763	LP PIPING	1C
80480	FIRE WATER-OTHER AREAS	29.082	LP PIPING	1C
80493	HP FLASH TANK VENT TO CONDENSER	1.963	LP PIPING	1C
80494	LP FLASH TANK VENT TO CONDENSER	3.654	LP PIPING	1C
80495	LP FLASH TANK DRAIN TO COND	2.600	LP PIPING	1C
80545	LP CONDENSATE PIPING WITHIN TG HALL FOR	11.530	LP PIPING	1C
80610	SERVICE AIR-COMP SUCT AND DIS TO RECEI	12.330	LP PIPING	1C
80612	SERVICE AIR FOR INDIVIDUAL UNITS	27.533	LP PIPING	1C
80614	INST AIR COMP SUC AND DIS TO RECEIVER	14.532	LP PIPING	1C

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80616	INSTRUMENT AIR FOR INDIVIDUAL UNIT	29.036	LP PIPING	1C
80673	LUBE OIL PIPING SYSTEM	11.897	LP PIPING	1C
81415	TEST THERMOWELLS	0.542	LP PIPING	1C
81416	PERFORMANCE GUARANTEE TEST MATERIALS	1.426	LP PIPING	1C
	TOTAL (LP PIPING)	604.691		
80412	CONDENSATE TRANSFER	1.161	SS PIPING	1D
80473	DEMINERALISED WATER SYSTEM	5.346	SS PIPING	1D
80601	LOW PRESSURE DOSING PIPING	1.812	SS PIPING	1D
80277	LOW PRESSURE PIPING VALVES	0.267	SS PIPING	1D
80290	AUXILIARY BOILER PIPING VALVES	0.434	SS PIPING	1D
80905	SG INTEGRAL PIPING VALVES	0.011	SS PIPING	1D
80913	POWER CYCLE PIPING VALVES	3.769	SS PIPING	1D
80914	ROOT VALVES	0.572	SS PIPING	1D
80918	QCNRV (EXTRACTION LINE NRVs)/CRHNRV	0.006	SS PIPING	1D
80919	TURBINE INTEGRAL PIPING VALVES	0.012	SS PIPING	1D
	TOTAL (SS PIPING)	13.391		
80830	H AND S OF CRITICAL PIPING FOR SB - STEA	224.730	H&S/ TANKS/ VESSELS	1E
80920	H AND S FOR HYDRO TEST	7.895	H&S/ TANKS/ VESSELS	1E
80921	H AND S FOR LIGHT UP STEAM LINE	65.900	H&S/ TANKS/ VESSELS	1E
80928	H AND S FOR BOILER LIGHT UP - TG	37.885	H&S/ TANKS/ VESSELS	1E
80930	H AND S FOR SYNCHRONISATION - TG	136.117	H&S/ TANKS/ VESSELS	1E
80933	H AND S FOR LP PIPING	68.915	H&S/ TANKS/ VESSELS	1E
80935	VLH & CLH for MS PIPING upto MSV	1.000	H&S/ TANKS/ VESSELS	1E

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
80936	VLH & CLH for SG PIPING	4.000	H&S/ TANKS/ VESSELS	1E
80937	VLH & CLH for Critical PIPING	7.000	H&S/ TANKS/ VESSELS	1E
80940	AUX STRUCTURE FOR CRITICAL PIPING-SG	145.175	H&S/ TANKS/ VESSELS	1E
80941	VLH & CLH for BFD PIPING	11.000	H&S/ TANKS/ VESSELS	1E
80942	VLH & CLH for TG cycle PIPING	21.000	H&S/ TANKS/ VESSELS	1E
81041	IMPURE CONDENSATE TANK	4.046	H&S/ TANKS/ VESSELS	1E
81100	CONDENSATE PUMP	3.000	H&S/ TANKS/ VESSELS	1E
81110	COOLING WATER PUMP	0.400	H&S/ TANKS/ VESSELS	1E
81411	DIRECT GAUGES FOR STEAM LINES	1.395	H&S/ TANKS/ VESSELS	1E
81412	DIRECT GAUGES FOR NON-STEAM LINES	0.797	H&S/ TANKS/ VESSELS	1E
81417	INSTRUMENTATION FOR STARTUP SYSTEM	0.200	H&S/ TANKS/ VESSELS	1E
XXX	LUBE OIL PUMPS & MOTORS WITH DUPLEX STRAINERS	0.600	H&S/ TANKS/ VESSELS	1E
XXX	CLEAN OIL TANK / DIRTY OIL TANK	8.400	H&S/ TANKS/ VESSELS	1E
XXX	OIL UNLOADING VESSEL	0.600	H&S/ TANKS/ VESSELS	1E
	TOTAL (H&S/ TANKS/ VESSELS)	750.053		
80604	ACID CLEANING PIPING-TEMPORARY	87.607	TP1	2A
80926	H AND S OF ACID CLEANING PIPING	36.409	TP1	2A
	TOTAL (TP1)	124.016		
80399	STEAM BLOWING PIPING-TEMPORARY	107.563	TP2	2B
80927	H AND S FOR TEMPORARY PIPING - STEAM BLO	9.590	TP2	2B
	TOTAL (TP2)	117.152		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

PGMA	DESCRIPTION	APPROX WEIGHT (MT)	CATEGORY	RATE SCHEDULE ID
81318	FIX COM FOR MISCELLANEOUS PPG INSULATION	7.197	INS-IRON	3A
XXX	PPG INSULATION - ANCILLARY MATERIALS	24.500	INS-IRON	3A
XXX	EQPT INSULATION - ANCILLARY MATERIALS	2.100	INS-IRON	3A
	TOTAL (INS-IRON)	33.797		
81325	MINERAL WOOL MATTRESS	63.809	INS-WOOL	3B
XXX	INSULATION COMPONENTS FOR DRIVE TURBINE PIPING	3.600	INS-WOOL	3B
XXX	PPG INSULATION - MINERAL WOOL MATTRESS	371.400	INS-WOOL	3B
XXX	EQPT INSULATION - MINERAL WOOL MATTRESS	11.000	INS-WOOL	3B
	TOTAL (INS-WOOL)	449.809		
81341	SEALING COMPOUND FOR INSL	0.440	INS-ALU	3C
81350	ALUMINIUM CLADDING FOR INSULATION	31.866	INS-ALU	3C
XXX	PPG INSULATION - ALUMINIUM SHEET	71.000	INS-ALU	3C
XXX	EQPT INSULATION - ALUMINIUM SHEET	6.000	INS-ALU	3C
	TOTAL (INS-ALU)	109.306		

Note to weight schedule :

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 to the contractor for the tonnage actually erected at the respective category as per the quoted / accepted rate. Quantity Variation will be dealt as per clause 2.14 of General Conditions of Contract (Volume I Book II).
2	There may be variation or addition of PGMA's, description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted/accepted rate in the respective category.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

3	The temporary piping for Chemical Cleaning & Steam Blowing will be issued as and where conditions in cut pieces. The scope includes cutting and edge preparation and erection as per the site condition & dismantling after the process is over and return to store with identification mark as instructed by the BHEL/Engineer. The quoted rate shall be inclusive of all this.
4	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, steam blowing, etc. are covered in this contract and shall be carried out as a part of work. There will not be any separate payment for this works.
5	Also refer Erection welding schedule in Chapter 2 of part II of Technical Conditions of Contract (Volume-I Book-I)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - X **GENERAL**

(Applicable for Package A & Package B)

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

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

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

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

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

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

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

1.10.3.1 BOCW Act & BOCW Welfare Cess Act

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

- a) Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.–NTPC, NTPL etc.
- b) Inspector of Factories 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

- 1.10.3.1.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.
- 1.10.3.1.5 Contractor shall make remittance of the BOCW cess as per the Act in consultation with BHEL as per the rates in force (presently 1%) BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the Fee paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.
- 1.10.3.1.6 Non-compliance to provisions of the BOCW Act and BOCW welfare Cess Act is not acceptable. BHEL reserves the right to withhold any sum it deems fit. Only upon total compliance to the BOCW Act and also discharge of total payment of Cess under the BOCW Cess act by the contractor, BHEL shall consider refund of the amounts.

1.10.3.2 PROVIDENT FUND

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

1.10.3.3 OTHER STATUTORY REQUIREMENTS

- 1.10.3.3.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no along with the first running bill.
- 1.10.3.3.2 The contractor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

- 1.10.3.3.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of “Non-compliance of Sec 21 or non-payment of wages” to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
- 1.10.3.3.4 The Contractor shall submit copies of Final Settlement statement of disbursement of retrenchment benefits on retrenchment of each workman under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with Copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (If applicable) to BHEL along with the Final Bill.
- 1.10.3.3.5 In case of any dispute pending before the appropriate authority under I D Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserves 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 The work shall be executed under the usual conditions existing in major power plant construction, without affecting power plant construction and in conjunction with other numerous operations and contracting agencies at site. The bidder and his personnel shall co-operate with the personnel of other agencies, co-

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

- 1.10.4.2 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
- 1.10.4.3 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.
- 1.10.4.4 Contractor shall erect all items / materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials / work fronts etc will decide the sequence of erection / commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection / commissioning adopted in erection / commissioning of similar job or for any reasons whatsoever.
- 1.10.4.5 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.
- 1.10.4.6 After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in a packed condition to BHEL stores / Customer stores. In case of any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.
- 1.10.4.7 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
- 1.10.4.8 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However completion time for erection agreed will be subject to the condition that contractor's work is not hampered by the agencies.
- 1.10.4.9 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 milestones are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.4.10 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the sit premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.
- 1.10.4.11 Contractor shall remove all scrap materials periodically generated from his working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor.
- 1.10.4.12 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.
- 1.10.4.13 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. 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.
- 1.10.4.14 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess draws at the rate prescribed by manufacturing units.
- 1.10.4.15 No member of the already erected structure / platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 1.10.4.16 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9001 – 2015 Standards.
- 1.10.4.17 For other agencies, such as Boiler, ESP, Turbine, Electrical, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope, Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.10.4.18 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 1.10.4.19 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.
- 1.10.4.20 It is the responsibility of the contractor to do the alignment, checking, etc. if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 1.10.4.21 The contractor shall submit a copy of license to undertake construction of Boilers & Piping issued by Boiler inspectorate before commencement of Pressure Parts / Piping Erection.
- 1.10.4.22 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 his cost.
- 1.10.4.23 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.
- 1.10.4.24 All the equipments / material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect.
- 1.10.4.25 The contractor shall 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.
- 1.10.4.26 Contractor shall retain all T&P / Testing instrument / Material handling equipments etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.
- 1.10.4.27 **SITE INSPECTION:**
 - 1.10.4.27.1 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 such duplication of inspection of work be entertained.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

1.10.4.27.3 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.

1.10.4.28 DOCUMENTATION

1.8.1.1.1 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.

1.8.1.1.2 Welder's performance record shall be furnished every month. The performance report of welders shall be indicating the percentage of repair for each welder.

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

1.10.4.29 AS BUILT DRAWINGS:

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

1.10.4.29.2 After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – XI

PROGRESS OF WORK

(Applicable for Package A & Package B)

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

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

- 1.11.1 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.
- 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 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
- 1.11.4 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.
- 1.11.5 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.
- 1.11.6 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details :-
 - a. Progress photographs in colour.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- b. Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
 - c. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan
 - d. Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operations and helpers. Data shall be split up under the work areas like Piping, Insulation 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.
- 1.11.7 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 1.11.8 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 1.11.9 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - XII

FOUNDATIONS, GROUTING AND CIVIL WORKS

(Applicable for Package A & Package B)

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

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

- 1.12.1 Foundation for the equipments to be erected shall be provided by BHEL / clients of BHEL. The dimensions of the foundations and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipments / plants shall be carried out by the contractor.
- 1.12.2 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., dewatering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form / shuttering work are within the scope this work.
- 1.12.3 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates / shims, and may be required for the erection of the equipment / plants will have to be carried out by the contractor without extra cost
- 1.12.4 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments / equipments based on the foundations including shear lug provisions / openings.
- 1.12.5 Foundation pockets are to be cleaned thoroughly before placing the supports / columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
- 1.12.6 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.12.7 Non shrink cementitious flowable grout shall be used for grouting of pockets and under pinning work below base plate of columns. Nominal thickness of grout shall be 50 mm. Non shrink cum plasticizer admixture shall be added in the grout. Crushing strength of the grout shall be generally be one grade higher than that of the base concrete. Minimum grade of grout shall be M30.
- 1.12.8 However, for Equipment Foundations, high strength (Minimum Characteristic Compressive Strength of 60 N/mm² at 28 days) ready mixed non-shrink, Chloride free, Cement based, free flowing, non-metallic grout as recommended by Equipment manufacturer shall be used. The ready mix grout shall be of reputed make as approved by the customer. Total grouting of the columns/equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column / equipments is in the scope of the contractor. The quoted rate shall inclusive of the same.
- 1.12.9 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.
- 1.12.10 All equipment bases and structural steel bases and foundations pockets shall be grouted and finished as per the 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.
- 1.12.11 The certificates of the grout is to be submitted 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.
- 1.12.12 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.
- 1.12.13 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.12.14 Providing & grouting of pocket holes, pipe sleeves and under base plate of structural steel work/ machinery/ pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. all complete with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture. Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade).
- 1.12.15 The contractor at his cost shall arrange for grouting of anchor points of T & P issued to him and also grouting of winches or any other supports required for T & Ps. Necessary grout materials are to be arranged by the contractor at his cost.
- 1.12.16 Total grouting of the columns/equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column/equipments is in the scope of the contractor. All the grouting Piping should be carried out by non-shrink cement like Conbextra GPI / Conbextra GP II of 'FOSROC' make / Shrinkkomp or its equivalent etc . This special non-shrink cement shall be arranged by the contractor at his cost. Premixed grout of above mentioned non-shrink cement of crushing strength 650kg/sq cm for major equipment foundation and 450 kg/sq cm for other foundation where concrete grade M30 or higher is provided. The quoted rate shall be inclusive of the same.

1.12.17 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER - XIII

MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

(Applicable for Package A & Package B)

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

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

- 1.13.1 While BHEL will endeavour to store / stack / identify materials properly in their open / closed storage yard / shed it shall be contractor's responsibility to assist BHEL in identifying materials well in time for erection, taking delivery of the same in time following the procedure indicated by BHEL and transport the material safely to pre-assembly yard / erection site in time according to program.
- 1.13.2 The contractor shall identify necessary supervisor / labour for the above work in sufficient quantity as may be needed by BHEL for areas covering their scope.
- 1.13.3 It shall be contractor's responsibility to arrange necessary tractors, trailer or trucks / slings / tools and tackles / labour including operators Fuel lubricants etc., for loading from storage yard and on to transport equipment, move it to erection site/pre-assembly yard and unload the same at pre-assembly yard/ erection site and the quoted rate shall include the same.
- 1.13.4 Any loss / damage to materials issued to contractor shall be made good by him or BHEL will arrange for replacement at cost recovery basis and decision of BHEL shall be final.
- 1.13.5 All welding filler wires / electrodes is issued to contractor shall be preserved by him carefully to prevent deterioration of their properties. Special care shall be taken to preserve alloy steel and other special electrodes / filler wires. Contractors shall exercise maximum care in using these electrodes, filler wires to minimize wastage by maintaining a record of all usages.
- 1.13.6 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.
- 1.13.7 All the surplus damaged, unused materials, package materials / containers / special transporting frames, gunny bags etc. supplied by BHEL shall be returned to the BHEL Stores by the contractor and maintain records.
- 1.13.8 The contractor shall take delivery of the components and equipments and special consumables from the storage area after getting the approval of the BHEL Engineer on standard indent forms to be specified by BHEL. At periodic / intervals of work, complete and detailed account of the equipment so erected and electrodes used shall be submitted to the BHEL Engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.13.9 The Contractor shall have total responsibility for all equipment and materials in his custody, stores, loose, semi-assembled, assembled or erected by him at site.
- 1.13.10 The contractor shall make suitable security arrangement including employment of security personnel to ensure the protection of all materials / equipments and works from theft, fire, pilferage and any other damage and loss.
- 1.13.11 The contractor shall ensure that the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are installed.
- 1.13.12 All equipments shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc. shall be used for unloading and / or handling of the equipments without the specific written permission of the Engineer. The equipments from the storage yard shall be moved to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage for such equipments at site.
- 1.13.13 The contractor shall take all reasonable care to protect the materials and work till such time the erected equipment has been taken over by BHEL/their client. Wherever necessary suitable temporary fencing and lighting shall have to be provided by the contractor as a safety measure against accident and damage of property of BHEL. Suitable caution notices shall be displayed where access to any part may be deemed to be unsafe and hazardous.
- 1.13.14 The contractor shall take delivery of equipment from BHEL / Customer stores and storage yard. He shall also make arrangements for verification of equipment, scrupulously maintain records and keep safe custody watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by BHEL's client. The stolen / lost / damaged goods shall have to be made good by the contractor at his own cost.
- 1.13.15 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / pre assembly area / working area of equipment, placement on respective foundation / location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks/ slings/ tools and tackles / labour including operators, fuel, lubricants etc. for loading & unloading of materials will be in the scope of contractor.
- 1.13.16 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, sandbags which are required for temporary supporting of the components at their stores at site.
- 1.13.17 Sometimes it may become necessary for the contractor to handle certain unrequired components in order to take out the required materials. The contractor

TECHNICAL CONDITIONS OF CONTRACT (TCC)

has to take this contingency also into account. No extra payment is payable for such contingencies.

- 1.13.18 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.
- 1.13.19 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.
- 1.13.20 Contractor has to arrange required fire retardant covering materials (tarpaulins) to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
- 1.13.21 Any fittings such as thermowell plugs, radiography plugs which has been assembled and despatched as a single Despatchable Unit (DU) shall be checked before drawing materials from BHEL Stores. If any such attachments / fittings is found missing the same shall be intimated to concern BHEL Officials and recorded before drawing materials. It shall be the contractor responsibility to safeguard such attachments / fittings. If lost at contractor custody, the same shall be arranged by the contractor else BHEL shall arrange at the cost of contractor.
- 1.13.22 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.
- 1.13.23 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. 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – XIV **ERECTION** **(Applicable for Package A & Package B)**

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

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

1.14.1 COMMON TO PIPING AND INSULATION

- 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 work covered under this scope of work is of highly sophisticated nature requiring best quality / precision workmanship engineering and construction management. He should also ensure successful and timely commercial operation of equipment installed. The contractor must have adequate quantity of precision tools, construction aids in possession. Contractor must also have adequate trained qualified and experienced supervisory staff and skilled personnel.
- 1.14.1.3 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.
- 1.14.1.4 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.
- 1.14.1.5 Contractor has to arrange required fire retardant covering materials (tarpaulins) to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
- 1.14.1.6 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 and during application of insulations shall be arranged by the contractor at his cost.
- 1.14.1.7 The contractor shall erect scaffolding / temporary platforms for erection as per the guidelines of relevant IS codes. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work

TECHNICAL CONDITIONS OF CONTRACT (TCC)

site. Only steel scaffolding materials with proper clamps should be used. Use of bamboo / casuarinas shall not be permitted.

- 1.14.1.8 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the packaging materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor and maintain records.
- 1.14.1.9 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.
- 1.14.1.10 Any faulty erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
- 1.14.1.11 Prior to erection of any components, inspection to be done for any foreign materials and damages and they are to be removed / attended as per instructions of BHEL engineer.
- 1.14.1.12 The contractor is strictly prohibited in using any of the BHEL's materials / components like angles, channels, hand-rails for any temporary supporting or scaffolding work or for using as bed for pre-assembly works etc.. In case of such misuse, a sum as determined by BHEL shall be recovered from contractor's bills.
- 1.14.1.13 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.
- 1.14.1.14 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.
- 1.14.1.15 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.

1.14.2 ERECTION OF PIPING

- 1.14.2.1 Handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam

TECHNICAL CONDITIONS OF CONTRACT (TCC)

blowing, surface finish, supply & application of primer & finish paints including labeling & flow direction on the piping over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer of Power cycle piping, LP Piping and its associated items / systems, hangers and supports, valves and other miscellaneous equipment.

- 1.14.2.2 Brief list of system / sub system, approximate weight of pipes and accessories to be erected by the contractor mentioned in the Bill of Quantity and numbers of joints mentioned in Erection Welding Schedule of this tender specification are meant for giving general idea to the tender only about magnitude of the work involved. The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.
- 1.14.2.3 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, inspection, edge preparation if required, 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.
- 1.14.2.4 All the works such as cleaning, inspection, edge preparation if required, 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 within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.
- 1.14.2.5 Erection of all items comprising piping systems such as valves, filters / strainers, expansion bellows, flow elements, hangers and supports, tanks, level instruments, pumps, associated skids are also a part of the scope.
- 1.14.2.6 All Operating / Approach platforms, cross over, canopies, ladders etc. along with their supporting structures, for the equipments / valves / filters etc shall be erected by the contractor as per instruction of BHEL and shall be paid as per accepted Tonnage rate for "Hangers and Supports".
- 1.14.2.7 Additional platforms, Cross over, Canopies, Ladders, etc. for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be fabricated and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for "Hangers

TECHNICAL CONDITIONS OF CONTRACT (TCC)

and Supports". 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.

- 1.14.2.8 If the provision of creep measurement is envisaged in the drawings, stubs erection and welding as per drawing shall be done by the contractor within the quoted rate.
- 1.14.2.9 The work on piping systems (air, water, oil, steam, gas etc.,) will include laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, NDE, fixing and adjustment of supports / hangers / shock absorbers and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineer's instructions and/or as per approved drawings / documents.
- 1.14.2.10 Contractor should obtain the formal clearance from Director of Boilers to carry out erection & Welding of piping under IBR purview (Power Cycle Piping, Special tanks, IBD Tank, CBD Tank and any other tanks as applicable). Arrangement for the visit of Boiler inspector for field inspection etc. is in the scope of contractor, and necessary drawing / details only will be given by BHEL. Inspection fee, if any shall be paid by BHEL.
- 1.14.2.11 Contractor shall arrange the necessary clearance from any other statutory authorities as required for installation of the plant and equipment and render all assistance, service required in this regard. Inspection fee, if any will be paid by BHEL.
- 1.14.2.12 Fittings like bends, tees, elbow / bends, reducers, flanges etc., will be supplied as loose items.
- 1.14.2.13 Fittings shall be supplied with standard dimensions. Edge preparation, matching inner diameter of pipes for welding as per the drawing dimensions shall be part of erection works. No separate payment will be made for the correction of pipes, edge preparation of standard fittings such as bends, Tees etc.,
- 1.14.2.14 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like tees, weld neck flanges, reducers, elbows, flanges, inserts etc., shall be suitably edge prepared and matched with pipes for welding. No extra cost shall be paid for this.
- 1.14.2.15 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.16 During connection & floating of any decks, etc., before and after pipe connections, adding tentative loads, readjusting of spring to the required level is covered in this scope of work.
- 1.14.2.17 Carrying out erection of piping as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work / specification, contractor shall carry out the terminal joints at either end. Also where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. In case piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer, with in the quoted rate.
- 1.14.2.18 Erection of all drains / vents / relief / escape / safety valve, piping to various tanks / sewage / drain canal / flash box / flash tank / condenser / sump / atmosphere etc. from the stubs on the piping to the equipments erected by the contractor is completely covered in the scope of work.
- 1.14.2.19 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 within the quoted / accepted rate.
- 1.14.2.20 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., shall be the responsibility of the contractor and the same shall be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if, the Items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package.
- 1.14.2.21 All the valves will have to be checked, cleaned, lapped or overhauled in full or in parts before erection, after chemical cleaning and during commissioning. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.
- 1.14.2.22 The valves, actuators etc., will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning, steam blowing and during commissioning as may be necessary.
- 1.14.2.23 Contractor shall study the layout of LP piping and other site routed piping well before the start of work. Final routing shall be decided after approval from Site erection Engineer for site routed pipe in such a way that it does not foul with critical piping.
- 1.14.2.24 For thermowell welding with Carbon steel / alloy steel welding applicable combination electrodes shall be arranged by the contractor within the quoted rate.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.25 During floating of critical lines insulation weights has to be added at hanger locations. Suitable weights like plates, structural members, etc shall be arranged by BHEL on returnable basis. Handling of the items shall be done by the contractor within the quoted rate.
- 1.14.2.26 Immediately after erecting electrically operated valves, Valve Tag Nos shall be painted or stickering shall be done for ease of identification.
- 1.14.2.27 All the valve packing has to be lubricated as per BHEL Engineer instruction till handing over. Necessary gland packing will be supplied by BHEL.
- 1.14.2.28 All the lifting equipment, actuators / power cylinders, valves / dampers, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The required cleaning, servicing and lubrication of bearings to be carried out before commissioning at no extra cost.
- 1.14.2.29 In the case of structural members, pipes, plates, ducts etc, 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 within the quoted rates / prices.
- 1.14.2.30 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. 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. Pipes below 2" diameter, shall be sponge cleaned with air flushing. 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.
- 1.14.2.31 All the equipments / material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints assembly and other components as per instruction of BHEL Engineer during erection at the quoted rate. The necessary compressor for air cleaning is to be arranged by contractor at his cost.
- 1.14.2.32 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. In case any minor modifications are required in these pipelines after completion to meet the system requirements, the same shall be carried out by the contractor within the quoted rate. The contractor should absorb this cost in his quoted rate.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.33 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.
- 1.14.2.34 Assistance for calibrating / testing the power cylinders/ actuators / valves, gauges, instruments, etc. and setting to actuators shall be provided by contractor within the quoted rates.
- 1.14.2.35 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.
- 1.14.2.36 All the drain lines should have sufficient slope towards drain. Slope of 1:500 shall be maintained towards drain point unless otherwise specified. Expansion loops shall be provided in all the vents and drains as per the drawings.
- 1.14.2.37 Wherever pipes / bends / equipments are supplied in pre-fabricated / assembled packages, there may be necessity to make minor changes, including strengthening by additional welds. This shall be treated as part of the contractor's scope.
- 1.14.2.38 All the oil & gas piping flanges, wherever provided are to be blue matched using surface plates for at least 80% contact area to attain leak proof of joints.
- 1.2.1.1 Wherever drawings indicate site routing and site fabrication, such pipes (in general equal to and less than 2" Dia) will be issued in running meters as straight length. These are to be cut to required at site length to suit layout as given in the erection drawing and edge prepared as per the standards / drawings and as per the instruction of BHEL Engineer. In some cases attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor. The contractor shall weld the joints of site routing piping as per site requirement.
- 1.14.2.39 Certain extra lengths of portions / parts of various site fabricated components / parts / bellows / piping etc. are provided as erection allowance and they shall have to be cut to suit site conditions and layout. Certain small length of portions / components / bellows / piping casing etc., may have to be added to suit conditions and layouts. Preparing edges afresh and adopting specified heat treatment procedure, are in the scope of work. No extra payment will be admitted for such works.
- 1.14.2.40 Some extra lengths in various fabricated pipes given as erection allowance shall have to be cut and edges prepared to suit the site conditions at no extra cost. The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible

TECHNICAL CONDITIONS OF CONTRACT (TCC)

machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer. Prepared edges to be preserved / applied with weldable primer.

- 1.14.2.41 Minor adjustment like removal of ovalities in pipes and opening or closing of the fabricated bends by process of heat correction or any other method approved by BHEL Engineer to suit the layout, with specified heat treatment procedure shall be carried out by the contractor within the quoted rate.
- 1.14.2.42 For pipes nominal bore size 2" and below routing shall not be shown in piping layouts or in isometrics and the same to be routed / connected as shown in schematics. For the above sizes if the routing is shown in layouts it is only for guidance and the same shall be routed and supported as per site requirement / convenience as per site engineer's advice.
- 1.14.2.43 For Piping of nominal bore size 2" and below, 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.
- 1.14.2.44 Contractor should fabricate bends of ≤ 2 " diameter size at site from running meters of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instructions.
- 1.14.2.45 Contractor shall use only bolted clamps for achieving alignment of piping. Wherever "L" shaped stoppers and wedges are to be used for aligning piping and equipments, the same shall be subject to the approval of BHEL Engineer. Contractor shall remove the bridge, stopper etc., by grinding / gouging and not by hammering. Any burrs left on the equipments / piping, after welding, shall be ground off or any scar or cavity made good by welding and grinding. NDT tests shall be carried out if necessary to detect surface and sub-surface cracks in these ground areas.
- 1.14.2.46 Flame cutting of piping and other equipment shall be strictly done as per BHEL Engineer's instructions and in his presence only.
- 1.14.2.47 All the weld joints on equipments and piping shall be ground or filed after completion of welding and before radiography as per instructions of BHEL Engineer so as to achieve smooth surface to avoid of ripples, undulations etc.,
- 1.14.2.48 Wherever elbows of 45 deg or any other angle are required, the same shall be cut from 90 deg. elbow supplied and used as per the instructions of BHEL engineer. No extra cost shall be paid.
- 1.14.2.49 Flow nozzles, orifice, spray nozzles etc., shall be mounted / erected after chemical cleaning / flushing / or steam blowing at site.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.50 Erection of Flow nozzles, flow orifices, flow switches, steam traps, filters, flow meters, flow indicators, other metering elements, spray nozzles, steam traps, flow orifices, flow indicators, control valves, aux. control valves, filters, suction strainers, CRH NRV and other NRVs, HPBP Valve and suction strainers of pumps, servomotors etc. forming part of the system (under this scope of work) irrespective of the suppliers is also to be carried out by the agency without any extra cost after chemical and / or steam blowing / oil flushing at site. This will include collecting from BHEL / Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography, NDE and stress relieving and commissioning.
- 1.14.2.51 Certain instruments like pressure switches, gauges, air sets, regulators, filters, junction boxes, power cylinders, dial gauges, thermometers, flow meters, valve actuators, flow indicators etc., are received in assembled conditions as integral part of equipments. Contractor shall dismount such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.
- 1.14.2.52 Fixing, fitting, welding of thermowells, stubs, hoses, tapping points, root valves and instruments etc., on different lines / equipments (which will be supplied by BHEL) is within the scope of work. Fixing of Pick-Ups, Probes & Accessories for vibration monitoring system is in the scope of this specification.
- 1.14.2.53 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.
- 1.14.2.54 Welding of all thermowells, draft, pressure and temperature instrumentation points and all other instrumentation points on piping and auxiliaries and welding of thermocouple pads for permanent system as well as for performance guarantee test is in the scope of work.
- 1.14.2.55 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 prefabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL.
- 1.14.2.56 All thermowells (released under applicable PGMA's and loose received along with instruments) are to be fixed into the equipment and piping erected by PIPING agency as per drawing and same to be welded as per FQP within the quoted rates.
- 1.14.2.57 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.58 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.
- 1.14.2.59 The contractor shall also weld all thermowells, small length of pipes to all pressure, flow and level tapping points, isolating valves and root valves on all equipment under scope of erection of this contract. All embedded temperature measuring elements provided in the bearings will have to be terminated at the junction box by the contractor. Thermowells tapping point connections incorporated shall be plugged during the pressure testing and steam blow out of piping systems. Upon completion of blow out operation all thermowells and flow elements with branch pipes be installed and welded.
- 1.14.2.60 The hangers and supports for pipelines and pressure parts may be supplied in dismantled / knocked down condition. It is the responsibility of the contractor to assemble them as per approved drawings and install them in position as per site engineer instructions.
- 1.14.2.61 For hangers and supports the instruction given in the drawings and documents must be followed for handling, erection and setting of cold / hot valves and locking etc.
- 1.14.2.62 Where the flange comes welded to the equipment, erection of counter flange, Hydrotesting and Normalisation of the line is under the scope of this contract. Where both the flange and counter flange come as loose items and need to be welded, the entire welding of flange and counter flange, Hydrotesting and Normalisation of the line are under the scope of this contract.
- 1.14.2.63 Wherever hangers and support materials of piping are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the piping system on temporary supports to ensure the progress of work within quoted rate. 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.
- 1.14.2.64 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.
- 1.14.2.65 Contractor has to fabricate and erect temporary spool pieces wherever required due to non-receipt of valves in time and after receipt of valves the spool pieces are to be replaced with regular valves at free of cost. For spool pieces materials will be supplied free of cost by BHEL.
- 1.14.2.66 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.67 Welding, non-destructive testing and heat-treatment as prescribed in BHEL Welding / Heat treatment manual is to be carried out by the contractor. The contractor shall conduct nondestructive tests like radiography, ultrasonic test for weld defects etc., ultrasonic test for finding thickness, dye penetrant tests, magnetic particle test etc. on weld joints, castings, valve bodies and other equipments etc. as per BHEL Engineer's instructions within the quoted rate.
- 1.14.2.68 The Matching Pieces / Nozzles / Reducers (including the reducers to be connected with HP Heaters) supplied for connecting BFP discharge piping to Boiler forming part of the systems are also in the scope of work including issue, transportation, suitably cutting the erected piping, cleaning, erection, welding, NDE and stress relieving and commissioning.
- 1.14.2.69 Cutting and removal of dummies for all the shop welded stubs (irrespective of the equipments supplier for the above) for all the terminal points and preparation of edge where the piping is to be terminated is also in the scope of the contractor without any extra payment.
- 1.14.2.70 The contractor shall fabricate piping, install lube oil systems, if any and carry out the acid cleaning of fabricated piping. The contractor shall also service the lub oil system, carry out the hydraulic test of oil coolers. etc.,
- 1.14.2.71 For skid mounted equipment, the checking and re-alignment required at site is in the scope of work.
- 1.14.2.72 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.
- 1.14.2.73 All the shafts of rotating equipment shall have to be properly aligned to those of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment.
- 1.14.2.74 All the bearings, gearboxes etc., of the equipment / actuators and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing / gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and shall arrange for re-greasing / lubricating them with recommended lubricants and assembling back. Lubricants will however be supplied by BHEL at free of cost.
- 1.14.2.75 The actuators / motors of valves may be supplied in loose parts, contractor shall have to match / assemble and align at site as per instructions of BHEL Engineer including placement on foundation.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.14.2.76 All dimensions / elevations refers to centerline of pipe unless otherwise specified, the pipe routing shall be carried out as per the drawing. Wherever the dimensions are not specified / shown as approximate the same may be routed as per site requirement / convenience as per site engineer's advice.
- 1.14.2.77 Pipelines shall be cleaned off welding slag and burrs by hand files, wire brushes and flexible grinders wherever required and using cloth.
- 1.14.2.78 All welded joints shall be subjected to acceptance by BHEL Engineer.
- 1.14.2.79 Please refer the "FIELD / ERECTION WELDING SCHEDULES" published under Chapter-02 of volume IA part II of this booklet.
- 1.14.2.80 Also refer "GUIDELINES FOR WELDING" and "GUIDELINES FOR HEAT TREATMENT" published under Chapter 7 and Chapter 8 respectively of Volume IA Part II of this booklet.

1.14.3 INSTALLATION OF INSULATION

- 1.14.3.1 Handling at site stores / storage yard, Transportation to site of work, Application of refractory & Insulation materials and connected works for Power cycle, LP and Turbine Piping, Gland Steam Piping, Vessels, equipment like Feed Pumps, Flash Tanks, HP and LP Heaters, Deaerator, FST, TDBFP and MDBFP Pumps etc., and binding and cladding with sheets etc., using their own tools plants, tackles, all consumables, supervisor and men as enumerated in the scope of contract.
- 1.14.3.2 Application of refractory, wool insulation, sheet metal cladding, welding of hooks / supports to hold insulation and refractories under this contract including but are not limited to the following. Insulation of HP & LP piping, temporary acid cleaning and steam blowing piping connected tubes, all drain lines, traps, flanges, fine fittings, sampling lines etc.
- 1.14.3.3 Bidders to note that application of Insulation of Main Turbine, Turbine Integral Piping under Hardwar scope of supply, TDBFP Drive Turbine, Boiler and ESP are excluded from the scope of this contract.
- 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 SUPPLIED 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 Manufacturing Units. However, supply and application of bituminous coating inside aluminium sheet is within the scope of the Contractor at no extra cost.
- 1.14.3.8 All the insulation, refractory materials and sheet metal covering etc., issued to the contractor shall be properly stored and handled before application of 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.
- 1.14.3.9 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.
- 1.14.3.10 The contractor shall provide the required quantity of wire, nails and other materials for centering works at their cost.
- 1.14.3.11 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 weld 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.
- 1.14.3.12 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.
- 1.14.3.13 Removal type of insulation to be provided for valves fittings, expansion joints etc., as per the drawings or as directed by BHEL Engineer.
- 1.14.3.14 All piping insulations shall be carried out in such a manner as to facilitate removal of bolts nuts and washers from the flanges.
- 1.14.3.15 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.
- 1.14.3.16 Fixing or welding of hooks / supports to equipments, piping and other connected equipments to support wool insulation applying of primer paint

TECHNICAL CONDITIONS OF CONTRACT (TCC)

to welded portion parts welding certain supports, by engaging approved welders on parts other than pressure parts to hold refractory's as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.

- 1.14.3.17 Fabrication, fixing or welding of hooks / supports to equipment piping and other connected equipment to support wool insulation applying of primer paint to welded portion parts welding certain supports on parts as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.
- 1.14.3.18 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.
- 1.14.3.19 Cladding sheets shall be suitably pressed along with diagonals to form diamond shape so as to improve the strength of the sheets, to avoid bumpiness and to give aesthetic look.
- 1.14.3.20 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.
- 1.14.3.21 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.
- 1.14.3.22 The contractor shall draw only one week's requirement of material for their work from BHEL stores and keep them in their semi-closed shed near to the work area. The materials required for a particular space of work only shall be taken to the work spot. At the end of the day's work the leftover or unused materials shall be taken back to their semi-closed shed for keeping the materials safe. Necessary records shall have to be maintained by the contractor in respect of the above draws / deposits, on daily basis as instructed by BHEL.
- 1.14.3.23 Welding of hooks as per pitch, non-pressure parts, applying primer paint to the welded portion as directed as per drawings before application of mineral wool mattresses will have to be done by the contractor.
- 1.14.3.24 Applying different layers of mineral wool as directed and as per drawings and specifications for 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.
- 1.14.3.25 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

and use the same hooks.

- 1.14.3.26 In case the contractor is required (which is not attributable to contractor) 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.
- 1.14.3.27 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.
- 1.14.3.28 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, etc., which are required for temporary supporting of the insulation materials at site.
- 1.14.3.29 Welding of iron components directly on pressure parts and HP piping are to be carried out by certified IBR High Pressure welders.
- 1.14.3.30 Welding of iron components directly on pressure parts and HP piping is in the scope of this contract and are to be carried out by certified IBR high pressure welders. Bidder to arrange for the same within the quoted rates.
- 1.14.3.31 Application of insulation and removal of the same for temporary piping under scope of erection of this contract is also included in the scope of the work. However, BHEL will supply the insulation materials free of cost.
- 1.14.3.32 Dressing of insulation to suit site conditions, sheet cladding over insulations, form the part of this work.
- 1.14.3.33 Fabrication, fixing or welding of hooks / supports to equipment of piping and other connected equipment to support wool insulation applying of primer paint to welded portion parts welding certain supports on parts other than pressure parts to hold refractory's (by engaging approved welders) as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.
- 1.14.3.34 Wastages allowance for the materials issued are envisaged as follows:
 - a) Wool mattresses 2%
 - b) Cladding sheets 5%
- 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 Also refer 'General Guidelines for Insulation Works' published under Chapter 9 of Volume IA Part II of this booklet.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER – XV

WELDING, HEAT TREATMENT & RADIOGRAPHY AND NON-DESTRUCTIVE TESTING

(Applicable for Package A & Package B)

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

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

- 1.15.1 The pressure parts, equipment 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 The contractor has to establish the WPS (Welding Procedure Specification) and PQR (Procedure Qualification Requirement) applicable for the scope of work for all the materials involved at his own cost. However, Test Materials for the same will be given by BHEL free of cost.
- 1.15.3 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.
- 1.15.4 Contractor shall carryout Radiography as per welding Manual booklet applicable as per IBR. However, percentage radiography shown in the respective drawings shall be final and binding on the contractors.
- 1.15.5 The field joints are to be radiographed and preheating and post weld heat treatment to be done as per BHEL procedure and manuals.
- 1.15.6 Erection of equipment involves good quality of Welding, Heat treatment and Non Destructive Testing. Wherever required, 100% dye penetrant tests have to be carried out as per instructions of BHEL Engineer. Contractor's Engineers, Supervisors, Technicians and workers engaged should have adequate knowledge on the above works.
- 1.15.7 All welded joints shall be subjected to acceptance by BHEL Engineer.
- 1.15.8 Welding electrodes for welding shall be procured from Customer / BHEL approved vendors only.
- 1.15.9 For Stainless Steel pipe, welding procedure will be as per BHEL site Engineers directive. During the root runs of stainless steel joints, if required, the contractor shall carry out purging the pipes with inert gas before and during welding.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.10 Welding of pressure parts, piping & fittings (under IBR code), high tensile structural steel shall be done by certified High Pressure welders who possess valid certificate of CIB of the State in which the equipment is erected as per provision of IBR and who are approved by BHEL Engineer. The High pressure welder who possesses necessary certificate shall ensure re-validation as per relevant provisions of IBR and keep the certificate valid till the completion of work. The services of such welders, the validity of whose certificates have expired shall not be utilized for high pressure works.
- 1.15.11 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.
- 1.15.12 BHEL Engineer is entitled to stop any Welder from the work if his performance is unsatisfactory for any technical reasons or if 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 Welder has earlier passed the tests prescribed by BHEL Engineers. The welders having passed qualification tests do not absolve the contractor of contractual obligation to check the welder's performance.
- 1.15.13 The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG welding method as specified in the drawings / EWS (Erection welding Schedule). Contractor to note that the EWS forms the part of this booklet (Volume-IA) of this tender specification. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required.
- 1.15.14 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.
- 1.15.15 All butt Joints shall be carried out by TIG root run and subsequent runs by Arc welding. Full TIG welding, wherever necessary shall be carried out within the quoted rates. For oil system piping root run of all the butt joints shall be carried out by TIG welding only.
- 1.15.16 For approval of contractor's welders for engaging in the erection work, all expenses for testing of welders including destructive and Non- destructive tests conducted by BHEL or by the inspecting authority at site or at laboratory shall

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 and all testing facility shall be made available by the contractor.

- 1.15.17 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.
- 1.15.18 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.
- 1.15.19 All butt / fillet welds shall be subject to Non Destructive testing as per the Drawing / Procedures / Welding Schedules / Documents at no additional cost.
- 1.15.20 The contractor shall deploy required number of High pressure welders to carry out the high pressure weld joints. The welding works should not be held up due to shortage / want of I.B.R./ High pressure welders.
- 1.15.21 The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and 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. All site welds shall be subject to acceptance of BHEL / Customer Engineers.
- 1.15.22 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.
- 1.15.23 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. Prior to any repair, approval shall be obtained from BHEL Engineer for the procedure for the repair of defective welds. After the repair has been carried out, the compliance document shall be submitted to the quality engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.24 All necessary preheating, post heating of welds and stress relieving operation of welds are part of the erection work and shall be performed by the contractor in accordance with the relevant regulations and standards of BHEL practice and to the satisfaction of BHEL Engineer and in accordance with the drawings and specifications.
- 1.15.25 Pre-heating, radiography and other NDE, post weld heating and stress relieving after welding of tubes, pipes including attachment welding wherever necessary, are parts of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer and as specified in Erection Welding Schedule, Welding, Heat Treatment & NDT manuals and FQP. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.
- 1.15.26 Contractor shall arrange all necessary Preheating, post weld heating, stress relieving equipment with automatic recording devices. The contractor shall arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment / stress-relieving operations. The contractor should take a note of the following,
- 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.
 - The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of SR operations.
- 1.15.27 **P 91 WELDING**
- The induction heating equipment and other accessories 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 with in quoted price. The contractor shall provide electrical cables & switches required. All the equipment shall be protected by providing covers and sheds at site by the contractor with in quoted rate.

Also refer clauses in Chapter IV and chapter V of Part I of Technical Conditions

TECHNICAL CONDITIONS OF CONTRACT (TCC)

of Contract (Volume-I Book-I) regarding P91 welding.

- 1.15.28 Welding of Hangers, supports, stubs and impulse piping to be carried out by the contractor as per drawing specification and as per BHEL engineers instructions. According to drawing specifications and as per BHEL Engineers instructions pre heating, post heating, stress relieving, etc. have to be carried out by the contractor wherever necessary.
- 1.15.29 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 Piping & other equipment has to be carried out by the Contractor within quoted rates.
- 1.15.30 All the prepared / patched edges will have to be suitably protected to prevent rusting or foreign material ingress.
- 1.15.31 For thermowell welding with carbon steel / alloy steel welding applicable combination of electrodes shall be arranged by contractor within quoted rate.
- 1.15.32 The regulators used on welding machines shall be calibrated before putting these into use for work. The Contractor at his cost shall also arrange periodic calibration for the same.
- 1.15.33 The thermostat and thermometer of electrode drying oven shall be also calibrated. All welders shall have electrodes drying portable oven at the work spot.
- 1.15.34 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.
- 1.15.35 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.
- 1.15.36 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).
- 1.15.37 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.
- 1.15.38 All radiographs shall be free from mechanical / chemical process marks to the extent they shall not confuse the radiographic image and defect finding. Penetrometer, as per ASME or ISO or IS must be used for each exposure.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.39 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.
- 1.15.40 Lead intensifying screens for front and back of the film shall be used as per ASME specification or as per the instructions of BHEL Engineer.
- 1.15.41 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.
- 1.15.42 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.
- 1.15.43 The percentage of Radiography are tentative, which may be increased depending upon the quality of joints at the discretion of BHEL.
- 1.15.44 In case of radiography of less than 100%, the joints identified by BHEL at random shall be radiographed.
- 1.15.45 Contractor shall note that 100% radiography will be done at the initial stages on all the piping welding joints. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out.
- 1.15.46 All the radiographs shall be properly preserved in air-conditioned rooms and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL / customer.
- 1.15.47 Radiography of joints shall be so planned after welding, that the same is done either on the same day or next day of the welding to assess the performance of High Pressure welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.
- 1.15.48 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.
- 1.15.49 All arrangements for carrying out radiography work including radiography source & equipment and consumables, 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies shall be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.

- 1.15.50 The contractor shall arrange air conditioned dark room, radiography equipment, films, chemicals and other dark room facilities. The air conditioned dark room shall be 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. There must be sufficient 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.
- 1.15.51 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.
- 1.15.52 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. Also contractor has to provide necessary labour required such as Riggers, Helpers etc. to assist the technicians for carrying the above radiography work and making other arrangements. Such as providing scaffolding, approaches, platform lighting arrangements at his cost as per the instructions of BHEL. It may please be noted that invariably the radiography will be carried out after the normal working hours only.
- 1.15.53 All welds shall be painted with primer as specified in the painting schedule, once radiography and stress relieving works are over. Necessary consumables and scaffolding etc including paints shall be provided by contractor at his own cost.
- 1.15.54 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.
- 1.15.55 Wherever radiographs are not accepted on account of poor exposure / bad shot, joints shall be re-radiographed and the film of the same shall be submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.56 The contractor shall also be equipped / arrange for carrying out **other** NDT like dye penetrant inspection, magnetic particle inspection, Ultrasonic testing, Hardness test etc as per welding schedules / drawings as and when required within the quoted rates.
- 1.15.57 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work includes such preparation and no extra charges are payable for this.
- 1.15.58 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.
- 1.15.59 The welded surface irrespective of place of welding shall be cleaned of slag and painted with primer paint to prevent corrosion at no extra cost towards this including supply of Paint for this purpose.
- 1.15.60 All welders shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the IBR 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.
- 1.15.61 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.
- 1.15.62 Heat treatment details of welds indicating minimum, Temperature recorded, Heating rate, Cooling rate, Soaking time etc. shall also be recorded and documented by the contractor as per BHEL Engineers instructions. Welder's performance record shall be furnished every month. The performance report of welders shall be indicate the percentage of repair for each welder.
- 1.15.63 All the data such as heating temperatures, heating rate, soaking time, maximum temperature reached during heat treatment shall be properly recorded and documented which will be property of BHEL.
- 1.15.64 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. The contractor shall obtain the

TECHNICAL CONDITIONS OF CONTRACT (TCC)

signature of engineer or his representative on the strip chart of the recorder prior to starting of SR operations.

- 1.15.65 For higher thickness joints for which radiography plugs are not provided, alternate NDE methods such as ultra sound examination as instructed by BHEL engineer shall be conducted with in the quoted rate.
- 1.15.66 Quantum of radiography (percentage of joints) shall be enforced as per specifications and as per the drawings. BHEL Engineer reserves the right to alter the quantum of radiography of joints. The decision of the BHEL Engineer in this regard is fixed and final and binding on the contractor. Any defects as pointed out by BHEL Engineer shall have to be rectified by the contractor at his cost.
- 1.15.67 If the contractor does not carry out radiography work in time due to non-availability of film, chemical etc. BHEL shall get the work done through some other agency at the risk and cost of the contractor.
- 1.15.68 Radiography work of the welds connected with this contract shall be arranged by the contractor including provisions of services of technicians and necessary equipment and consumables like Isotope camera, X-Ray films, chemicals and other dark room facilities etc. Also contractor has to provide necessary labour required such as Riggers, Helpers etc. to assist the technicians for carrying the above radiography work and making other arrangements. Such as providing scaffolding, approaches, platform lighting arrangements at his cost as per the instructions of BHEL. It may please be noted that invariably the radiography will be carried out after the normal working hours only.
- 1.15.69 Radiography inspection of welds shall be performed in accordance with the requirements and recommendations of BHEL Engineer. The minimum extent of radiographic inspection shall be as per BHEL drawings / IBR Regulations. At the discretion of BHEL Engineer / Boiler inspection authority, they may however be increased depending upon the performance of the individual welder. It is the responsibility of the contractor to get the IBR clearance, wherever required including arranging for IBR Inspection.
- 1.15.70 All field joints shall be subjected to dye penetrant examination as specified in the respective drawings and shall have to be accepted by BHEL Engineer. Any rectifications required shall have to be done by the contractor at his cost.
- 1.15.71 Oxy-acetylene flame heating or exo-thermic chemical heating for stress relieving is not permitted. Heating shall be by means of Electric Induction coil or Electric resistance coil. Potentiometric type recorders shall only be used for temperature recording purposes.
- 1.15.72 Please refer the "FIELD / ERECTION WELDING SCHEDULES" published under Chapter-02 of volume IA part II of this booklet.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.15.73 Also refer "GUIDELINES FOR WELDING" and "GUIDELINES FOR HEAT TREATMENT" published under Chapter 7 and Chapter 8 respectively of Volume IA Part II of this booklet.
- 1.15.74 Also refer the clause on FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P91 WELDING
- 1.15.75 Also refer the clause on extra work rate for welding published in chapter VII of volume IA part I of this booklet.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME- IA PART –II CHAPTER -XVI

HYDRAULIC TESTING, PRE-COMMISSIONING, COMMISSIONING AND POST COMMISSIONING (Applicable for Package A & Package B)

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

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

- 1.16.1 All required tests indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. These tests / activities may not have been listed in these specifications. Specialized test equipment, if any, shall be provided by BHEL/ its client free of hire charges. The contractor shall carryout all tests 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.
- 1.16.2 It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, commissioning of piping and the other equipment, even though the delay reasons are not attributable to the contractor.
- 1.16.3 The contractor shall carryout the required tests on the equipment & pipelines, such as gas tightness test / air tightness test, kerosene test, hydrostatic test and rectify all the defects caused due to contractor's fault at his own cost. Contractor may have to replace old / damaged gaskets / packing etc. of equipment and the same shall be carried out by contractor as per requirement. Compressed air for pneumatic testing is to be arranged by contractor. The contractor shall carry out the trial run of motors including checking the direction of rotation in the uncoupled condition, checking, aligning and coupling the motor to the respective driven equipment. Before starting the motor IR values of insulation shall be recorded and if found necessary dry out to be done by the contractor to improve the IR value at no extra cost.
- 1.16.4 During the initial stages of work, trenches for draining water may not be available after Leak test, Hydro test, Flushing or mass flushing. For discharging / emptying the equipment, system and piping, necessary low point drains and temporary piping up to safe location are to be erected by the contractor at his cost. The materials will be provided by BHEL.
- 1.16.5 In case any erection defect and / or malfunctioning is detected during various tests / operations, trial runs as detailed above, such as loose components, undue noises, vibration, strain on connected equipment, steam / oil / water leakage, etc.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

the contractor shall immediately attend these defects and take necessary corrective measures. If any readjustment and re-alignments are necessary, the same shall be done as per BHEL Engineer's instructions. If any part needs repairs rectification and replacement the same shall be done by the contractor at no extra cost. The parts to be replaced shall be provided by BHEL free of cost. If 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.

- 1.16.6 For conducting Hydro test / steam blowing of MSL, CRH & HRH internals of valves and NRVs (LP BP, ESV, IV & LP BP Valves & NRVs) are to be removed, Hydro Test devices are to be fixed and after Hydro Test the internals are to be re-assembled by the contractor as instructed by BHEL without any additional cost.
- 1.16.7 Temporary blinds / lugs / caps of piping and associated equipment like tanks, pumps etc. required for oil flushing / alkali cleaning / acid cleaning of piping & other equipment during erection & pre-commissioning shall be erected by contractor within the quoted rate.
- 1.16.8 During Commissioning, opening / closing of valves, changing of gaskets, attending to leakage and adjustments of erected equipment may arise. Contractor may have to replace old / damaged gaskets / packing etc. for equipment and the same shall be carried out by contractor as per requirement. The finally accepted price / rates shall also include all such work.
- 1.16.9 Replacing / cleaning of filters of the erected equipment and piping system etc., during pre-commissioning / commissioning stage is within the scope of work.
- 1.16.10 During steam blowing operations the required manpower for fixing the target plates 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.
- 1.16.11 Main Steam Line Strainers bodies are erected first before steam blowing of the lines. After Hydraulic Test, the strainer elements are fixed. During trial operation, if required the strainers are removed for inspection of debris & cleaning. Contractor has to carry out the work as part of his work without any extra cost.
- 1.16.12 Cleaning of strainers erected is the responsibility of the contractor during pre-commissioning and commissioning activities.
- 1.16.13 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, transporting & adding of chemicals / consumables and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables in his scope, T&Ps, IMTEs etc., and any other assistance required

TECHNICAL CONDITIONS OF CONTRACT (TCC)

during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

1.16.14 After synchronization, the commissioning activities and trial operations will continue up to handing over. 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, hand tools, supervision etc. as part commissioning assistance for equipment erected by the contractor till handing over of sets to customer. The rate quoted shall include 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. Mill Wright Fitters
- c. HP / Structural welders
- d. Riggers
- e. Unskilled workers
- f. Supervisors
- g. Electricians
- h. Any other category of workers as may be required

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

1. One supervisor per shift for three shifts
2. Two fitters per shift for three shifts
3. Two helpers per shift for three shifts.

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 and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.

1.16.15 Steam blowing of system piping if required will involve laying of temporary pipe lines, valves, etc. and dismantling & restoration of piping. The required steam shall be provided at a central point by BHEL.

1.16.16 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.16.17 Contractor has to arrange Hydraulic Test pump / Hand Pump at his cost for Hydraulic testing of LP lines.
- 1.16.18 Hydraulic testing pumps for High Pressure lines shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working conditions. 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.
- 1.16.19 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.
- 1.16.20 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc. shall be removed by him and returned to BHEL. All thermowell points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.
- 1.16.21 All welded joints for temporary piping required for alkali flushing, acid cleaning and steam blowing should be got done by High Pressure welders only. The root run should be done by TIG welding. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.
- 1.16.22 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 equipment 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.
- 1.16.23 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.
- 1.16.24 Providing dummy / plugs for the thermowell points during hydro test / steam blowing shall be done by the contractor within the quoted rate. During hydro test, pipe end dummy if required shall be supplied by BHEL, plates shall be cut for the requirement and shall be returned back to BHEL Stores.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.16.25 After hydro test / steam blowing during the restoration works, it is the responsibility of the contractor to ensure the removal of dummy/plugs and edge preparation for the thermowell stubs if required within the quoted rate.
- 1.16.26 Hanger adjustment / readjustment 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.
- 1.16.27 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.
- 1.16.28 During hydraulic test, the pipes being tested shall be isolated from the equipment to which they are connected.
- 1.16.29 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.
- 1.16.30 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 using contractors own labour and scaffoldings etc.,
- 1.16.31 All the tests shall be repeated till all the pipelines / equipment 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.
- 1.16.32 Test records shall be made for pressure testing of above piping system. These records shall contain the following information:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- a) Date of test
- b) Identification of piping tested
- c) Test fluid
- d) Test pressure
- e) Approval of the Engineer.

- 1.16.33 The scope of pre-commissioning activities covers installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, dummy plates & other miscellaneous equipment etc along with accessories required for hydro test, pre-boiler system detergent flushing / chemical cleaning, steam blowing or for any other tests on piping. The scope also covers the offsite disposal of effluents.
- 1.16.34 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, steam blowing, etc. are covered in this contract and shall be carried out as a part of work. The quoted rate shall be inclusive of all this.
- 1.16.35 Temporary lines for chemical cleaning shall be erected as per the instructions of BHEL Engineer. Necessary pipes and other items will be supplied by BHEL free of cost. 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.
- 1.16.36 Temporary lines for Steam blowing / chemical cleaning of Power Cycle piping shall be erected as per the instructions of BHEL Engineer. Necessary pipes, valves and other items will be supplied by BHEL free of cost. All arrangements for erection including welding has to be arranged by the contractor at the rates specifically quoted / accepted for this work. After completion of steam blowing chemical cleaning, all the temporary lines to be dismantled and restoration of piping to be carried out, within quoted rate. The required steam shall be provided at a central point by BHEL.
- 1.16.37 Contractor shall lay the temporary pipelines with fittings, accessories and erection & commissioning of pumps, tanks 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 equipment are within the scope of work. Necessary materials for this will be provided by BHEL. Overhauling / cleaning / revisioning / servicing of valves, fittings in temporary system and acid cleaning tanks for re-commissioning activities / operation like water flushing / steam blowing / washing / flushing / passivation / chemical cleaning etc., and also over hauling / revisioning

TECHNICAL CONDITIONS OF CONTRACT (TCC)

of the pumps & equipment and also to carry out the repairs to attend leaks etc., in the temporary piping & equipment, prior & while carrying out the above operations / activities. All the above works are within the scope of work. All the chemicals will be supplied by BHEL free of cost.

1.16.38 Chemical cleaning (Acid cleaning of piping / 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 carried out by the contractor. Required materials will be provided by BHEL free of cost. Chemicals for chemical Cleaning will be provided by BHEL. All other consumables are to be provided by the contractor.

1.16.39 All items / materials (Including Chemicals) required for conducting hydraulic test, pre-Boiler system detergent flushing / chemical cleaning, steam blowing etc., will be supplied by BHEL. However, fabrication, servicing, erection, dismantling and returning of the same to stores are 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.

Dismantling of the temporary equipment and piping will be done by the agency that has erected the equipment. He will also return the equipment to the stores. The quoted rate shall be inclusive of all this.

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.

1.16.40 During commissioning opening of valves changing of gaskets attending to leakages, minor modification, and 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.16.41 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.
- 1.16.42 Contractor shall cut open the 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.
- 1.16.43 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.
- 1.16.44 All the valves, Actuators will have to be checked, cleaned, lapped or overhauled / serviced in full or in parts before erection, prior to pre – commissioning, during commissioning and Trial operation. 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. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.
- 1.16.45 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.
- 1.16.46 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.
- 1.16.47 During this period, though BHEL's and customer's staff also be associated in the work, it is the contractor's responsibility to make available the resources in his scope till such time the commissioned units are taken over by the customer / BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-I CHAPTER- XVII

PAINTING

(Applicable for Package A & Package B)

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

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

1.17 FINAL PAINTING

- 1.17.1 The scope of work shall also include supply and application of final painting of all the erected equipment as required and specified in the BHEL / Customer / Customer Consultant's painting specification / scheme that forms the part of this tender for the components of all piping & its auxiliaries and other equipment erected under the scope of this tender. Supply & application of primer & finish paints are included in the scope of work.
- 1.17.2 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.
- 1.17.3 In the case of steel fabricated items, raw steel after fabrication has to be cleaned and subsequent painting to be carried out.
- 1.17.4 All the exposed metal parts of the equipment 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.
- 1.17.5 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 engineer or the BHEL client, in certain cases, spray painting has to be done wherever brush painting is not accessible, by the contractor, within the quoted rates. Contractor has to carryout painting as per the procedure lay down by the customer.
- 1.17.6 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 1.17.7 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.,
- 1.17.8 All surfaces 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. 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.
- 1.17.9 Before applying the subsequent coats the thickness of each coat shall be measured and recorded with BHEL / Customer.
- 1.17.10 Finish coat paint, Number 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 mentioned in Volume-IA part-II Chapter-3 of this booklet which is forming part of this tender shall be used as guidelines to be followed.
- 1.17.11 The scope of painting includes application of colour bands, lettering the names of the systems equipment; tag Nos. of valves, marking the directions of flow and other data required by BHEL within the quoted rate.
- 1.17.12 The actual colour to be applied shall be approved by the customer before starting of actual painting work.
- 1.17.13 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.
- 1.17.14 Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
- 1.17.15 Primer painting after proper surface cleaning wherever required to be done as per site requirement over all surfaces to be insulated prior to the application of the insulation. This is to be done as a part of contract without any additional charges.
- 1.17.16 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'

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

- 1.17.17 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.

1.17.18 PRESERVATION / TOUCH UP PAINTING DURING ERECTION & COMMISSIONING

Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, etc. shall be arranged by Contractor.

Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipment 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.

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.

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.

All welded joints should be painted with anti-corrosive paint, once NDE works are over.

Required primer / paint, thinner, other required consumable such as wire brush, brush etc. shall have to be arranged by the contractor at their own cost. The required manpower, T & P etc. shall be provided by the contractor within the quoted rate.

All rectification including painting of Employer's structure which are damaged by contractor during his work. Painting of portions of Employer's structures wherever connection/welding is carried out by contractor for supporting structures.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

VOLUME-IA PART-II CHAPTER-1

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

SI No: 1

Clause 4.1.11 of SCC is deleted.

SI 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.

SI 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.

SI 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).

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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 for Bank Guarantee for EMD is enclosed with this Tender.
- b) The Bank Guarantee shall be valid for at least 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 the 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

SI 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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
- b. Cash (as permissible under the extant Income Tax Act)
 - c. Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL
 - d. 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.
 - e. 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.
 - f. 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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 SI. No. 04 Earnest Money Deposit) may be used for the purpose of arranging Bank Guarantees towards Security Deposit / Additional Security Deposit also.

SI 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:
- 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.
 - Withdrawal from or abandonment of the work by contractor before completion of the work as per contract.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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= $[(A-B) + (A \times H/100)]$

Where,

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

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

H = Overhead Factor to be taken as 5

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

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

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

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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: In case 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. $T2 = [1 - (X/Y)] \times T1$
- v). LD shall be calculated in line with LD clause (clause 2.7.9) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

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

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

Following sequence shall be applicable for recoveries from contractor:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

SI No: 8

OVERRUN COMPENSATION (ORC)

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

2.12 OVERRUN COMPENSATION (ORC)

- 2.12.1 **ORC during original contract period:** No ORC shall be applicable during the original contract period.
- 2.12.2 **ORC during extended period for the reasons solely attributable to contractor:** No ORC shall be applicable during the extended period granted for the reasons solely attributable to contractor and work executed during this period shall be paid as per original contract rates.
- 2.12.3 **ORC during extended period for the reasons not attributable to contractor:** ORC shall be payable as per following procedure:
- 2.12.3.1 For initial period of twelve months of extended period, ORC rate applicable over executed value shall be 5%. For every subsequent period of twelve months, ORC rate shall be further increased by 5% over the previous rate. For example, ORC rates applicable for initial period of 12 months and subsequent period of 12 months are given below.

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

- 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.

SI 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.”

SI. No: 10

-Void -

SI 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	MONTHLY ALL-INDIA AVERAGE CONSUMER	40	25	30	65	80

TECHNICAL CONDITIONS OF CONTRACT (TCC)

	(ALL CATEGORIES)	PRICE INDEX NUMBERS FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)					
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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

Where

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

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

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

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:

- 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

SI No: 12

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

2.21 ARBITRATION & CONCILIATION

2.21.1 ARBITRATION:

2.21.1.1 Except as provided elsewhere in this Contract, in case Parties are unable to

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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 6). 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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.

SI No:13

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.

SI No: 14

Reverse Auction

The chapter Reverse auction procedure published in 'Forms and Procedures' of Volume

TECHNICAL CONDITIONS OF CONTRACT (TCC)

I Book-II stands deleted. Reverse Auction Guidelines available in the website <http://www.bhel.com> shall be applicable.

SI No: 15

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 10.

SI No: 16

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 11.

SI No: 17

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 13

SI No: 18

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 14.

VOLUME-IA PART – II

CHAPTER 2 to 14

In next 385 pages as below

Description	Chapter	No. of pages
Field / Erection Welding Schedule	Chapter-2	94
Painting scheme	Chapter-3	2
Hire charges on issue of Capital Tools & Plants (Only corresponding charges)	Chapter-4	14
Health, Safety and Environment Plan for Site Operation By Subcontractors” (Doc. No. HSEP:14 Rev 00)	Chapter-5	72
Procedure 2.3 of Arbitration & Conciliation	Chapter-6	11
Guidelines for Welding	Chapter-7	98
Guidelines for Heat treatment	Chapter-8	18
General Guidelines for Insulation works	Chapter-9	54
Format for Form no.: F-14 (Rev 01); Monthly Plan & Review with Contractor	Chapter-10	5
Format for Form no.: F-15 (Rev 02); Monthly Performance-Evaluation of Contractor	Chapter-11	6
Proforma of Bank Guarantee for Earnest Money	Chapter-12	3
Proforma of Bank Guarantee for Security Deposit	Chapter-13	3
Integrity Pact (IP)	Chapter-14	5



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-300
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	MS PIPING SH O/L HDR TO MS BOILER STOP VALVE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
1	0-80-300-07112	PIPE	SA335P91	ID	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	350			16	2384	608	1008	5664									
2		PIPE	SA335P91	ID	75	TIG & ARC	75	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	350			2	270	76	126	1056									
3		PIPE	SA335P91	ID	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA182F91	350			2	298	76	126	708									
4		FORGING	SA182F91	OD	105	TIG & ARC	105	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	609.6			2	339	93	152	1301									
5		PIPE	SA335P91	OD	15.24	TIG & ARC	15.24	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	88.9			20	480	160	200	100									
6		PIPE	SA335P91	OD	15.24	TIG & ARC	15.24	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA217GRC12A	88.9			8	192	64	80	40									
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:		
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																				
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
PRADEEP		TRINADHA RAO		SESHAGIRI				05-06-2018		4-80-300-80776		01		OF		01		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660 ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-301
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	MS PIPING FROM BOILER STOP VALVE TO EMERGENCY STOP VALVE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm	Qty		Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C							
		PIPE	SA335P91	ID	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	350			33	4917	1254	2079	11682									
		PIPE	SA335P91	ID	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA217GRC12A	350			2	298	76	126	708									
		PIPE	SA335P91	ID	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA182F91	350			5	745	190	315	1770									
		PIPE	SA335P91	ID	85	TIG & ARC	85	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	460			12	2218	605	994	8511									
		PIPE	SA335P91	ID	85	TIG & ARC	85	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA182F91	460			8	1479	404	663	5674									
		FORGING	SA182F91	ID	85	TIG & ARC	85	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WP91	460			1	185	51	83	710									
		PIPE	SA335P91	ID	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WP91	350			1	149	38	63	354									
		FORGING	SA182F91	ID	135	TIG & ARC	135	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA182F91	390			2	#N/A	#N/A	#N/A	#N/A									
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:		
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																				
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
PRADEEP		TRINADHA RAO		SESHAGIRI				05-03-2018		4-80-301-80779		01		OF		01		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2x660MW ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-303
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF MAIN STEAM PPG. TO AUXILIARY PRESSURE REDUCTION AND DESUPER HEATING STATION

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks										
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes														
								Size	Qty (gms)	Qty(nos)																			
										mm	mm									Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C				
1	1-80-303-21596	PIPE+PIPE	SA335P91	OD	34	TIG & ARC	34 	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3										
		FITTING VALVE	SA234WP91	219.1			16	960	288	400	848																		
	2	1-80-303-21596	PIPE	SA335P22	OD		9.53	TIG & ARC	9.53 	ER90S-B3	E9018-B3									1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
			PIPE	SA335P22	457.2				4	600	136																	212	0
																			REFER NOTE-3										
																			REFER NOTE-3										
																		REFER NOTE-3											
																		REFER NOTE-3											
																		REFER NOTE-3											
																		REFER NOTE-3											
																		REFER NOTE-3											
																		REFER NOTE-3											
																		REFER NOTE-3											
																		REFER NOTE-3											
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:											
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:											
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																													
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																													
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.															
S.RAJU		TRINADHA RAO		SESHAGIRI				09.03.2018		4-80-303-81725		01		OF	01	00													



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-300
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HPBP UPSTREAM PIPING HPBP VALVE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
							Qty	Dia2.4												
1	1-80-304-21597	PIPE	SA335P91	OD	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	323.9			12	960	288	468	2340									
2		PIPE	SA335P91	OD	60	TIG & ARC	60	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA217GRC12A	323.9			2	160	48	78	390									
3																		REFER NOTE-3		
4																		REFER NOTE-3		
5																		REFER NOTE-3		
6																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
PRADEEP		TRINADHA RAO		SESHAGIRI				05-06-2018		4-80-304-81087		01		OF		01		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2x660MW ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-307
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HPBP WARM-UP LINE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks							
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes											
								Size		Qty (gms)	Qty(nos)															
																				mm	mm	Dia2.4	Dia2.5	Dia3.2	Dia4.0	
1	3-80-307-34375	PIPE	SA335P91	OD	6.35	TIG & ARC		ER90S-B9	E9015-B9				1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3						
		FITTING ORIFICE	SA335P91	33.4																	20	112	140	0	0	
																			REFER NOTE-3							
																			REFER NOTE-3							
																			REFER NOTE-3							
																			REFER NOTE-3							
																			REFER NOTE-3							
																			REFER NOTE-3							
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:								
														Approved:				Approved:								
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:				REV. NO.										
S.RAJU		TRINADHA RAO		SESHAGIRI				09.03.2018		4-80-307-81988		01				OF 01 00										



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660 ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-310
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HRH PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)									
		Part-2	Part-2	Size mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0								
	1-80-310-21599	PIPE	SA335P91	ID	38	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
	1-80-310-21600			675				40	10248	2352	3864									10976
		PIPE	SA335P91																	
	1-80-310-21599	PIPE	SA335P91	ID	42	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
	1-80-310-21600			675				9	2256	530	870									3012
		PIPE	SA335P91																	
	1-80-310-21599	PIPE	SA335P91	ID	38	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
	1-80-310-21600			675				4	1025	236	387									1098
		FORGING	SA182F91																	
	1-80-310-21599	PIPE	SA335P91	ID	38	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
	1-80-310-21600			675				2	513	118	194									549
		FORGING	SA182F91																	
	1-80-310-21599	PIPE	SA335P91	ID	42	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
	1-80-310-21600			675				4	1003	236	387									1339
		VALVE	SA217GRC12A																	
	1-80-310-21600	PIPE	SA335P91	ID	48	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
				850				10	2992	714	1173									4777
		PIPE	SA335P91																	
	1-80-310-21600	PIPE	SA335P91	ID	48	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
				850				7	2095	500	822									3344
		FORGING	SA182F91																	
	1-80-310-21600	PIPE	SA335P91	ID	52	TIG & ARC		ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
				850				1	310	76	125									240
		PIPE	SA335P91																	
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:		
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																				
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
PRADEEP		TRINADHA RAO		SESHAGIRI				05-03-2018		4-80-310-80801		01		OF 02 00						



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660 ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-310
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HRH PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0	
																					Part-1
				mm	mm		Qty	Dia2.4				in deg C	in deg C								
	1-80-310-21600	FORGING	SA182F91	ID	58	TIG & ARC	58	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FORGING	SA182F91	730			2	538	135	221	1264										
		1-80-310-21599	FORGING	SA182F91	ID	80	TIG & ARC	80	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P91	672	2			462	126	207	1773										
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
																			REFER NOTE-3		
	Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:			
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																					
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																					
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
PRADEEP		TRINADHA RAO		SESHAGIRI				05-03-2018		4-80-310-80801				02		OF		02		00	



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD Size	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm		Qty					in deg C	in deg C						
	0-80-312-07117	PIPE	SA335P91	OD	42	TIG & ARC	42 	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WP91	711			33	7680	1802	2961	10254								
		PIPE	SA335P91	OD	42	TIG & ARC	42 	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA335P91	711			4	931	219	359	1243								
		PIPE	SA335P91	OD	42	TIG & ARC	42 	ER90S-B9	E9015-B9			1050/R EV05	220	755±15	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FORGING	SA182F91	711			2	466	110	180	622								
		PIPE	SA691GR22	OD	28	TIG & ARC	28 	ER90S-B3	E9018-B3			1035/R EV04	220	750±20	2.5(60 MINUTES MINIMUM)	100% UT 100% MT 100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FORGING	SA182F91	1118			2	798	177	290	446								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	

- (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01
- (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.
- (3) 100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.

PREPARED BY	DESIGN/CHD.	DESIGN/APPD.	QA-CHD./APPRD.	DATE	DRAWING NO:	SHEET NO:			REV. NO.
PRADEEP	TRINADHA RAO	SESHAGIRI		05-03-2018	4-80-312-80808	01	OF	00	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660 ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-320
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CRH PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm	Qty		Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C							
	1-80-320-21594	PIPE	SA335P22	OD	37	TIG & ARC	37	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P22	965			1	330	76	125	353									
	1-80-320-21594	PIPE	SA335P22	OD	37	TIG & ARC	37	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA217WC9	965			2	659	152	249	706									
	1-80-320-21594	FITTING	SA234WP22	OD	37	TIG & ARC	37	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P22	965			7	2306	530	870	2470									
	1-80-320-21594	PIPE	SA335P22	OD	37	TIG & ARC	37	ER80S-B2	E8018-B2			1012/R EV04	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA182F11	965			1	330	76	125	353									
	1-80-320-21594	FORGING	SA182F11	OD	34	TIG & ARC	34	ER70S-A1	E7018-1			1033/R EV03	150	660±10	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	965			4	1340	303	497	1124									
	1-80-320-21594	FITTING	SA234WP22	OD	50	TIG & ARC	50	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA182F22	914			1	300	72	118	478									
	1-80-320-21593	PIPE	SA106GRC	OD	34	TIG & ARC	34	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	965			8	2679	605	994	2247									
	1-80-320-21593	PIPE	SA106GRC	OD	34	TIG & ARC	34	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPC	965			4	1340	303	497	1124									
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:		
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																				
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
PRADEEP		TRINADHA RAO		SESHAGIRI				05-03-2018		4-80-320-80795				01				OF	02	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660 ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-320
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CRH PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			Arc spec		Temp.	Hold time per mm in minutes								
		Part-1	Part-2	Size	mm			Qty (gms)	Qty(nos)										
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2			Dia4.0					
	1-80-320-21593	PIPE	SA106GRC	OD	34	TIG & ARC	34	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA105	965			1	335	76	125									281
	1-80-320-21593	PIPE	SA106GRC	OD	27	TIG & ARC	27	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	762			33	8778	1941	3188									4898
	1-80-320-21593	PIPE	SA106GRC	OD	27	TIG & ARC	27	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FORGING	SA105	762			6	1596	353	580									891
	1-80-320-21593	PIPE	SA106GRC	OD	27	TIG & ARC	27	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPC	792			2	570	126	207									318
	1-80-320-21593	PIPE	SA106GRC	OD	30	TIG & ARC	30	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	508			2	338	76	126									240
	1-80-320-21593	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	323.9			1	112	24	51									0
	1-80-320-21593	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PLATE	SA515GR70	323.9			1	112	24	51									0
	1-80-320-21594	PIPE	SA335P22	OD	28	TIG & ARC	28	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WP22	323.9			2	206	48	78									110
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:	
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																			
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
PRADEEP		TRINADHA RAO		SESHAGIRI				05-03-2018		4-80-320-80795		02		OF		02 00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660 ME ENNORE SEZ STPP	CUST. NO:	7270 & 7271
		PGMA:	80-321
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HPBP DOWN STREAM PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Size	mm	Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm			Qty					in deg C	in deg C					
	1-80-321-21595	PIPE	SA335P22	OD	25	TIG & ARC	25	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WP22	406.4			2	272	60	100	114								
	1-80-321-21595	PIPE	SA335P22	OD	25	TIG & ARC	25	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		VALVE	SA217WC9	406.4			2	272	60	100	114								
	1-80-320-21594	FITTING	SA234WP22	OD	40	TIG & ARC	40	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FORGING	SA182F22	660			2	440	101	166	471								
	1-80-320-21594	FITTING	SA234WP22	OD	36	TIG & ARC	36	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FORGING	SA182F22	660			2	444	101	166	396								
	1-80-320-21594	PIPE	SA335P22	OD	28	TIG & ARC	28	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA335P22	508			14	2408	532	882	1316								
	1-80-320-21594	PIPE	SA335P22	OD	28	TIG & ARC	28	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT 3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WP22	508			4	688	152	252	376								
	1-80-320-21593	PIPE	SA106GRC	OD	34	TIG & ARC	34	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRC	965			8	2679	605	994	2247								
						TIG & ARC												REFER NOTE-3	
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:	
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																			
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
PRADEEP		TRINADHA RAO		SESHAGIRI				05-03-2018		4-80-321-81148		01		OF		01		00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660MW ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-323
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	EXTRACTION STEAM FROM COLD REHEAT PIPING TO BOILER FEED PUMP DRIVE TURBINE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Size	Qty (gms)	Qty(nos)									
										mm	mm								
1	0-80-323-07308	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPB	323.9			8	832	192	296	0								
2	0-80-323-07308	FITTING	SA234WPB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		VALVE	SA216WCB	273			2	186	40	66	12								
3	0-80-323-07308	PIPE+PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT (NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA216WCC	273			52	4836	1040	1716	312								
4	0-80-323-07308	PIPE	SA106GRC	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT (NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		STUB EDNCOVER	SA515GR70	114.3			2	54	42	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.	
S.RAJU		TRINADHA RAO		SESHAGIRI				09.03.2018		4-80-323-81805				01		OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660MW ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-331
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	EXTRACTION STEAM PIPING TO LP HEATER - 2

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD Size mm	Thick mm			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)		Qty(nos)									
								Dia2.4	Dia2.5	Dia3.2	Dia4.0								
1	1-80-331-21884	PIPE+PIPE	SA672GRB70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA672GRB70	914			20	6256	1428	2244									0
2	1-80-331-21884	FITTING	SA234WPB	OD	10	TIG & ARC	10	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB	SA672GRB70	1016			1	350	80	126									0
3	1-80-331-21884	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB ENDCOVER	SA515GR70	323.9			4	416	96	148									0
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:	
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																			
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.	
S.RAJU		TRINADHA RAO		SESHAGIRI				09.03.2018		4-80-331-81404				01		OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-334
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO. OF EXTRACTION STEAM PIPING TO LP HEATER - 4

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2								
		Part-1	Part-2	mm	mm	Qty					in deg C	in deg C							
1	1-80-334-21876	PIPE+PIPE	SA672GRB70	OD	10	TIG & ARC	10	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA672GRB70	559			24	4858	1109	1743	0								
2	1-80-334-21876	PIPE+PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	508			9	1629	342	567	126								
3	1-80-334-21876	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		STUB FITTING	SA234WPB	219.1			4	284	148	0	0								
4	1-80-334-21876	FITTING	SA105	OD	20	TIG & ARC	20	ER70S-A1		E7018-1		1004/R EV03	10	610±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		STUB	SA106GRB	660			1	236	51	83	62								
5	1-80-334-21876	FITTING	SA234WPB	OD	12.7	TIG & ARC	12.7	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		STUB	SA106GRB	610			1	220	47	76	17								
6	1-80-334-21876	FITTING	SA234WPB	OD	5.49	TIG & ARC	5.49	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPB	88.9			2	40	30	0	0								
																			REFER NOTE-3
																			REFER NOTE-3
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:	
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																			
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				12.03.2018		4-80-334-81396		01		OF	01	00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-335
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	EXTRACTION STEAM PIPING TO DEAERATOR

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Size	mm	Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm		Qty					in deg C	in deg C						
1	0-80-335-07283	PIPE	SA672GRB70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING STUB	SA672GRB70	965			8	2650	605	951	0								
2	0-80-335-07283	PIPE+PIPE	SA672GRB70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA672GRB70	610			21	4251	971	1525	0								
3	0-80-335-07283	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	406.4			35	4620	1050	1645	0								
4	0-80-335-07283	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		STUB ENDCOVER	SA106GRB	219.1			4	284	148	0	0								
5	0-80-335-07283	FITTING	SA234WPB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPC	508			1	167	38	60	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				12.03.2018		4-80-335-81741				01			OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-336
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	EXTRACTION STEAM PIPING TO HPH-6

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm		Qty	Dia2.4												
1	1-80-336-21852	PIPE	SA335P22	OD	9.53	TIG & ARC	9.53	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA217WC9	355.6			2	230	54	82	0									
2	1-80-336-21852	PIPE+PIPE	SA335P22	OD	9.53	TIG & ARC	9.53	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WP22	323.9			29	3016	696	1073	0									
3	1-80-336-21852	PIPE	SA335P22	OD	7.11	TIG & ARC	7.11	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB FITTING	SA234WP22	168.3			3	159	45	33	0									
4	1-80-336-21852	FITTING	SA234WP22	OD	19.05	TIG & ARC	19.05	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB	SA335P22	457			1	158	34	56	41									
5	1-80-336-21852	FITTING	SA234WP22	OD	6.02	TIG & ARC	6.02	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WP22	114.3			2	54	42	0	0									
																		REFER NOTE-3		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-337
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	EXTRACTION STEAM PIPING FROM CRH STEAM TO HPH-7

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Part-1	Part-2	Size mm								
1	1-80-337-22196	PIPE	SA106GRC	OD	15.09	TIG & ARC	15.09	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	355.6			21	2583	567	924	294								
2	1-80-337-22196	FITTING	SA234WPC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING STUB	SA234WPC	323.9			2	224	48	102	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				12.03.2018		4-80-337-81807		01		OF 01 00					



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-338
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF EXTRACTION STEAM PIPING TO HPH-8

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm		Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C						
1	1-80-338-21821	PIPE+PIPE	SA106GRC	OD	15.09	TIG & ARC	15.09	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	273			27	2376	540	891	270								
2	1-80-338-21821	PIPE	SA106GRC	OD	10.97	TIG & ARC	10.97	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPC	168.3			10	510	150	230	0								
3	1-80-338-21821	FITTING	SA234WP11	OD	14.27	TIG & ARC	14.27	ER70S-A1	E7018-1			1033/R EV03	150	660±10	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE STUB	SA234WPB	168.3			4	212	60	92	16								
4	1-80-338-21821	PIPE	SA106GRC	OD	8.56	TIG & ARC	8.56	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		STUB FITTING	SA234WPC	114.3			4	101	44	36	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:			SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHGIRI				12.03.2018		4-80-338-81296			01		OF 01		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-340
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM UNIT HEADER

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
				mm	mm		Qty					in deg C	in deg C						
1	1-80-340-22198	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	457.2			40	6000	1360	2120	0								
2	1-80-340-22198	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	355.6			2	230	54	82	0								
3	1-80-340-22198	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPB	219.1			6	426	222	0	0								
4	1-80-340-22198	PIPE+FITTIN G	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		VALVE ENDCOVER	SA216WCB	114.3			17	453	357	0	0								
5	1-80-340-22198	STUB	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		VALVE	SA216WCB	88.9			2	40	30	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-340-81978				01			OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-341
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM STATION HEADER INTERCONNECTION PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Part-1	Part-2	Qty (gms)	Qty(nos)									
											Part-1									Part-2
1	1-80-341-22113	PIPE+PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			57	5073	1140	627	0									
2	1-80-341-22113	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB ENDCOVER	SA515GR70	114.3			2	54	42	0	0									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-341-81726		01		OF 01 00						



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-342
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM TO SCAPH AND FO ATOMIZATION

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0	
																					Part-1
		Part-2	Part-2	mm	mm		Qty	Dia2.4				in deg C	in deg C								
1	0-80-342-07323	PIPE+PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA234WPB	273			28	2436	560	840	0										
2	0-80-342-07323	PIPE+PIPE	SA106GRB	OD	8.18	TIG & ARC	8.18	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	219.1			15	1050	255	270	0										
3	0-80-342-07323	PIPE+PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	168.3			55	2915	825	605	0										
4	0-80-342-07323	PIPE+PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	88.9			34	667	510	0	0										
5	0-80-342-07323	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA234WPB	114.3			4	107	84	0	0										
6	0-80-342-07324	PIPE+PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	168.3			54	2862	810	594	0										
7	0-80-342-07324	PIPE+PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	88.9			34	667	510	0	0										
8	0-80-342-07324	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA234WPB	114.3			4	107	84	0	0										
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-342-81906				01		OF		01		00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-343
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM TO AIR HEATER SOOT BLOWER

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD Size mm	Thick mm			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
1	0-80-343-07322	PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	168.3			61	3233	915	671									0
2	0-80-343-07322	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	114.3			2	54	42	0									0
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-343-81900		01		OF 01 00					



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-344
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM TO FUEL OIL PUMP HOUSE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks			
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes							
								Part-1	Part-2	Qty (gms)	Qty(nos)											
																				Part-1	Part-2	Dia2.4
																			in deg C	in deg C		
1	2-80-344-14655	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE FITTING	SA234WPB	273			258	22962	5160	2838	0											
2	2-80-344-14655	PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE FITTING	SA234WPB	168.3			112	5936	1680	1232	0											
	2-80-344-14655	PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE	SA106GRB	33.4			30	192	150	0	0											
	2-80-344-14655	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		STUB	SA105	46			35	NIL	66	0	0											
																		REFER NOTE-3				
																		REFER NOTE-3				
																		REFER NOTE-3				
																		REFER NOTE-3				
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:				
														Approved:				Approved:				
												PREPARED BY										
S.RAJU												4-80-344-81286				01			OF	01	00	
DESIGN/CHD.																						
DESIGN/APPD.																						
QA-CHD./APPRD.																						
DATE																						
14.03.2018																						



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-345
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM TO DEAERATOR

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes					
								Size	mm	Qty (gms)	Qty(nos)										
											mm	Dia2.4									Dia2.5
Part-1	Part-2	Part-1	Part-2	mm	mm	Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C									
1	0-80-345-07335	PIPE	SA387GR12	OD	10	TIG & ARC	10	ER80S-B2			1009/R EV03	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING VALVE	SA387GR12	559			2	405	93	146									0		
2	0-80-345-07335	PIPE+PIPE	SA515GR70	OD	10	TIG & ARC	10	ER70S-A1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING VALVE	SA234WPB	559			8	1620	370	581									0		
3	0-80-345-07335	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING VALVE	SA234WPB	323.9			28	2912	672	1036									0		
4	0-80-345-07335	PIPE	SA335P11	OD	9.53	TIG & ARC	9.53	ER80S-B2			1009/R EV03	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING	SA234WP11	323.9			2	208	48	74									0		
5	0-80-345-07335	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		STUB ENDCOVER	SA515GR70	219.1			2	142	74	0									0		
6	0-80-345-07335	PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING VALVE	SA216WCB	168.3			13	689	195	143									0		
7	0-80-345-07335	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		STUB ENDCOVER	SA515GR70	114.3			2	54	42	0									0		
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-345-81984				01		OF	01	00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-349
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM TOMAIN TURBINE GLAND SEALING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Size	mm	Qty (gms)										Qty(nos)	
										mm	mm									Dia2.4	Dia2.5
in deg C																					
1	1-80-349-22195	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA216WCB	114.3			2	54	42	0	0										
2	1-80-349-22195	PIPE+PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA216WCB	88.9			26	510	390	0	0										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-349-81802				01				OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-351
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY STEAM PIPING TO MILL INERTING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm		Qty	Dia2.4				in deg C	in deg C							
1	0-80-351-07326	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA216WCB	355.6			11	1265	297	451	0									
2	0-80-351-07326	PIPE+PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA216WCB	273			64	5568	1280	1920	0									
3	0-80-351-07326	PIPE	SA106GRB	OD	8.18	TIG & ARC	8.18	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	219.1			36	2520	612	648	0									
4	3-80-351-32451	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRB	273			16	1392	320	480	0									
5	3-80-351-32451	PIPE	SA106GRB	OD	6	NIL	6	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB	SA105	273			8	NIL	102	0	0									
																		REFER NOTE-3		
																			REFER NOTE-3	
																			REFER NOTE-3	
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:		
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																				
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				14.03.2018		4-80-351-81930				01			OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-363
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF BFPT EXHAUST TO CONDENSER, BFPT A&B RUPTURE DISC EXHAUST TO ATMOSPHERE,START-UP VENT FROM EXT.STEAM TO BFPT A&B

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes					
								Size	mm	Qty (gms)	Qty(nos)										
											mm	mm									Dia2.4
Part-1	Part-2	Part-1	Part-2	Size	mm	Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C									
1	0-80-363-07224	P.F.PIPE	SA515GR70	OD	16	TIG & ARC	16	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		P.F.PIPE BEND	SA515GR70	1829			28	18388	3881	6376	2126										
	2	0-80-363-07224	P.F.PIPE	SA515GR70	OD	8	NIL	8 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FLANGE	SA515GR70	1829	4			NIL	229	184	0										
3		0-80-363-07224	P.F.PIPE	SA515GR70	OD	7	NIL	7 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FLANGE	SA515GR70	1829	4			NIL	458	0	0										
	4	1-80-363-21943	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	323.9	18			1872	432	666	0										
5		1-80-363-22110	PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	168.3	20			1060	300	220	0										
																			REFER NOTE-3		
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:			
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																					
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																					
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-363-81529				01				OF	01	00	



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)											
									Part-1	Part-2	Size									mm
1	1-80-370-21936	P.F.PIPE	SA515GR70	OD	12	TIG & ARC	12	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		P.F.PIPE BEND	SA515GR70	1828			18	10871	2495	4099	1188									
2	1-80-370-21936	PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPB	273			9	783	180	270	0									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-370-81494				01				OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-371
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	UNIT FLASH TANK DARIN AND VENT PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Part-1	Part-2	Size mm	mm	Qty					in deg C	in deg C							
1	1-80-371-21995	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPB	508			8	1336	304	480									0
2	1-80-371-21995	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPB	219.1			14	994	518	0									0
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:			REV. NO.				
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-371-81621		01			OF	01	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-373
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HT AND LT AUXILIARY STEAM HEADER SV EXHAUST PIPING TO ATMOSPHERE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
		Part-1	Part-1	Size			Qty					in deg C	in deg C						
		Part-2	Part-2	mm	mm														
1	1-80-373-22117	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPB	273			8	712	160	88	0								
2	1-80-373-22117	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	355.6			14	1610	378	574	0								
3	1-80-373-22117	PIPE	SA106GRB	OD	7	NIL	7 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	273			4	NIL	68	0	0								
4	1-80-373-22117	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	273			4	NIL	51	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-373-81738		01		OF 01 00					



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-375
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	LPH-2,3,4 AND HPH-7 SV EXHAUST TO FLASH PIPE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
				mm	mm		Qty					in deg C	in deg C						
1	1-80-375-22175	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	323.9			10	1070	240	170	0								
2	1-80-375-22175	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	273			17	1513	340	187	0								
3	1-80-375-22175	PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	168.3			44	2332	660	484	0								
4	1-80-375-22175	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	168.3			4	NIL	32	0	0								
5	1-80-375-22175	PIPE	SA106GRB	OD	7	NIL		ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	168.3			4	NIL	42	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-375-81744				01			OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-379
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HPH-6 & 8 SV EXHAUST TO HP FLASH PIPE (FLASH PIPE-2)

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm		Qty	Dia2.4				in deg C	in deg C							
1	1-80-379-22176	PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	508			7	1267	266	441	98									
2	1-80-379-22176	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	273			11	979	220	121	0									
3	1-80-379-22176	PIPE+PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPB	219.1			22	1562	814	0	0									
4	1-80-379-22176	PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPB	168.3			10	530	150	110	0									
5	1-80-379-22176	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB ENDCOVER	SA515GR70	114.3			2	54	42	0	0									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-379-81749				01			OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-381
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	HEATERS AND DEARATOR VENTS , START-UP VENT

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size	Qty (gms)			Qty(nos)											
		Part-2	Part-2	mm	mm			Dia2.4	Dia2.5	Dia3.2	Dia4.0			in deg C	in deg C				
1		PIPE	SA106GRB	OD	8.74	TIG & ARC	8.74	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	60.3			35	389	350	105	0								
2		PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	33.4			10	64	50	0	0								
3		PIPE	SA106GRB	OD	8	NIL	8 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	60.3			90	NIL	148	119	0								
4		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	33.4			27	NIL	28	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:			REV. NO.				
S.RAJU		TRINADHA RAO		SESHAGIRI				15.03.2018		4-80-381-81721		01			OF	01	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-382
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF LPH -1,2,3 AND 4 AIR EXTRACTION TO CONDENSER

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)											
									Dia2.4	Dia2.5	Dia3.2									Dia4.0
Part-1	Part-2	Size	mm	mm	Qty					in deg C	in deg C									
1	2-80-382-15052	PIPE+PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	168.3			16	848	240	176									0	
2	2-80-382-15052	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA105	33.4			10	NIL	10	0									0	
3	2-80-382-15053	PIPE+PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	114.3			23	612	483	0									0	
4	2-80-382-15053	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA105	33.4			11	NIL	11	0									0	
5	2-80-382-15054	PIPE+PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	114.3			22	586	462	0									0	
6	2-80-382-15054	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA105	33.4			10	NIL	10	0									0	
7	2-80-382-15055	PIPE+PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	114.3			23	612	483	0									0	
8	2-80-382-15055	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA105	33.4			10	NIL	10	0									0	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				16.03.2018		4-80-382-81660		01		OF		01 00				



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-385
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	SV ESCAPE PIPING OF EXTRACTION LINE TOTDBFD,GSC ALTERNATE EXHAUST TO ATMOSPHERE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Part-1	Part-2	Size								
1	1-80-385-22034	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	406.4			12	1584	360	564	0								
2	1-80-385-22034	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	273			6	534	120	66	0								
3	1-80-385-22034	PIPE	SA106GRB	OD	7	NIL	7 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	273			4	NIL	68	0	0								
4	1-80-385-22034	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	273			4	NIL	51	0	0								
5	1-80-385-22034	PIPE	SA106GRB	OD	7	NIL	7 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	168.3			4	NIL	#VALUE!	#VALUE!	#VALUE!								
6	1-80-385-22034	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FLANGE	SA515GR70	168.3			4	NIL	32	0	0								
7	1-80-385-22035	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA106GRB	323.9			15	1605	360	255	0								
8	1-80-385-22035	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	60.3			5	63	50	0	0								
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				16.03.2018		4-80-385-81655		01		OF 01 00					



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size	Qty (nos)															
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0		in deg C	in deg C					
1	2-80-395-15497	PIPE+PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
	FITTING VALVE	SA234WPB	114.3	11			293	231	0	0										
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				16.03.2018		4-80-395-81895				01				OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-400
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CONDENSATE EXTRACTION PUMP SUCTION PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-1	Size	mm	mm	Qty	Qty	Qty	Qty	in deg C	in deg C									
Part-2	Part-2	mm	mm																
1	1-80-400-21952	PIPE	SA672GRB70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING ENDCOVER	SA515GR70	660			16	3533	807	1268									0
2	1-80-400-21952	PIPE	SA672GRB70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA515GR70	559			23	4656	1063	1670									0
3	1-80-400-21952	PIPE+FITTING	SA106GRB	OD	5.54	NIL	5.54 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FLANGE STUB	SA105	60.3			45	NIL	117	0									0
4	1-80-400-21952	PIPE	SA106GRB	OD	4.55	NIL	4.55 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FLANGE STUB	SA105	33.4			8	NIL	9	0									0
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:			REV. NO.				
S.RAJU		TRINADHA RAO		SESHAGIRI				16.03.2018		4-80-400-81560		01			OF 01 00				



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-401
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF CEP DISCHARGE TO DEAERATOR PART - 1, 2, AND 3

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)										
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2			Dia4.0	in deg C				
1	1-80-401-22205	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPC	457.2			5	810	170	280	60								
2	1-80-401-22205	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	323.9			23	2392	552	851	0								
3	1-80-401-22205	PIPE+FITTIN G	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		VALVE STUB	SA216WCB	88.9			24	471	360	0	0								
4	1-80-401-22212	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	457.2			16	2592	544	896	192								
5	1-80-401-22212	PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	406.4			8	1144	240	400	80								
6	1-80-401-22213	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPC	457.2			13	2106	442	728	156								
7	1-80-401-22213	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	323.9			14	1456	336	518	0								
8	1-80-401-22213	PIPE+PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA216WCB	114.3			22	586	462	0	0								
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:			SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				17.03.2018		4-80-401-81838			01			OF	02	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-401
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF CONDENSATE FROM DRAIN COOLER TO LPH-1 / ISO.OF CEP DISCHARGE TO DEAERATOR PART-2 / ISO.OF GSC MINIMUM FLOW RECIRCULATION

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Qty (gms)	Qty(nos)	Dia2.4	Dia2.5									Dia3.2	Dia4.0
							Qty					in deg C	in deg C								
1	1-80-401-22214	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		PIPE FITTING	SA234WPC	457.2			30	4860	1020	1680	360										
2	1-80-401-22215	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	457.2			33	5346	1122	1848	396										
3	1-80-401-22215	PIP	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA216WCB	406.4			11	1573	330	550	110										
4	1-80-401-22215	PIPE+FITTIN G	SA106GRC	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		STUB ENDCOVER	SA234WPC	114.3			6	160	126	0	0										
5	1-80-401-22216	PIPE+PIPE	SA106GRC	OD	8.18	TIG & ARC	8.18	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	219.1			52	3640	884	936	0										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				17.03.2018		4-80-401-81838				02				OF	02	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-402
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CEP DISCHARGE FROM LPH-1 OUTLET TO LPH-4 INLET AND HEATERS BYPASS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Part-1	Part-2	Size mm	mm	Qty					in deg C	in deg C							
1	0-80-402-07285	PIPE+PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	457.2			96	15552	3264	5376	1152								
2	0-80-402-07285	PIPE+PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	406.4			35	5005	1050	1750	350								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				17.03.2018		4-80-402-81746		01		OF	01	00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-403
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CEP DISCHARGE PIPING FROM LPH-4 TO DEAERATOR

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Size	mm	Qty (gms)										Qty(nos)	
										mm	mm									Dia2.4	Dia2.5
1	0-80-403-07284	PIPE+PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	457.2			46	7452	1564	2576	552										
2	0-80-403-07284	PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	406.4			8	1144	240	400	80										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.							
S.RAJU		TRINADHA RAO		SESHAGIRI				17.03.2018		4-80-403-81745		01		OF 01 00							



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-407
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CONDENSATE FOR SEALING VACCUM

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks			
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes							
								Part-1	Part-1	Qty (gms)	Qty(nos)											
																				Part-2	Part-2	Dia2.4
																			in deg C	in deg C		
1		PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE	SA234WPB	60.3			25	315	250	0	0											
2		PIPE	SA217GRC12A	OD	4.5	TIG & ARC	4.5	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT100% MT100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE	SA217GRC12A	31.8			100	640	500	0	0											
3		PIPE	SA106GRB	OD	3.73	TIG & ARC	3.73	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE	SA106GRB	21.3			60	810	0	0	0											
4		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING	SA105	60.3			90	NIL	173	0	0											
5		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING	SA105	31.8			480	NIL	#VALUE!	#VALUE!	#VALUE!											
6		PIPE	SA106GRB	OD	3.73	NIL	3.73 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		FITTING	SA105	21.3			270	NIL	105	0	0											
																		REFER NOTE-3				
																		REFER NOTE-3				
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:				
														Approved:				Approved:				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				17.03.2018		4-80-407-81647				01			OF	01	00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-408
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF CONDENSATE EXCESS RETURN PIPING TO CST

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size				Qty (gms)	Qty(nos)										
		Part-2	Part-2	mm	mm			Dia2.4	Dia2.5	Dia3.2	Dia4.0								
1	1-80-408-22030	PIPE+PIPE	SA106GRC	OD	8.18	TIG & ARC	8.18	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	219.1			37	2590	629	666	0								
2	1-80-408-22030	PIPE	SA106GRC	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	168.3			10	530	150	110	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				17.03.2018		4-80-408-81650				01			OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-412
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF EMERGENCY MAKEUP PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Part-1	Part-2	Qty (gms)	Qty(nos)									
																				Size
		Part-2	Part-2	mm	mm		Qty													
1	1-80-412-22223	PIPE+PIPE	SA312TP304H	OD	3.05	TIG & ARC	3.05	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
2	1-80-412-22223	PIPE	SA312TP304H	OD	3.05	TIG & ARC	3.05	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				19.03.2018		4-80-412-81862				01			OF	01	00	



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD Size mm	Thick mm			TIG		Arc spec				Temp. in deg C	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
1		PIPE+PIPE	SA106GRB	OD	3.73	TIG & ARC	3.73	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		NIPPLE	SA106GRB	21.3			800	10800	0	0	0								
		REDUCER																	
																			REFER NOTE-3
																			REFER NOTE-3
																			REFER NOTE-3
																			REFER NOTE-3
																			REFER NOTE-3

Notes:

(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01

(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.

(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.

PREPARED BY	DESIGN/CHD.	DESIGN/APPD.	QA-CHD./APPRD.	DATE	DRAWING NO:	SHEET NO:	REV. NO.
S.RAJU	TRINADHA RAO	SESHAGIRI		19.03.2018	4-80-418-83271	01	OF 01 00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-419
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF DEAERATOR SV ESCAPE PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Qty (gms)	Qty(nos)	Dia2.4	Dia2.5									Dia3.2	Dia4.0
							Qty					in deg C	in deg C								
1	1-80-419-21998	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	114.3			17	453	357	0	0										
3	1-80-419-21998	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	60.3			28	353	280	0	0										
4	1-80-419-21924	PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA234WPB	273			6	534	120	66	0										
5	1-80-419-21924	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		PIPE FITTING	SA234WPB	355.6			16	1840	432	656	0										
6	1-80-419-21924	PIPE	SA106GRB	OD	7	NIL	7 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FLANGE	SA515GR70	273			6	NIL	#VALUE!	#VALUE!	#VALUE!										
7	1-80-419-21924	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FLANGE	SA515GR70	273			6	NIL	77	0	0										
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.							
S.RAJU		TRINADHA RAO		SESHAGIRI				19.03.2018		4-80-419-81467		01		OF		01		00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-420
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	BOILER FEED SUCTION PIPING TO TDBFP A AND B / ISO.FOR BOILER FEED SUCTION PIPING TO MDBFP

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks							
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes											
								Qty (gms)	Qty(nos)	Dia2.4	Dia2.5									Dia3.2	Dia4.0					
																						Part-1	Part-2	Size	mm	
																			Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
																					Approved:					
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																										
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.								
S.RAJU		TRINADHA RAO		SESHAGIRI				19.03.2018		4-80-420-81290				01		OF	01	00								



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-421
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	BFP REC.PIPING FROM MOTOR DRIVEN FP / BFP REC.PIPING FRO TURBINR DRIVEN BFP-B AND A

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)											
									Dia2.4	Dia2.5	Dia3.2									Dia4.0
Part-1	Part-2	Size	mm	mm	Qty					in deg C	in deg C									
1	1-80-421-21601	PIPE+PIPE	SA106GRB	OD	50	TIG & ARC	50	ER70S-A1		E7018-1		1004/R EV03	100	610±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			26	1820	520	858	3146									
2	1-80-421-21601	PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			9	783	180	270	0									
3	1-80-421-21601	PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB ORIFICE	SA106GRB	273			3	279	60	99	18									
4	1-80-421-21602	PIPE+PIPE	SA106GRB	OD	50	TIG & ARC	50	ER70S-A1		E7018-1		1004/R EV03	100	610±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			29	2030	580	957	3509									
5	1-80-421-21602	PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			9	783	180	270	0									
6	1-80-421-21602	PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		STUB ORIFICE	SA106GRB	273			3	279	60	99	18									
7	1-80-421-21603	PIPE+PIPE	SA106GRB	OD	50	TIG & ARC	50	ER70S-A1		E7018-1		1004/R EV03	100	610±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			32	2240	640	1056	3872									
8	1-80-421-21603	PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	273			11	957	220	330	0									
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:			SHEET NO:			REV. NO.				
S.RAJU		TRINADHA RAO		SESHAGIRI				19.03.2018		4-80-421-80802			01			OF	02	00		



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes					
		Part-1	Part-1	Size	Qty (gms)			Qty(nos)													
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0		in deg C	in deg C						
1	1-80-421-21601	PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		STUB ORIFICE	SA234WPB	273			3	279	60	99	18										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				19.03.2018		4-80-421-80802				02		OF		02		00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-423
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	BFW DISCHARGE PIPING FROM MDBFP-C TO CONTROL STN. / CONTROL STN. TO HEATER INLET / BFW DISC.PIPING FROM TDBFP TO FEED CONTROL STN.

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm			Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C	minutes						
1	1-80-423-21612	PIPE	SA106GRC	OD	116	TIG & ARC	116	ER70S-A1	E7018-1			1005/R EV05	150	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPC	660			6	#N/A	#N/A	#N/A	#N/A									
2	1-80-423-21612	PIPE+PIPE	SA106GRC	OD	82	TIG & ARC	82	ER70S-A1	E7018-1			1005/R EV05	150	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	450			33	3828	1122	1848	15345									
3	1-80-423-21614	PIPE	SA106GRC	OD	116	TIG & ARC	116	ER70S-A1	E7018-1			1005/R EV05	150	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPC	660			4	#N/A	#N/A	#N/A	#N/A									
4	1-80-423-21614	PIPE	SA106GRC	OD	64	TIG & ARC	64	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	355.6			6	468	162	264	1860									
5	1-80-423-21614	PIPE+PIPE	SA106GRC	OD	72	TIG & ARC	72	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	559			39	6607	1802	2961	25354									
6	1-80-423-21614	PIPE	SA106GRC	OD	64	TIG & ARC	64	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	355.6			8	624	216	352	2480									
7	1-80-423-21618	PIPE	SA106GRC	OD	116	TIG & ARC	116	ER70S-A1	E7018-1			1005/R EV05	150	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPC	660			10	#N/A	#N/A	#N/A	#N/A									
8	1-80-423-21618	PIPE+PIPE	SA106GRC	OD	82	TIG & ARC	82	ER70S-A1	E7018-1			1005/R EV05	150	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	457.2			35	4060	1190	1960	16275									
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:		
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																				
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																				
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				20.03.2018		4-80-423-80865				01		OF	01	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-424
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	BF DISCHARGE PIPING FROM HPH-06 TO 07 AND HPH-06 BYPASS / BF DISCHARGE PIPING FROM HPH-07 TO 08 AND HPH-07 BYPASS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Part-1	Part-2	Size mm	mm	Qty					in deg C	in deg C							
1	0-80-424-07125	PIPE	SA106GRC	OD	62	TIG & ARC	62	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	457			5	650	170	280									1565
2	0-80-424-07125	PIPE+PIPE	SA106GRC	OD	72	TIG & ARC	72	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	559			44	7454	2033	3340									28605
3	0-80-424-07126	PIPE	SA106GRC	OD	72	TIG & ARC	72	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	559			33	5591	1525	2505									21454
4	0-80-424-07126	PIPE	SA106GRC	OD	62	TIG & ARC	62	ER70S-A1	E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	457			10	1300	340	560									3130
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				20.03.2018		4-80-424-80874				01			OF	01	00



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			Arc spec		Temp.	Hold time per mm in minutes									
		Part-1	Part-1	Size	Qty (nos)															
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2			Dia4.0						
1	0-80-425-07127	PIPE+PIPE	SA106GRC	OD	72	TIG & ARC	72	ER70S-A1		E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	559			41	6946	1895	3112	26655									
2	0-80-425-07127	PIPE	SA106GRC	OD	62	TIG & ARC	62	ER70S-A1		E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	457			9	1170	306	504	2817									
3	0-80-425-07127	PIPE	SA106GRC	OD	62	TIG & ARC	62	ER70S-A1		E7018-1		1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	457			9	1170	306	504	2817									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				20.03.2018		4-80-425-80878				01				OF	01	00



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)											
									Part-1	Part-2	Size									mm
1	1-80-430-22201	PIPE+PIPE	SA106GRC	OD	32	TIG & ARC	32	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	219.1			25	1550	450	625	1100									
2	1-80-430-22201	PIPE	SA106GRC	OD	27.5	TIG & ARC	27.5	ER70S-A1	E7018-1			1005/R EV05	100	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	168.3			16	720	224	384	320									
3	1-80-430-22201	PIPE	SA335P22	OD	30	TIG & ARC	30	ER90S-B3	E9018-B3			1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WP22	168.3			14	602	196	336	378									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				20.03.2018		4-80-430-81823				01				OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-431
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	SCHEME OF SPRAY WATER PIPING TO AUXILIARY PRESSURE REDUCING DESUPER HEATER

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm		Qty					in deg C	in deg C						
1	2-80-431-15843	PIPE+PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3		1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
			FITTING VALVE	SA234WP22	60.3		11	139	110	0	0								
2	2-80-431-15843	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
			PIPE FITTING	SA234WPB	60.3		46	580	460	0	0								
3	2-80-431-15843	PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
			FITTING	SA234WPB	33.4		4	26	20	0	0								
4	2-80-431-15843	PIPE	SA335P11	OD	5.54	TIG & ARC	5.54	ER80S-B2	E8018-B2		1009/R EV03	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
			PIPE VALVE	SA335P11	60.3		2	26	20	0	0								
5	2-80-431-15843	FITTING	SA234WPB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
			VALVE	SA216WCB	48.3		2	20	16	0	0								
6	2-80-431-15843	PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
			FITTING	SA105	60.3		44	NIL	114	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes:												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01														Approved:				Approved:	
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.																			
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.																			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.	
S.RAJU		TRINADHA RAO		SESHAGIRI				21.03.2018		4-80-431-81827				01		OF	01	00	



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
				Part-1	Part-2			Size		Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2		Dia4.0	in deg C	in deg C				
1	0-80-433-07328	PIPE+PIPE	SA106GRC	OD	21.95	TIG & ARC	21.95	ER70S-A1		E7018-1		1005/R EV05	10	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	168.3			16	784	224	384	208								
2	0-80-433-07328	PIPE+PIPE	SA106GRC	OD	13.49	TIG & ARC	13.49	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	114.3			73	2482	803	1095	0								
3	1-80-433-22260	PIPE+PIPE	SA106GRC	OD	21.95	TIG & ARC	21.95	ER70S-A1		E7018-1		1005/R EV05	10	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPC	168.3			54	2646	756	1296	702								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				21.03.2018		4-80-433-81939				01			OF	01	00



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Size	mm	Qty (gms)										Qty(nos)	
										Part-1	Part-2									Dia2.4	Dia2.5
		Part-2	Part-2	mm	mm	Qty					in deg C	in deg C									
1	1-80-436-22024	PIPE+PIPE	SA106GRC	OD	9.27	TIG & ARC	9.27 	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	273			26	2262	520	780	0										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			

Notes:

(1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01
(2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable.
(3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.

PREPARED BY	DESIGN/CHD.	DESIGN/APPD.	QA-CHD./APPRD.	DATE	DRAWING NO:	SHEET NO:	REV. NO.
S.RAJU	TRINADHA RAO	SESHAGIRI		21.03.2018	4-80-436-81629	01	OF 01 00



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Size mm	mm	Qty															
1	1-80-442-22197	PIPE+PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	88.9			29	569	435	0									0
2	1-80-442-22197	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	60.3			5	63	50	0									0
3	1-80-442-22197	PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	33.4			7	45	35	0									0
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:			SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				21.03.2018		4-80-442-81809			01			OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-444
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF LPH-2 DRAIN TO LPH-1 / ISO.OF LPH-2 DRAIN TO LPDFT-B / LPH-4 DRAIN TO LHP-3 / LPH-3 DRAIN TO LPH-2 AND FT-B

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Size	mm	Qty (gms)	Qty(nos)										
																				Part-1	Part-2
		Part-2	Part-2	mm	mm		Qty					in deg C	in deg C								
1	1-80-444-22054	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	355.6			12	1380	324	492	0										
2	1-80-444-22054	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	323.9			19	1976	456	703	0										
3	1-80-444-22055	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	355.6			4	460	108	164	0										
4	1-80-444-22055	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	323.9			21	2184	504	777	0										
5	1-80-444-22056	PIPE	SA106GRC	OD	8.18	TIG & ARC	8.18	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	219.1			13	910	221	234	0										
6	1-80-444-22056	PIPE+PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	168.3			43	2279	645	473	0										
7	1-80-444-22057	PIPE+PIPE	SA106GRB	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	273			35	3115	700	385	0										
8	1-80-444-22057	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	323.9			11	1144	264	407	0										
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				21.03.2018		4-80-444-81691				01		OF		02		00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-444
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISO.OF LPH-2 DRAIN TO LPH-1 / ISO.OF LPH-2 DRAIN TO LPDFT-B / LPH-4 DRAIN TO LHP-3 / LPH-3 DRAIN TO LPH-2 AND FT-B

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-1	Size			Qty					in deg C	in deg C								
Part-2	Part-2	mm	mm																
9	1-80-444-22057	PIPE	SA335P11	OD	9	TIG & ARC	9	ER80S-B2	E8018-B2		1009/R EV03	150	NIL	NIL(NIL)	10% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WP11	323.9			2	208	48	74									0
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-447
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF HP HEATER-6 DRAIN TO DEAERATOR

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Qty (gms)	Qty(nos)	Dia2.4	Dia2.5									Dia3.2	Dia4.0
		Part-1	Part-1	mm	mm		Qty					in deg C	in deg C								
1	1-80-447-22101	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	323.9			29	3016	696	1073	0										
2	1-80-447-22102	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	355.6			4	460	108	164	0										
3	1-80-447-22102	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	323.9			18	1872	432	666	0										
4	1-80-447-22102	FITTING	SA234WPB	OD	8.18	TIG & ARC	8.18	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		VALVE	SA216WCB	219.1			2	140	34	36	0										
5	1-80-447-22103	PIPE+PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	323.9			32	3584	768	1632	0										
6	1-80-447-22103	FITTING	SA234WPC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING STUB	SA234WPC	406.4			4	572	120	200	40										
7	1-80-447-22103	FITTING	SA234WPC	OD	10.97	TIG & ARC	10.97	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		VALVE	SA216WCC	168.3			2	102	30	46	0										
8	1-80-447-22104	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPC	355.6			4	496	108	176	36										
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.							
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-447-81713		01		OF		02		00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-447
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF HP HEATER-6 DRAIN TO DEAERATOR

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm		Qty	Dia2.4				in deg C	in deg C							
9	1-80-447-22104	PIPE+PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	323.9			27	3024	648	1377	0									
10	1-80-447-22104	FITTING	SA234WPC	OD	10.97	TIG & ARC	10.97	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA216WCC	168.3			2	102	30	46	0									
11	1-80-447-22105	PIPE	SA106GRC	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	273			3	279	60	99	18									
12	1-80-447-22105	PIPE+PIPE	SA106GRC	OD	12.5	TIG & ARC	12.5	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	219.1			32	2144	544	800	256									
13	1-80-447-22105	FITTING	SA234WPC	OD	8.56	TIG & ARC	8.56	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA216WCC	114.3			2	51	22	18	0									
14	1-80-447-22106	PIPE+PIPE	SA106GRC	OD	12.5	TIG & ARC	12.5	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPC	219.1			26	1742	442	650	208									
15	1-80-447-22106	FITTING	SA234WPC	OD	15.09	TIG & ARC	15.09	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPC	273			2	176	40	66	20									
16	1-80-447-22106	FITTING	SA234WPC	OD	8.56	TIG & ARC	8.56	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE	SA216WCC	114.3			2	51	22	18	0									
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-447-81713		02		OF		02		00		



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size	Qty (nos)															
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0		in deg C	in deg C					
1	1-80-448-22178	PIPE+PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	114.3			23	612	483	0	0									
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-448-81757				01				OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-449
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	TG CYCLE PIPING DRAINS AND VENTS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Part-1	Part-2	Size mm								
1		PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA105	60.3			170	2142	1700	0	0								
		ENDCOVER																	
2		PIPE	SA106GRB	OD	6	NIL	6 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	60.3			455	NIL	1166	0	0								
3		PIPE	SA312TP304H	OD	3.91	TIG & ARC	3.91	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA312TP304H	60.3			40	2432	0	0	0								
4		PIPE	SA312TP304H	OD	4	NIL	4 	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA312TP304H	60.3			80	NIL	100	0	0								
5		PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	33.4			450	2880	2250	0	0								
6		PIPE	SA234WPB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	33.4			975	NIL	957	0	0								
7		PIPE	SA312TP304H	OD	3.38	TIG & ARC	3.38	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA312TP304H	33.4			110	704	550	0	0								
8		PIPE	SA312TP304H	OD	4	NIL	4 	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA312TP304H	33.4			150	NIL	98	0	0								
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-449-81712		01		OF 02 00					



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-449
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	TG CYCLE PIPING DRAINS AND VENTS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
								Qty (gms)		Qty(nos)										
								Part-1	Part-1	Size mm	mm	Dia2.4								
9		PIPE	SA106GRB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA105	48.3			20	198	160	0	0									
		ENDCOVER																		
10		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA105	48.3			55	NIL	83	0	0									
11		PIPE	SA106GRB	OD	3.73	TIG & ARC	3.73	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRB	21.3			50	675	0	0	0									
12		PIPE	SA106GRB	OD	4	NIL	4 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA105	21.3			165	NIL	63	0	0									
13		PIPE	SA312TP304H	OD	3.73	TIG & ARC	3.73	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA312TP304H	21.3			5	68	0	0	0									
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-449-81712		02		OF		02		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-451
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	BOILER INTEGRAL PIPING DRAINS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Size	mm	mm	Qty					in deg C	in deg C								
1	1-80-451-22231	PIPE+PIPE	SA335P22	OD	17.12	TIG & ARC	17.12	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING ENDCOVER	SA234WP22	114.3			26	832	312	364									78
2	1-80-451-22231	PIPE	SA335P22	OD	14.02	TIG & ARC	14.02	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WP22	73			9	225	72	90									18
3	1-80-451-22232	PIPE	SA335P22	OD	11.07	TIG & ARC	11.07	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	60.3			43	392	559	301									0
4	1-80-451-22233	PIPE+PIPE	SA335P22	OD	17.12	TIG & ARC	17.12	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING ENDCOVER	SA234WP22	114.3			33	1056	396	462									99
5	1-80-451-22233	PIPE	SA335P22	OD	14.02	TIG & ARC	14.02	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WP22	73			16	400	128	160									32
6	1-80-451-22233	PIPIPE	SA335P22	OD	20	TIG & ARC	20	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	88.9			25	525	200	275									100
7	1-80-451-22234	PIPE	SA335P22	OD	20	TIG & ARC	20	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	88.9			23	483	184	253									92
8	1-80-451-22234	PIPE	SA106GRC	OD	15.24	TIG & ARC	15.24	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPC	88.9			9	216	72	90									45
											Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
													Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:			SHEET NO:			REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-451-81567			01			OF	02	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-451
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	BOILER INTEGRAL PIPING DRAINS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm															
9	1-80-451-22235	PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	60.3			26	328	260	0	0									
10	1-80-451-22236	PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	60.3			35	441	350	0	0									
11	1-80-451-22237	PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	60.3			20	252	200	0	0									
12	1-80-451-22238	PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	60.3			23	290	230	0	0									
13	1-80-451-22239	PIPE	SA106GRC	OD	21.95	TIG & ARC	21.95	ER70S-A1	E7018-1			1005/R EV05	10	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPC	168.3			8	392	112	192	104									
14	1-80-451-22239	PIPE	SA106GRC	OD	21.95	TIG & ARC	21.95	ER70S-A1	E7018-1			1005/R EV05	10	635±15	2.5(30 MINUTES MINIMUM)	100% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPC	168.3			12	588	168	288	156									
15	1-80-451-22240	PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	60.3			18	227	180	0	0									
																			REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-451-81567				02				OF	02	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-452
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	PIPES AND FITTINGS FOR HIGH PRESSURE PIPING DRAINS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm	Qty		Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C	minutes						
1		PIPE	SA335P91	OD	12.5	TIG & ARC	12.5	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT100% MT100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP91	60.3			700	6370	9100	4900	0									
	2		PIPE	SA335P91	OD	5.54	TIG & ARC	5.54	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT100% MT100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WP91	60.3	275			3465	2750	0	0									
3			PIPE	SA335P22	OD	5.54	TIG & ARC	5.54	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA335P22	60.3	115			1449	1150	0	0									
	4		PIPE	SA335P91	OD	9.09	TIG & ARC	9.09	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT100% MT100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WP91	33.4	122			440	1708	0	0									
5			PIPE	SA335P91	OD	4.55	TIG & ARC	4.55	ER90S-B9	E9015-B9			1036/R EV07	220	745±15	2.5(30 MINUTES MINIMUM)	100% UT100% MT100% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WP91	33.4	165			1056	825	0	0									
	6		PIPE	SA335P22	OD	6.35	TIG & ARC	6.35	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA335P22	33.4	7			40	49	0	0									
7			PIPE	SA335P22	OD	4.55	TIG & ARC	4.55	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA335P22	33.4	20			128	100	0	0									
	8		PIPE	SA106GRC	OD	12.5	TIG & ARC	12.5	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPC	60.3	210			1911	2730	1470	0									
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				23.03.2018		4-80-452-81711				01		OF	02	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-452
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	PIPES AND FITTINGS FOR HIGH PRESSURE PIPING DRAINS

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD Size mm	Thick mm			TIG		Arc spec					Temp. in deg C	Hold time per mm in minutes				
								Qty (gms)		Qty(nos)										
								Part-1	Part-2	Dia2.4	Dia2.5	Dia3.2								
9		PIPE	SA106GRC	OD	10.15	TIG & ARC	10.15	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	48.3			105	725	945	420	0									
10		PIPE	SA335P22	OD	7.47	TIG & ARC	7.47	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P22	21.3			10	#N/A	#N/A	#N/A	#N/A									
11		PIPE	SA335P22	OD	3.73	TIG & ARC	3.73	ER90S-B3	E9018-B3			1013/R EV02	150	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA335P22	21.3			4	54	0	0	0									
12				OD															REFER NOTE-3	
13				OD															REFER NOTE-3	
14				OD															REFER NOTE-3	
15				OD															REFER NOTE-3	
16				OD															REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SEHAGIRI				23.03.2018		4-80-452-81711		02		OF	02	00				



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-453
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	LOW PRESSURE PIPING DRAINS (SG AREA)

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
				mm	mm		Qty					in deg C	in deg C						
1	3-80-453-34310	PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	33.4			150	960	750	0	0								
2	3-80-453-34310	PIPE	SA106GRB	OD	3.73	TIG & ARC	3.73	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	21.3			10	135	0	0	0								
3	3-80-453-34310	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	33.4			400	NIL	393	0	0								
4	3-80-453-34310	PIPE	SA106GRB	OD	4	NIL	4 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	21.3			20	NIL	8	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				29.03.2018		4-80-453-81736				01			OF	03	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-453
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	LOW PRESSURE PIPING DRAINS (TG AREA)

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
		Part-2	Part-2	mm	mm		Qty					in deg C	in deg C						
1		PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRB	33.4			625	4000	3125	0									0
2		PIPE	SA106GRB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRB	48.3			100	990	800	0									0
3		PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRB	60.3			155	1953	1550	0									0
4		PIPE	SA106GRC	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	33.4			140	896	700	0									0
5		PIPE	SA106GRC	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	48.3			30	297	240	0									0
6		PIPE	SA106GRC	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE	SA106GRC	60.3			150	1890	1500	0									0
7		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA105	33.4			1050	NIL	1031	0									0
8		PIPE	SA106GRC	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA105	33.4			150	NIL	148	0									0
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				29.03.2018		4-80-453-81736				02			OF	03	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-453
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	LOW PRESSURE PIPING DRAINS (TG AREA)

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks		
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes						
								Qty (gms)	Qty(nos)	Dia2.4	Dia2.5									Dia3.2	Dia4.0
		Part-2	Part-2	mm	mm		Qty					in deg C	in deg C								
9	2-80-453-15297	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA105	48.3			240	NIL	360	0	0										
10	2-80-453-15297	PIPE	SA106GRC	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA105	48.3			70	NIL	106	0	0										
11	2-80-453-15297	PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA105	60.3			320	NIL	612	0	0										
12	2-80-453-15297	PIPE	SA106GRC	OD	5	NIL	5 	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	100% RT(NOTE-2)	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING	SA105	60.3			210	NIL	402	0	0										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
Notes: (1) Refers to NDE Manual no. PSQ-NDEM-COM-2010/R01 (2) Drain & vent piping: 100% RT upto the last root valve. Beyond the last root valve, 10% RT is applicable. (3)100% LPI on all Butt welds after PWHT for Non-P91 piping. 100% MPI on all Butt welds after PWHT for P91 piping.												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:			REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				29.03.2018		4-80-453-81736		03			OF 03 00						



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-454
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	SCAPH DRAIN TO FLASH TANK DRAIN TANK-PART-1 AND PART-2

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
			Part-1	Part-1	Size			Qty (gms)	Qty(nos)										
			Part-2	Part-2	mm			mm	Dia2.4	Dia2.5	Dia3.2			Dia4.0	in deg C				
1	0-80-454-07332	PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	113.4			15	399	315	0									0
2	0-80-454-07332	PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPB	88.9			10	196	150	0									0
3	0-80-454-07332	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPB	60.3			12	152	120	0									0
4	0-80-454-07332	PIPE+PIPE	SA106GRB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	48.3			144	1426	1152	0									0
5	0-80-454-07333	PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WPB	88.9			15	294	225	0									0
6	0-80-454-07333	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA234WPB	60.3			12	152	120	0									0
7	0-80-454-07333	PIPE+PIPE	SA106GRB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA234WPB	48.3			144	1426	1152	0									0
8				OD														REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				26.03.2018		4-80-454-81973				02			OF	02	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-455
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	DRAINS FROM UNLISTED EQUIPMENTS AND VESSELS - SG SCOPE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Size	mm	mm	Qty					in deg C	in deg C								
1	1-80-455-22190	PIPE+FITTIN G	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		VALVE STUB	SA234WPB	406.4			31	4092	930	1457	0								
2	1-80-455-22191	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	355.6			11	1265	297	451	0								
3	1-80-455-22191	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	323.9			40	4160	960	1480	0								
4	1-80-455-22191	PIPE+PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING VALVE	SA234WPB	168.3			30	1590	450	330	0								
5	1-80-455-22192	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING STUB	SA234WPB	609.6			12	2429	555	872	0								
6	1-80-455-22192	PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING STUB	SA234WPB	60.3			5	63	50	0	0								
7	1-80-455-22193	PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	273			4	348	80	120	0								
8	1-80-455-22193	PIPE+PIPE	SA106GRB	OD	8.18	TIG & ARC	8.18	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING STUB	SA234WPB	219.1			22	1540	374	396	0								
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.	
S.RAJU		TRINADHA RAO		SESHAGIRI				26.03.2018		4-80-455-81808				01		OF	02	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-455
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	DRAINS FROM UNLISTED EQUIPMENTS AND VESSELS - SG SCOPE

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Size	mm	mm	Qty					in deg C	in deg C								
9	1-80-455-22193	PIPE+FITTIN G	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE STUB	SA234WPB	88.9			16	314	240	0									0
10	1-80-455-22193	PIPE+FITTIN G	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		VALVE STUB	SA234WPB	60.3			11	139	110	0									0
11	1-80-455-22224	PIPE	SA106GRC	OD	15.09	TIG & ARC	15.09	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPC	273			2	176	40	66									20
12	1-80-455-22224	PIPE	SA335P11	OD	15.09	TIG & ARC	15.09	ER80S-B2	E8018-B2		1010/R EV06	150	660±10	2.5(60 MINUTES MINIMUM)	10% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP11	273			2	176	40	66									20
13	1-80-455-22224	PIPE	SA335P22	OD	15.09	TIG & ARC	15.09	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	273			2	176	40	66									20
14	1-80-455-22225	PIPE	SA106GRC	OD	15.09	TIG & ARC	15.09	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPC	273			5	440	100	165									50
15	1-80-455-22225	PIPE	SA335P11	OD	15.09	TIG & ARC	15.09	ER80S-B2	E8018-B2		1010/R EV06	150	660±10	2.5(60 MINUTES MINIMUM)	10% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP11	273			4	352	80	132									40
16	1-80-455-22225	PIPE	SA335P22	OD	15.09	TIG & ARC	15.09	ER90S-B3	E9018-B3		1014/R EV03	150	700±20	2.5(60 MINUTES MINIMUM)	10% RT3% HARDNESS	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	SA234WP22	273			8	704	160	264									80
											Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
													Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				26.03.2018		4-80-455-81808		02		OF	02	00			



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size	Qty (gms)			Qty(nos)												
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0		in deg C	in deg C					
1	2-80-459-14844	PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING STUB	SA234WPB	457.2			14	2100	476	742	0									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-459-81511				01		OF	01	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-460
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY COOLING WATER PIPING IN BOILER AREA

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-2	Qty (gms)	Qty(nos)								
1		PIPE	IS3589	OD	6.35	TIG & ARC	6.35	NIL	E7018		1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS3589	273.1			40	NIL	960	680									0
2		PIPE	IS3589	OD	6.35	TIG & ARC	6.35	NIL	E7018		1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS3589	219.1			132	NIL	4884	0									0
3		PIPE	IS1239	OD	5.4	TIG & ARC	5.4	E6013	E7018		1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS1239	150			200	10800	5400	0									0
4		PIPE	IS1239	OD	5.4	TIG & ARC	5.4	E6013	E7018		1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS1239	100			118	3139	2124	0									0
5		PIPE	IS3589	OD	4.85	TIG & ARC	4.85	NIL	E7018		1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS3589	80			554	NIL	7202	0									0
6		PIPE	IS1239	OD	4.05	TIG & ARC	4.05	#N/A	#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS1239	50			59	744	590	0									0
7		PIPE	IS1239	OD	4.05	TIG & ARC	4.05	#N/A	#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS1239	40			28	278	224	0									0
8		PIPE	IS1239	OD	4.05	TIG & ARC	4.05	#N/A	#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE FITTING	IS1239	25			150	960	750	0									0
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-460-80729		01		OF	02	00			



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-460
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	AUXILIARY COOLING WATER PIPING IN BOILER AREA

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Part-1	Part-2	Size								
9		PIPE	IS3589	OD	3.25	TIG & ARC	3.25	#N/A		#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	IS3589	15			120	NIL	0	0	0								
10		PIPE	IS3589	OD	4	NIL	4 	#N/A		#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS3589	50			188	NIL	191	0	0								
11		PIPE	IS1239	OD	4	NIL	4 	#N/A		#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS1239	40			130	NIL	104	0	0								
12		PIPE	IS1239	OD	4	NIL	4 	#N/A		#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS1239	25			392	NIL	182	0	0								
13		PIPE	IS3589	OD	3	NIL	3 	#N/A		#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS3589	15			186	NIL	#VALUE!	#VALUE!	#VALUE!								
14		PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1		E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	88.9			55	1078	825	0	0								
15		PIPE	IS1239	OD	4.5	TIG & ARC	4.5	#N/A		#N/A		#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	IS1239	65			6	126	78	0	0								
16																			REFER NOTE-3
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:			REV. NO.				
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-460-80729		02			OF	02	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-463
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	TG AUXILIARY COOLIG WATER PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks				
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes								
								Part-1	Part-2	Qty (gms)	Qty(nos)												
																				Size	mm	Dia2.4	Dia2.5
																			in deg C	in deg C			
1		PIPE	IS3589	OD	10	TIG & ARC	10	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	813			9	NIL	567	891	0												
2		PIPE	IS3589	OD	8	TIG & ARC	8	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	610			8	NIL	370	388	0												
3		PIPE	IS3589	OD	8	TIG & ARC	8	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	508			54	NIL	2052	1620	0												
4		PIPE	IS3589	OD	8	TIG & ARC	8	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	457			44	NIL	1496	1584	0												
5		PIPE	IS3589	OD	8	TIG & ARC	8	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	406			39	NIL	1170	1248	0												
6		PIPE	IS3589	OD	8	TIG & ARC	8	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	355.6			25	NIL	675	675	0												
7		PIPE	IS3589	OD	6.35	TIG & ARC	6.35	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	323.9			130	NIL	3120	2210	0												
8		PIPE	IS3589	OD	6.35	TIG & ARC	6.35	⌒	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3			
		PIPE BEND	IS3589	273			65	NIL	1300	715	0												
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:					
														Approved:				Approved:					
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.									
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-46383267		01		OF		02		00					



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-463
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	TG AUXILIARY COOLIG WATER PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-1	Part-2	mm	mm	Qty		Dia2.4	Dia2.5	Dia3.2	Dia4.0	in deg C	in deg C							
9		PIPE	IS3589	OD	6.4	TIG & ARC	6.4 	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS3589	219.1			20	NIL	740	0	0									
10		PIPE	IS1239	OD	5.4	TIG & ARC	5.4 	E6013	E7018			1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	150			240	12960	6480	0	0									
11		PIPE	IS1239	OD	5.4	TIG & ARC	5.4 	E6013	E7018			1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	100			62	1650	1116	0	0									
12		PIPE	IS1239	OD	4.85	TIG & ARC	4.85 	#N/A	#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	80			222	4662	2886	0	0									
13		PIPE	IS1239	OD	4.5	TIG & ARC	4.5 	#N/A	#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	50			106	1336	1060	0	0									
14		PIPE	IS1239	OD	4.05	TIG & ARC	4.05 	#N/A	#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	40			56	555	448	0	0									
15		PIPE	IS1239	OD	3.2	TIG & ARC	3.2 	#N/A	#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	15			56	0	0	0	0									
16																		REFER NOTE-3		
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-463-83267		02		OF		02		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-468
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	CW SUPPLY AND RETURN PIPING INSIDE TG HALL

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes					
								Qty (gms)	Qty(nos)	Dia2.5	Dia3.2									Dia4.0
		Part-2	Part-2	mm	mm		Qty	Dia2.4				in deg C	in deg C							
1	0-8-468-07208	PIPE	IS1239	OD	20	TIG & ARC	20	E6013	E7018			1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS1239	2540			33	29753	6376	10475	7742									
2	0-8-468-07311	PIPE	IS3589	OD	10	TIG & ARC	10	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS3589	813			40	NIL	2520	3960	0									
3	0-8-468-07311	PIPE	IS3589	OD	8	TIG & ARC	8	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	IS3589	508			35	NIL	1330	1050	0									
4	0-8-468-07312	PIPE	SA672GRB70	OD	3.76	TIG & ARC	3.76	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	SA672GRB70	219.1			60	4320	1680	0	0									
5	0-8-468-07312	PIPE	SA672GRB70	OD	3.4	TIG & ARC	3.4	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PIPE BEND	SA672GRB70	168.3			42	2310	1008	0	0									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.						
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-468-81416		01		OF		01		00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-471
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	APH AND ESP WATER WASH PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Part-1	Part-1	Qty (gms)	Qty(nos)								
				Size mm	mm		Qty												
1		PIPE	IS3589	OD	8	TIG & ARC	8	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	IS3589	355.6			70	NIL	1890	1890	0								
2		PIPE	IS3589	OD	9.5	TIG & ARC	9.5	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	IS3589	273			50	NIL	1000	1500	0								
3		PIPE	IS3589	OD	6.4	TIG & ARC	6.4	NIL	E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	IS3589	219.1			20	NIL	740	0	0								
4		PIPE	IS1239	OD	5.4	TIG & ARC	5.4	E6013	E7018			1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	IS1239	150			22	1188	594	0	0								
5		PIPE	IS1239	OD	4	TIG & ARC	4	#N/A	#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	IS1239	25			20	128	100	0	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				27.03.2018		4-80-471-80731		01		OF		01		00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-473
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	DEAERATOR INITIAL FILLING PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
								Qty (gms)		Qty(nos)										
								Part-1	Part-2	Size mm	mm	Dia2.4								
1		PIPE+PIPE	SA312TP304H	OD	3.38	TIG & ARC	3.38	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA312TP304H	33.4			170	1088	850	0	0									
2		PIPE+PIPE	SA312TP304H	OD	3.68	TIG & ARC	3.68	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING	SA312TP304H	48.3			80	792	640	0	0									
3	1-80-473-22194	PIPE+PIPE	SA312TP304H	OD	3.05	TIG & ARC	3.05	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING VALVE	SA312TP304H	114.3			30	798	480	0	0									
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
																		REFER NOTE-3		
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-473-81787				01				OF	01	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-480
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	APH AND MILL FIRE FIGHTING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
								Qty (gms)		Qty(nos)										
								Part-1	Part-2	Size mm	mm	Dia2.4								
		Part-2	Part-2	mm	mm	Qty						in deg C	in deg C							
1		PIPE+PIPE	IS1239	OD	4	TIG & ARC	4	#N/A		#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS1239	25			140	896	700	0	0									
2		PIPE+PIPE	IS1239	OD	4	TIG & ARC	4	#N/A		#N/A			#N/A	#N/A	#N/A	#N/A	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS1239	40			560	5544	4480	0	0									
3		PIPE+PIPE	IS3589	OD	6.4	TIG & ARC	6.4	NIL		E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS3589	219.1			20	NIL	740	0	0									
4		PIPE+PIPE	IS3589	OD	9.5	TIG & ARC	9.5	NIL		E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS3589	273			40	NIL	800	1200	0									
5		PIPE+PIPE	IS3589	OD	8	TIG & ARC	8	NIL		E7018			1213/R EV00	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	IS3589	355.6			70	NIL	1890	1890	0									
6		PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1		E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	33.4			25	160	125	0	0									
7		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1		E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA105	33.4			240	NIL	237	0	0									
																				REFER NOTE-3
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:				REV. NO.				
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-480-80732		01				OF	01	00		



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-493
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF FLASH TANK-B VENT PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Part-1	Part-2	Size mm	mm	Qty					in deg C	in deg C							
1	2-80-493-14847	PF.PIPE	SA515GR70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PF.PIPE	SA515GR70	1118			7	2705	618	971	0								
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
																		REFER NOTE-3	
											Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
													Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.	
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-493-81514				01		OF	01	00	



PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-494
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ISOMETRIC OF FLASH TANK-A DRAIN AND VENT PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
		Part-1	Part-1	Size	Qty (gms)			Qty(nos)												
		Part-2	Part-2	mm	mm			Dia2.4	Dia2.5	Dia3.2	Dia4.0									
1	2-80-495-14849	PIPE+PIPE	SA515GR70	OD	6.35	TIG & ARC	6.35	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		BEND	SA515GR70	273			8	712	160	88	0									
2	2-80-494-14850	PF.PIPE	SA515GR70	OD	10	TIG & ARC	10	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		PF.PIPE	SA515GR70	1118			9	3478	794	1248	0									
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:			Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-494-81528				01				OF	01	00



Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks	
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes					
		Part-1	Part-1	Size	Qty (gms)			Qty(nos)													
		Part-2	Part-2	mm	mm			Qty	Dia2.4	Dia2.5	Dia3.2	Dia4.0		in deg C	in deg C						
1	1-80-545-22114	PIPE+PIPE	SA106GRB	OD	9.53	TIG & ARC	9.53	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3		
		FITTING VALVE	SA234WPB	355.6			44	5060	1188	1804	0										
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
																		REFER NOTE-3			
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:			
														Approved:				Approved:			
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.			
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-545-81734				01				OF	01	00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-604
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ACID CLEANING PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Size	Qty (gms)	Qty(nos)									
										mm	mm								
1		PIPE	SA106GRB	OD	12.7	TIG & ARC	12.7	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	406.4			27	3861	810	1350	270								
2		PIPE	SA106GRB	OD	9.27	TIG & ARC	9.27	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	273			150	13050	3000	4500	0								
3		PIPE	SA106GRB	OD	7.11	TIG & ARC	7.11	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	168.3			135	7155	2025	1485	0								
4		PIPE	SA106GRB	OD	6.02	TIG & ARC	6.02	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	114.3			60	1596	1260	0	0								
5		PIPE	SA312TP304H	OD	3.91	TIG & ARC	3.91	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA312TP304H	60.3			15	912	0	0	0								
6		PIPE	SA312TP304H	OD	5.49	TIG & ARC	5.49	ER347	E316			1032/R EV01	20	NIL	NIL(NIL)	#N/A	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA312TP304H	88.9			60	1176	900	0	0								
7		PIPE	SA106GRC	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRC	60.3			200	2520	2000	0	0								
8		PIPE	SA106GRB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA106GRB	48.3			25	248	200	0	0								
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
														Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:		SHEET NO:		REV. NO.					
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-604-83269		01		OF		02		00	



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-604
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	ACID CLEANING PIPING

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.					W.P.S no.	Min pre heat temp. in deg C	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec					Temp.	Hold time per mm in minutes				
								Size	mm	Qty (gms)	Qty(nos)									
											mm	mm								
9		PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1		E7018-1			1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA234WPB	33.4				125	800	625	0	0								
10		PIPE	IS1239	OD	6.4	TIG & ARC	6.4	E6013		E7018			1001/R EV01	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	IS1239	273.1				200	21400	4800	3400	0								
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
																			REFER NOTE-3	
												Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:		
														Approved:				Approved:		
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-604-83269				02				OF	02	00



ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-650
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	FUEL OIL SUPPLY AND RETURN PIPING

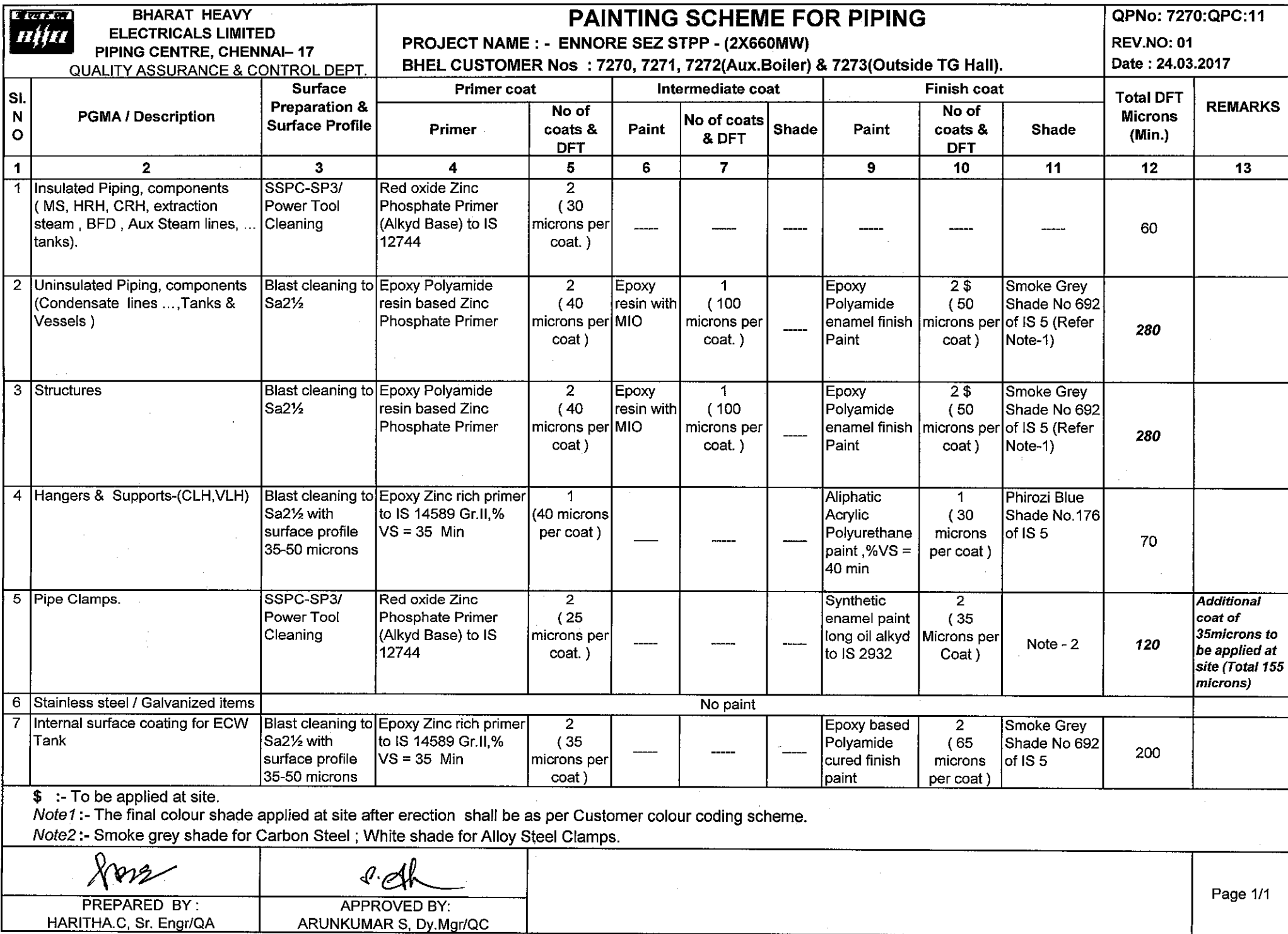
Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks							
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes											
								Part-1	Part-1	Qty (gms)	Qty(nos)															
																				Part-2	Part-2	Dia2.4	Dia2.5	Dia3.2	Dia4.0	
																			Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:	
																					Approved:				Approved:	
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:				REV. NO.								
S.RAJU		TRINADHA RAO		SESHAGIRI				28.03.2018		4-80-650-81283				01		OF		01		00						

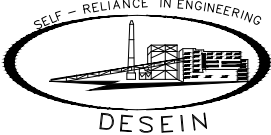
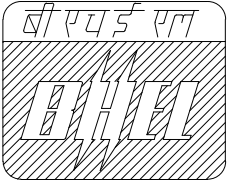


ERECTION/FIELD WELDING SCHEDULE

PROJECT:	2X660ME ENNORE SEZ STPP	CUST. NO:	7270
		PGMA:	80-673
NAME OF THE CUSTOMER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD	CUST. DOC. NO.	
		SYSTEM DESCRIPTION:	LUBE OIL PIPING SYSTEM

Sl.No.	Drg. No. for weld location	Description of parts to be welded	Matl. Spec.	Dimensions		Process of Welding	Type of weld	Electrode filler spec.				W.P.S no.	Min pre heat temp.	Heat Treatment		NDT method/Quantum	Ref. Spec. No.	Acc. Norm. Ref.	Remarks
				ID/OD	Thick			TIG		Arc spec				Temp.	Hold time per mm in minutes				
								Qty (gms)	Qty(nos)										
									Dia2.4	Dia2.5	Dia3.2								
Part-1	Part-2	Size	mm	Qty	mm						in deg C	in deg C							
1		PIPE+PIPE	SA106GRB	OD	5.49	TIG & ARC	5.49	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3	
		FITTING ENDCOVER	SA234WPB	88.9			620	12152	9300	0									0
	2		PIPE	SA106GRB	OD	5.54	TIG & ARC	5.54	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	60.3	10			126	100	0	0								
3			PIPE	SA106GRB	OD	5.08	TIG & ARC	5.08	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	48.3	10			99	80	0	0								
	4		PIPE	SA106GRB	OD	4.55	TIG & ARC	4.55	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE FITTING	SA234WPB	33.4	50			320	250	0	0								
5			PIPE	SA106GRB	OD	3.73	TIG & ARC	3.73	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA234WPB	21.3	10			135	0	0	0								
	6		PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		FITTING	SA234WPB	60.3	20			NIL	39	0	0								
7			PIPE	SA106GRB	OD	5	NIL	5 	ER70S-A1	E7018-1		1003/R EV03	10	NIL	NIL(NIL)	10% RT	REFER NOTE-1	REFER NOTE-1	REFER NOTE-3
		PIPE	SA234WPB	33.4	100			NIL	99	0	0								
																			REFER NOTE-3
								Rev.no.	Date:	Altered:		Rev.no.	Date:	Altered:					
										Approved:				Approved:					
PREPARED BY		DESIGN/CHD.		DESIGN/APPD.		QA-CHD./APPRD.		DATE		DRAWING NO:				SHEET NO:			REV. NO.		
S.RAJU		TRINADHA RAO		SESHAGIRI				29.03.2018		4-80-673-81620				01			OF	01	00



PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI	
	OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
	OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
	EPC CONTRACTOR:-	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI
LOGO	EPC CONSULTANT:-	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
LOGO	VENDOR	XXXXXXXXXXXX
DOCUMENT TITLE: QUALITY PLAN FOR PAINTING SCHEME FOR LP PIPING (CW ,ACW,ECW , Plant Water, Air Piping)		
DOCUMENT NO.	7270:QPC:12	REV 02
SUB VENDER DOCUMENT NO.		

 BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, CHENNAI- 17 QUALITY ASSURANCE & CONTROL DEPT.			PAINTING SCHEME FOR LP PIPING (CW / ACW / ECW / Plant water, Air Piping, etc...,) PROJECT NAME : - ENNORE SEZ STPP - (2X660MW) BHEL CUSTOMER Nos : 7270, 7271, 7272(Aux.Boiler) & 7273(Outside TG Hall).								QPNo: 7270:QPC:12 REV.NO: 02 Dt : 16.05.2017		
Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat			Total DFT Microns (Min.)	REMARKS	
			Primer	No of coats	Paint	No of coats	Shade	Paint	No of coats	Shade			
1	2	3	4	5	6	7	8	9	10	11	12	13	
1	(a) Internal Surface - Steel Pipe - Seawater handling	Blast Cleaning SSPC SP-10 / SA 2½ (Refer Note 1)	Isophthalic polyester / acrylic co-polymer filled with glass flakes coating								1000 Microns (min)	(Refer Note 2)	
	(b) Holiday test (Refer Note 3)	Holiday testing as per Paint Manufacturer's Quality Plan approved by BHEL. Holiday test Equipment shall be calibrated before testing.											
2	External Surface --Buried Piping / Encased in concrete (Temporary Protection for transportation from works to site). **Further protection to be done by BHEL Erection Group as per Contract requirement.	SSPC-SP3 / Power Tool Cleaning	Red Oxide Zinc Phosphate (Alkyd base to IS 12744)	1 (30 Microns per coat)	-----	-----	-----	-----	-----	-----	30 Microns		
2A	External Surface --Buried Piping - Not Encased in concrete	Blast cleaning to SSPC SP-10 / SA 2½	Primer : Coal Tar primer compatible with coal tar enamel grade. 2 coats of 35 microns each. Total DFT:70microns. Finish Coat : Coal tar enamel (25mm overlap min) Type-I to IS7193-1974 conforming to table of 10 of IS10221-1982. Tickness - 4.0mm (or) Coal Tar Wrapping conforming to IS 15337-2003; Tickness - 4.0mm Test : Bond/Adhesion; Holiday test									Shall be done by BHEL's Erection Group.	
3	Internal Surface -Other than Sea water handling - (For 800Nb and above diameters)	Blast cleaning to SSPC SP-10 / SA 2½	Epoxy Polyamide resin based Zinc Phosphate Primer	2 (35 microns per coat)	Epoxy resin with MIO	1 (75 microns per coat.)	-----	Epoxy Polyamide finish Paint	1 \$ (40 microns per coat)	Smoke Grey Shade No 692 of IS 5 (Refer Note-4)	145 at shop + 40 at site	\$: 1 coat of DFT-40 microns finish coat at site	
4	External Surface - Over ground piping (For all diameters)	Blast cleaning to SSPC SP-10 / SA 2½	Epoxy Polyamide resin based Zinc Phosphate Primer	2 (35 microns per coat)	Epoxy resin with MIO	1 (75 microns per coat.)	-----	Epoxy Polyamide finish Paint	1 \$ (40 microns per coat)	Smoke Grey Shade No 692 of IS 5 (Refer Note-4)	145 at shop + 40 at site	\$: 1 coat of DFT-40 microns finish coat at site	
5	Galvanised and Stainless steel Piping	No painting . Site painting requirements as indicated in specification (Vol-III, cl.13.10.5) shall be done by BHEL's erection group.											
Notes: 1. Blast cleaning to near white metal to obtain roughness as per paint manufacturer's recommendations. 2. Application and inspection (including DFT) of Isophthalic polyester / acrylic co-polymer filled with glass flakes shall be as per Paint manufacturer's QP and Painting procedure approved by BHEL. 3. Witness by BHEL / BHEL nominated inspection agency. 4. Shade for finish coat to be done at site shall be as per project specification/contract requirement.													
 PREPARED BY : VIVEKANANDA YELLU, Dy.Mgr/QA			 APPROVED BY: A.P.MADHAVANKUTTY, AGM/Q			For Customer use :					Page 1/1		



BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR(FINANCE)- HEAD QUARTERS
ASIAD, NEW DELHI

From : Kalyan Coari
AGM-Finance

For : As Per Distribution List

No. PW:FM:FAX:T&P Hire :2019-21
Dated : 31st May, 2019

Subject : Revision of Hire Charges on Issue of Capital Tools & Plants

The rates of hire charges for capital Tools and Plants and Operator's charges circulated vide letter No. PWR:FM:T&P Hire 2017-19 dated 01st June,2017 were valid upto 31.5.2019. The Revised Rates effective from 01.06.2019 are enclosed as detailed below :

- (i) Annexure C1 & T1 : Rates of hire charges applicable to contractors working for BHEL
- (ii) Annexure C2 & T2 : Rates of hire charges applicable to outside agencies other than Contractors working for BHEL.
2. The Crane Operator's charges will be as follows :
 - A. **If BHEL operator is utilised Rs. 7200/- (Rupees Seven thousand two hundred only) per day of 8 hours.** For services less than 4 hours, half of per day rate will be charged. For services for 4 hours or more but up to 8 hours, full day rate will be charged. Overtime Allowance (OTA) will be charged at double the rate on hourly basis.
 - B. **If vendor sourced operator is provided, the rates shall be the actual cost to BHEL with 30% overheads.**
3. The hire charges of Capital Tools & Plants are exclusive of operating expenses e.g. fuel & consumables. **All Operating expenses are chargeable to User's account.**
4. All other terms and conditions / aspects governing the issue of T&P on Hire "will remain the same as already circulated vide our letter of even number dated 22.1.1992 (copy enclosed).
5. **The revised rates will be effective from 01.06.2019 and will remain valid upto 31.5.2021.** This will be subject to revision thereafter.
6. For any additional item, the rates of hire charges will be worked out jointly by PS-MSX & Finance (PS-Hqrs) on specific request. All necessary details will be provided by the concerned Region.


(Kalyan Coari) 31/05/19
AGM (Fin)

Encl : As above



REF: PWR:FAX: HIRE CHARGES
DT : 22.1.92.

SUBJECT : ISSUE OF TOOLS AND PLANTS
TO SUB-CONTRACTORS AND RECOVERY
OF HIRE CHARGES THEREOF - - - -

The rates of hire charges for capital tools and plants last circulated vide Sr. Manager/Finance's letter reference PWA:SMQ:FAX:24.02 dated 20.5.88 have been revised. The revised rates have been worked out based upon the recommendations of the study team set up vide office order No. PW:SMQ:FAX:11.36 Dt. 1.10.88. The study team's/committee's recommendations relating to issue of T&P to sub contractors A e enclose rates of hire charges have been worked out and are enclosed as follows :-

- i) Annexures 1.1, 1.2, 1.3, & 1.4
Rates for hire charges as applicable to contractors working for BHEL.
- ii) Annexures 2.1 & 2.2
Rates of hire charges as applicable to outside agencies other than contractors working for BHEL.
- iii) Annexure - III
Crane operators charges.

The important conditions/aspects governing the issue of T&P on hire are as follows :-

- i) The tender documents shall specify :-
 - a) List of T&P to be provided by BHEL free of hire charges
 - b) List of T&P which may be given on hire, if available at site and the rate of hire charges recoverable for the same. For items and rates specified in the N.I.T. these charges shall not change during the currency of that contract. For items/rates not specified in N.I.T. the current rates shall be charged.
- ii) The rates given in Annexure 1.1, 1.2, & 2.1 are on hourly basis. The unit of recovery is an hour and for fraction of an hour, the chargeable unit will be an hour only. The rates given in Annexure 1.3, 1.4 & 2.2 are on day basis (day means a calendar day) and fraction of a day will be charged as full day purpose of recovery of hire charges.

...2/-



- iii) Operator's charges are on per day basis considering average 8 working hours. For services of less than 4 hours, half the rates will be charged. For services of 4 hours upto 8 hours, full daily rates will be charged. Overtime will be charged at double the rates on hourly basis.
- iv) The hire charges are recoverable on the basis of out time and in time i.e. from the time a particular item is issued to the contractor from BHEL's store till the time it is returned. However, the hourly rate is applicable for T&P which cannot be frequently returned due to intermittent use, logging shall be done for actual use and charged accordingly. In case of cranes, marching time for onward and return shall be charged at 50% of the hire charges rates.
-
- v) The rates do not include transportation charges from and to BHEL's store. Safe transportation of T&P from and to BHEL's store shall be the contractors responsibility.
- vi) Small T&P items i.e. items costing less than Rs. 10,000/- each shall not be issued to contractors on hire charges. Such items may however be issued to contractors on non-returnable basis at replacement cost plus 30% overheads reduced by depreciation as applicable or a certain reserve price whichever is higher.
- vii) If a contractor commits certain T&P at the time of award of contract/L.O.I. and fails to actually deploy the same in time at site, then even for contractors working for BHEL, higher rates of hire charges as given in Annex 2.1 & 2.2 shall be applicable for such items.

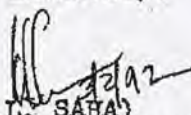
The revised rates of hire charges and operator's charges as enclosed, together with terms stated above and other aspects/conditions relating to issue of T&P to sub contractors as given in Appendix I shall be effective from 1.2.1992 till 31.10.93 and will be subject to revision thereafter.

...3/-



For any additional item not appearing in the enclosed list, rates of hire charges may be calculated by TS HQ in consultation with PS-HQ (Finance) on receipt of necessary details from regions and communicated to the regions.

This issues ^{with} the approval of competent authority.


(R.L. SAHA)
GENERAL MANAGER (F)
PS-HQ


Encl : As above.

DISTRIBUTION :

ED, PS-NR, New Delhi

ED, PS-WR, NAGPUR

ED, PS-PEM, New Delhi

GM I/C PS-SR Madras

GM PS-ER CALCUTTA

ED/PMG&TS/New Delhi

Advisor (Finance) Corporate Office, N.Delhi.

S.A. to Director (Power).

**REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (BEYOND USEFUL LIFE)
I.	CRANES :-			
1	Portal Gantry Crane 500T	15	20100.00	19980.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	11370.00	11320.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	56290.00	55940.00
4	PORTAL CRANE, 360T	15	14070.00	13980.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	55460.00	55110.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	68610.00	68180.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	33510.00	33300.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	20940.00	20810.00
9	MANITOWOC M-250T TRUCK CRANE	15	30160.00	29970.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	31660.00	31470.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	26390.00	26220.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	36110.00	36110.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	15130.00	15030.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	18850.00	18850.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	16750.00	16650.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	21780.00	21640.00
15	CRAWLER CRANE SUMITOMO, 150T	15	10890.00	10820.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	13400.00	13320.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	10830.00	10780.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	10720.00	10650.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	8880.00	8820.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	10050.00	9990.00
20	CRAWLER CRANE 100 T (KH 500)	15	10050.00	9990.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	5410.00	5390.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6140.00	6110.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5370.00	5340.00
24	Mobile Crane, 55MT (TIL)	12	4410.00	4390.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3030.00	3010.00
26	MOBILE CRANE, 20MT (TIL)	10	2270.00	2260.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2270.00	2260.00
28	MOBILE CRANE ESCORTS- 14MT	10	710.00	710.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	390.00	380.00
30	ELECTRIC GANTRY CRANE 3T	5	430.00	430.00
31	ELECTRIC GANTRY CRANE 5T	5	540.00	540.00
32	ELECTRIC GANTRY CRANE 30T	5	3640.00	3620.00
33	FORK LIFT 5T	5	650.00	650.00
34	FORK LIFT 3T	5	540.00	540.00

**REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
OUTSIDE AGENCIES**

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/06/2019 to 31/5/2021 (BEYOND USEFUL LIFE)
I.	CRANES :-			
1	Portal Gantry Crane 500T	15	22340.00	22200.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	12630.00	12570.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	62550.00	62160.00
4	PORTAL CRANE, 360T	15	15630.00	15540.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	61620.00	61240.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	76230.00	75760.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	37230.00	37000.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	23270.00	23120.00
9	MANITOWOC M-250T TRUCK CRANE	15	33510.00	33300.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	35180.00	34960.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	29320.00	29130.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	40120.00	40120.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	16810.00	16700.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	20950.00	20950.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	18610.00	18500.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	24200.00	24050.00
15	CRAWLER CRANE SUMITOMO, 150T	15	12100.00	12020.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	14890.00	14800.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	12030.00	11970.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	11910.00	11840.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	9860.00	9800.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	11170.00	11100.00
20	CRAWLER CRANE 100 T (KH 500)	15	11170.00	11100.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	6010.00	5980.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6830.00	6790.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5970.00	5940.00
24	Mobile Crane, 55MT (TIL)	12	4900.00	4880.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3370.00	3350.00
26	MOBILE CRANE, 20MT (TIL)	10	2520.00	2510.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2520.00	2510.00
28	MOBILE CRANE ESCORTS- 14MT	10	790.00	790.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	430.00	430.00
30	ELECTRIC GANTRY CRANE 3T	5	480.00	480.00
31	ELECTRIC GANTRY CRANE 5T	5	600.00	600.00
32	ELECTRIC GANTRY CRANE 30T	5	4040.00	4030.00
33	FORK LIFT 5T	5	720.00	720.00
34	FORK LIFT 3T	5	600.00	600.00

**RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	20930
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	310
3	MULTI SHEAVE PULLEY BLOCK 100T	630
4	MULTI SHEAVE PULLEY BLOCK 150T	1260
5	ELCTRIC WINCH 5T	1270
6	ELCTRIC WINCH 10T	2360
7	ELECTRIC WINCH 15 T	2150
8	PASSENGER CUM GOODS HOIST 1T	2270
9	FURNACE MAINTENANCE PLATFORM	5040
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2100
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	16380
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	8190
3	WELDING GENERATOR 320/300 A	300
4	WELDING RECTIFIER 400A/300A	300
5	WELDING RECTIFIER 600A	400
6	DIESEL WELDING GENERATOR 400A/300A	400
7	TRANSFORMER,600A	300
8	TRANSFORMER 300/400A	200
III	SERVICE PLANTS & ALLIED EQUIPT.	0
1	500KVA DIESEL GENERATOR	3800
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO- , WITH STORAGE TANK	7280
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON	1360
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON	1820
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON	3640
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750	1270
9	Low Vacuum de-hydration unit	630
10	DIESEL GENERATING SET,250 KVA	1770
11	DIESEL GENERATING SET,25 KVA	500
12	VACUUM PUMP(ABSOLUTE V.C.)	540
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1090
14	ACID TRANSFER PUMP 20/50 T/HR	540
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	80
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4240

**RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
17	AIR COMPRESSORS 250/300/330/360/350 CFM	2730
18	AIR COMPRESSORS 140/150/190/210 CFM	910
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	1820
20	Industrial Blower 2000CFM	1270
21	Air Leak Test Blower (Flow: 40000 m ³ /Hr)	1160
22	Air Blower (Flow: 20000 m ³ /Hr)	940
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	630
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1630
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	1800
4	-do- Gun with nose Assembly only	540
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	36980
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	800
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1090
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1270
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1330
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2230
7	BOLT STRETCHING DEVICE	910
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	3640
9	ULTRASONIC FLAW DETECTOR	2730
10	MPI TEST KIT	360
11	GAS LEAK DETECTOR	270
12	VIBRATION/SOUND LEVEL METER IRD-306	360
13	VIBRATION/SOUND LEVEL METER IRD-308	360
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1450
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2540
16	SHOCK PULSE METER	630
17	HV.DC TEST KIT UPTO 50 KV	540
18	HV.DC TEST KIT ABOVE 50 KV	1000
19	HV.AC TEST KIT UPTO 50KV	810
20	HV.AC TEST KIT ABOVE 50KV	2910
21	MOTORISED MEGGER 2.5KV	400
22	MOTORISED MEGGAR 5KV	450
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	450
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1090
25	WAVEFORM ANALYSER	910
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1630
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1090
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	910
29	DIGITAL LOW RESISTANCE METER	630
30	DC POTENTIOMETER	180
31	PRECISION DEAD WEIGHT TESTER	1000
32	OPTICAL ALIGNMENT KIT	1360
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1200
34	VERNIER THEODOLITE,PRECISION	1200
35	VERNIER THEODOLITE,ORDINARY	200
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	120
37	ISKAMATIC 'A'	3200
38	CALIBRATOR '03'	1000
39	48 POLE EXTENDER CARD	200

**RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS**

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
40	MULTIJET NPM	400
41	OSCILLOMETER	10190
42	VOC EQUIPMENT	1400
43	BINARY SIGNAL GENERATOR	290
44	ELECTRIC COUNTER	690
45	FREQUENCY GENERATOR	1000
46	DBF 3 VIBRATION RECORDER/ANALYSER	3270
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	490
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1180
49	VIBROPORT 41/FFT ANALYSER	5460
50	ELCID kit	10010
51	UNIVERSAL CALIBRATION SYSTEM	2730
52	NATURAL FREQUENCY TESTER	2910
53	DIGITAL HARDNESS TESTER	360
54	ADRE 208 VIBRATION ANALYSER	7280
55	PCB DIAGNOSTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 $\mu\Omega$ TO 20K Ω	3230
59	PMI Machine OLYMPUS make	3350
60	Mobile Lighting Mast - 9 metres (4X400 W)	860
61	10KVA RESISTANCE BRAZING MACHINE	140
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	460
63	HYDROGEN GAS LEAK DETECTOR	50
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	4980
65	WEDGE DEFLECTION KIT	80
66	TILE PRESSING MACHINE FOR GAS TURBINE	270
67	INDUCTION BRAZING MACHINE	4870
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	3640
69	ULTRASONIC FLOW METER	180
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	40
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. : FLOW 60 M3/HR	470
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. : FLOW 15 M3/HR	430
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	1810
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1260
75	5KV Insulation Tester	450
76	4 Channel Digital Oscilloscope /Fast Recorder	1710
77	4 Channel Oscillographic Recorder	580
78	Sound Level Meter	230
79	Thermal Imaging Camera	770
80	Videoscope (Video Boroscope)	1510
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1310
82	Conductivity Meter	80
83	Core Flux Test Kit	7280
84	Primary Current Injection Kit (2000A)	870
85	3 Phase Secondary Injection Kit (Relay Test)	3760
86	FRF Filtration Kit	1330
87	FFT Analyser	2290

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
88	Flue Gas Analyser	1030
89	Oil Test Kit (Mineral Oil)-Transformer	1010
90	Winding Resistance kit (R L C Load)	880
91	SFRA test Kit	1190
92	Tan Delta test Kit	4060
93	PF Meter	330
94	Ultrasonic Flow Meter	830
95	Oil Particle Counter	360

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	23250
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	350
3	MULTI SHEAVE PULLEY BLOCK 100T	700
4	MULTI SHEAVE PULLEY BLOCK 150T	1400
5	ELECTRIC WINCH 5T	1410
6	ELECTRIC WINCH 10T	2620
7	ELECTRIC WINCH 15 T	2390
8	PASSENGER CUM GOODS HOIST 1T	2520
9	FURNACE MAINTENANCE PLATFORM	5600
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2330
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	18190
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	9090
3	WELDING GENERATOR 320/300 A	330
4	WELDING RECTIFIER 400A/300A	330
5	WELDING RECTIFIER 600A	440
6	DIESEL WELDING GENERATOR 400A/300A	440
7	TRANSFORMER,600A	330
8	TRANSFORMER 300/400A	220
III	SERVICE PLANTS & ALLIED EQUIPT.	
1	500KVA DIESEL GENERATOR	4220
2	TRANSFORMER OIL FILTRATION EQUIPMENT 6000LPH	7070
3	-DO- , WITH STORAGE TANK	8080
4	OIL FILTRATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	1010
5	OIL FILTRATION M/C, 250GPH/1000LPH (OTHER THAN SILICON	1510
6	OIL FILTRATION M/C, 500GPH/2500LPH (OTHER THAN SILICON	2020
7	OIL FILTRATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON	4040
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750	1410
9	Low Vacuum de-hydration unit	700
10	DIESEL GENERATING SET,250 KVA	1970
11	DIESEL GENERATING SET,25 KVA	560
12	VACUUM PUMP(ABSOLUTE V.C.)	600
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1210
14	ACID TRANSFER PUMP 20/50 T/HR	600
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	90
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4710

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

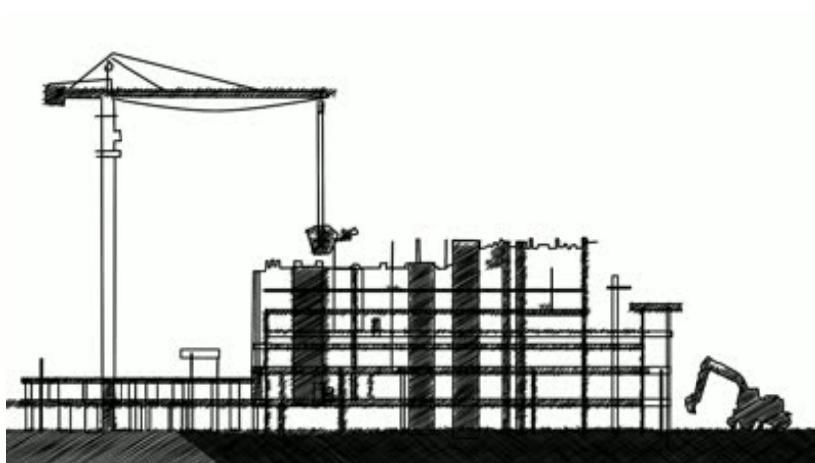
SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
17	AIR COMPRESSORS 250/300/330/360/350 CFM	3030
18	AIR COMPRESSORS 140/150/190/210 CFM	1010
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	2020
20	Industrial Blower 2000CFM	1410
21	Air Leak Test Blower (Flow: 40000 m ³ /Hr)	1290
22	Air Blower (Flow: 20000 m ³ /Hr)	1040
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	700
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1810
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	2000
4	-do- Gun with nose Assembly only	600
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	41090
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	880
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1210
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1410
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1480
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2480
7	BOLT STRETCHING DEVICE	1010
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	4040
9	ULTRASONIC FLAW DETECTOR	3030
10	MPI TEST KIT	400
11	GAS LEAK DETECTOR	300
12	VIBRATION/SOUND LEVEL METER IRD-306	400
13	VIBRATION/SOUND LEVEL METER IRD-308	400
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1610
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2830
16	SHOCK PULSE METER	700
17	HV.DC TEST KIT UPTO 50 KV	600
18	HV.DC TEST KIT ABOVE 50 KV	1110
19	HV.AC TEST KIT UPTO 50KV	900
20	HV.AC TEST KIT ABOVE 50KV	3230
21	MOTORISED MEGGER 2.5KV	440
22	MOTORISED MEGGAR 5KV	500
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	500
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1210

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
25	WAVEFORM ANALYSER	1010
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1810
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1210
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	1010
29	DIGITAL LOW RESISTANCE METER	700
30	DC POTENTIOMETER	200
31	PRECISION DEAD WEIGHT TESTER	1110
32	OPTICAL ALIGNMENT KIT	1510
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1330
34	VERNIER THEODOLITE,PRECISION	1330
35	VERNIER THEODOLITE,ORDINARY	220
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	130
37	ISKAMATIC 'A'	3550
38	CALIBRATOR '03'	1110
39	48 POLE EXTENDER CARD	220
40	MULTIJET NPM	440
41	OSCILLOMETER	11320
42	VOC EQUIPMENT	1550
43	BINARY SIGNAL GENERATOR	320
44	ELECTRIC COUNTER	760
45	FREQUENCY GENERATOR	1110
46	DBF 3 VIBRATION RECORDER/ANALYSER	3630
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	540
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1310
49	VIBROPORT 41/FFT ANALYSER	6060
50	ELCID kit	11120
51	UNIVERSAL CALIBRATION SYSTEM	3030
52	NATURAL FREQUENCY TESTER	3230
53	DIGITAL HARDNESS TESTER	400
54	ADRE 208 VIBRATION ANALYSER	8080
55	PCB DIAGNOSTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER	3590
59	PMI Machine OLYMPUS make	3730
60	Mobile Lighting Mast -	960
61	10KVA RESISTANCE BRAZING MACHINE	160
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH	510

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/06/2019 to 31/5/2021
63	HYDROGEN GAS LEAK DETECTOR	60
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE	5530
65	WEDGE DEFLECTION KIT	90
66	TILE PRESSING MACHINE FOR GAS TURBINE	300
67	INDUCTION BRAZING MACHINE	5410
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	4040
69	ULTRASONIC FLOW METER	200
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	50
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR	520
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR	480
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL	2010
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1400
75	5KV Insulation Tester	500
76	4 Channel Digital Oscilloscope /Fast Recorder	1900
77	4 Channel Oscillographic Recorder	650
78	Sound Level Meter	260
79	Thermal Imaging Camera	860
80	Videoscope (Video Boroscope)	1680
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1460
82	Conductivity Meter	90
83	Core Flux Test Kit	8090
84	Primary Current Injection Kit (2000A)	960
85	3 Phase Secondary Injection Kit (Relay Test)	4180
86	FRF Filtration Kit	1480
87	FFT Analyser	2550
88	Flue Gas Analyser	1140
89	Oil Test Kit (Mineral Oil)-Transformer	1120
90	Winding Resistance kit (R L C Load)	970
91	SFRA test Kit	1320
92	Tan Delta test Kit	4510
93	PF Meter	360
94	Ultrasonic Flow Meter	920
95	Oil Particle Counter	400



HEALTH, SAFETY and ENVIRONMENT PLAN

for

**SITE
OPERATIONS**

by

**SUB-
CONTRACTORS**

POWER SECTOR



HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS

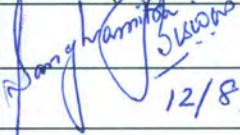
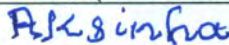
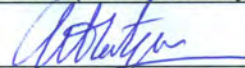
POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

DOCUMENT ISSUE SHEET

	Prepared	Reviewed	Approved
Name	Sanghamitra B. Jayant	A.K. Sinha	Anuj Bhatnagar
Designation	Dy. Manager PSHQ(FQA & Safety)	GM PSHQ(FQA & Safety)	ED PSHQ(FQA & Safety)
Signature			
Date	12/8/14	12/8/14	12/8/14

HSE PLAN FOR SITE OPERATIONS BY BHEL'S SUBCONTRACTORS

AT A GLANCE

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

EXECUTE SAFELY

OPERATIONAL CONTROL PROCEDURES

PERMIT TO WORK

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

SAFETY DURING WORK EXECUTION

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

HOUSE KEEPING

WASTE MANGEMENT

TRAFFIC MANAGEMENT

ENVIRONMENTAL CONTROL

EMERGENCY PREPAREDNESS AND RESPONSE PLAN

CHECKS

HSE AUDITS & INSPECTION

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

HSE PERFORMANCE EVALUATION PARAMETERS

NON CONFORMANCE

PENALTY for NON CONFORMANCE

Refer Clause 16

Incremental penalty

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 1 of 43

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 2 of 43

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



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

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 3 of 43

POWER SECTOR

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

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

1.0 PURPOSE

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

2.0 SCOPE

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

3.0 OBJECTIVES AND TARGETS

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

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



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

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 5 of 43

POWER SECTOR

HSE TARGETS

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

4.0 BHEL POWER SECTOR HEALTH, SAFETY & ENVIRONMENT POLICY

Power Sector HSE Policy

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

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

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

Sd/-

Date: 01.05.2013

Director (Power)

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

5.0 MEMORANDUM OF UNDERSTANDING:

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

Memorandum of Understanding

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

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

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

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

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

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

Name :

Place & Date:



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 7 of 43

6.0 TERMS AND DEFINITIONS

6.1 DEFINITIONS

6.1.1 INCIDENT

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

6.1.2 NEAR MISS

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

6.1.3 MAN-HOUR WORKED

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

6.1.4 FIRST AID CASES

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

6.1.5 LOST TIME INJURY

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

6.1.6 MEDICAL CASES

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

6.1.7 TYPE OF INCIDENTS & THEIR REPORTING:

The three categories of Incident are as follows:

Non-Reportable Cases:

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 8 of 43

Reportable Cases:

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

Injury Cases:

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

6.1.8 TOTAL REPORTABLE FREQUENCY RATE

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

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

6.1.9 SEVERITY RATE

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

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

6.1.10 INCIDENCE RATE

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

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

7.0 HSE ORGANISATION

Number of safety officers:

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

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

7.1 QUALIFICATION FOR HSE PERSONNEL

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

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

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

7.2 RESPONSIBILITIES

7.2.1 SITE IN -CHARGE OF SUBCONTRACTOR

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 10 of 43

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

7.2.2 HEALTH, SAFETY AND ENVIRONMENT OFFICER OF SUBCONTRACTOR

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

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

8.0 PLANNING BY SUBCONTRACTOR

8.1 MOBILISATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR

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

8.2 MOBILISATION OF MANPOWER BY SUBCONTRACTOR

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



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 12 of 43

8.3 PROVISION OF PPEs

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

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

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

Relevant is-codes for personal protection

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 13 of 43

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

Colour scheme for Helmets:

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

8.4 ARRANGEMENT OF INFRASTRUCTURE

8.4.1 DRINKING WATER

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

8.4.2 WASHING FACILITIES

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

8.4.3 LATRINES AND URINALS

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

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

8.4.4 PROVISION OF SHELTER DURING REST

Proper Shed & Shelter shall be provided for rest during break

8.4.5 MEDICAL FACILITIES

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

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

8.4.5.2 FIRST AIDER

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

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

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

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

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 15 of 43

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

8.4.6 PROVISION OF CANTEEN FACILITY

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

8.4.7 PROVISION OF ACCOMODATION/LABOUR COLONY

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

8.4.8 PROVISION OF EMERGENCY VEHICLE

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

8.4.9 PEST CONTROL

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

8.4.10 SCRAPYARD

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

8.4.11 ILLUMINATION

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



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

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 16 of 43

POWER SECTOR

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

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

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

9.0 HSE TRAINING& AWARENESS

9.1 HSE INDUCTION TRAINING

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

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 17 of 43

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

9.2 HSE TOOLBOX TALK

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

9.3 TRAINING ON HEIGHT WORK

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

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

9.4 HSE TRAINING DURING PROJECT EXECUTION

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

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

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

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

9.5.1 Display of HSE posters and banners

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

9.5.2 Display of HSE signage

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

9.5.3 Competition on HSE and award

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

9.5.4 HSE awareness programme

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

10.0 HSE COMMUNICATION

10.1 INCIDENT REPORTING

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

10.2 HSE EVENT REPORTING

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



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 19 of 43

POWER SECTOR

11.0 OPERATIONAL CONTROL

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

LIST OF OCPs

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

11.1 HSE ACTIVITIES

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

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 20 of 43

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

11.2 WORK PERMIT SYSTEM

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

11.3 SAFETY DURING WORK EXECUTION

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

11.3.1 WELDING SAFETY

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

11.3.2 RIGGING

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

11.3.3 CYLINDERS STORAGE AND MOVEMENT

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

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

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

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

11.3.4 DEMOLITION WORK

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

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

11.3.5 T&Ps

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

11.3.6 CHEMICAL HANDLING

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

11.3.7 ELECTRICAL SAFETY

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 22 of 43

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

11.3.8 FIRE SAFETY

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

11.3.9 SCAFFOLDING

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

11.3.10 WORK AT HEIGHT:

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



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 23 of 43

POWER SECTOR

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

11.3.11 WORKING PLATFORM

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

11.3.12 EXCAVATION

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

11.3.13 LADDER SAFETY

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

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

11.3.14 LIFTING SAFETY

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 24 of 43

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

11.3.15 HOISTING APPLIANCE

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

11.4 ENVIRONMENTAL CONTROL

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

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

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

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

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

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

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

11.5 HOUSEKEEPING

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 25 of 43

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

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

11.6 WASTE MANAGEMENT

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

11.6.1 BINS AT WORK PLACE

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

11.6.2 STORAGE AND COLLECTION

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

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

11.6.3 SEGREGATION

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

11.6.4 DISPOSAL

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

11.6.5 WARNING AND SIGNS

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

11.7 TRAFFIC MANAGEMENT SYSTEM

11.7.1 SAFE WORKPLACE TRANSPORT SYSTEM

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 27 of 43

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

11.7.2 TRAFFIC ROUTE FOR PEDESTRIANS

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

11.7.3 WORK VEHICLE

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

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

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

11.7.4 DAILY CHECK BY DRIVER

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

11.7.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

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

11.7.6 MAINTENANCE

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

11.8 EMERGENCY PREPAREDNESS AND RESPONSE

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 29 of 43

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

12.0 HSE INSPECTION

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

12.1 DAILY HSE CHECKS

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

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

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

12.2 INSPECTION OF PPE

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

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

12.3 INSPECTION OF T&Ps

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

12.4 INSPECTION OF CRANES AND WINCHES

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

12.5 INSPECTION ON HEIGHT WORKING

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

12.6 INSPECTION ON WELDING AND GAS CUTTING OPERATION

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 31 of 43

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

12.7 INSPECTION ON ELECTRICAL INSTALLATION / APPLIANCES

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

12.8 INSPECTION OF ELEVATOR

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

13.0 HSE PERFORMANCE

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

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

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

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

14.0 HSE PENALTIES

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

15.0 OTHER REQUIREMENTS

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



HEALTH, SAFETY AND ENVIRONMENT PLAN FOR SITE OPERATION by SUBCONTRACTORS

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 33 of 43

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

16. NON COMPLIANCE

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

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

• Legend:-

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

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 34 of 43

17.0 HSE AUDIT/INSPECTION

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

18.0 MONTHLY HSE REVIEW MEETING

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

19.0 FORMATS USED(Details available in Annexure-04)

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: **35 of 43**

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

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

20.0 ANNEXURES

ANNEXURE 01

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

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

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

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

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

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 37 of 43

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

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



HEALTH, SAFETY AND ENVIRONMENT
PLAN FOR
SITE OPERATION by SUBCONTRACTORS

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 38 of 43

ANNEXURE 02

HSE AUDIT/INSPECTION CHECKLIST CUM COMPLIANCE REPORT

PROJECT: _____

SUBCONTRACTOR: _____

DATE : _____

OWNER : _____

INSPECTION BY: _____

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

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



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

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

POWER SECTOR

Page: 39 of 43

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



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

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 40 of 43

POWER SECTOR

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: 41 of 43

ANNEXURE 03

REFERENCES

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

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



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

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

POWER SECTOR

Page: 42 of 43

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



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

POWER SECTOR

Doc no.: HSEP: 14

REV: 00

Date: 12.08.2014

Page: **43 of 43**

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

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

FORMAT NO: HSEP:13-F01

REV NO.: 00

PAGE NO. 01 OF 02

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

Number of employees on the site:- _____

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

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

FORMAT NO: HSEP:13-F01

REV NO.: 00

PAGE NO. 02 OF 02

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

Signature of Subcontractor's Site I/C::

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

FORMAT NO: HSEP:13-F02

REV NO.: 00

PAGE NO. 01 OF 02

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

NAME:

History Of Past Illness	H/O Epilepsy
	H/O Drug Allergy
	H/O Diabetics/ Hypertension
	H/O Unconsciousness

Personal History

EXAMINATION	OBSERVATION
<u>General Physical Examination</u>	
Height :	
Weight :	
BMI :	
Built And nourishment :	
Pallor :	
Temperature :	
Chest Expansion :	Inspiration Expansion
Lymph Node Enlargement :	
<u>Ear, Nose, Throat</u> :	
Ear :	
Nose :	
Throat :	

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

FORMAT NO: HSEP:13-F02

REV NO.: 00

PAGE NO. 02 OF 02

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

Signature of the examining doctor

**POWER SECTOR****HSE INDUCTION TRAINING**

FORMAT NO: HSEP:13-F03

REV NO.: 00

PAGE NO. 01 OF 01

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

Sl No.	Name	Designation	Organisation	Signature

Signature of Training co-ordinator :

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

Name of Site :	
Sub-Contractors Name :	
Date :	

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

Signature of Site I/C of Subcontractor :

**POWER SECTOR****PERSONAL PROTECTIVE EQUIPMENTS**

FORMAT NO: HSEP:13-F06

REV NO.: 00

PAGE NO. 01 OF 01

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

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

Signature of Site I/C of Subcontractor :

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

FORMAT NO: HSEP:13-F07

REV NO.: 00

PAGE NO. 01 OF 01

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

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

Signature-Site Safety Officer (BHEL)

Signature-Subcontractor/ Subcontractor's
Safety Officer

**POWER SECTOR****STATUS OF T&Ps**

FORMAT NO: HSEP:13-F08

REV NO.: 00

PAGE NO. 01 OF 01

Name of Site	
Name of Sub-Contractor	
Date of Inspection	

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

Signature of Site I/C of subcontractor :

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

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 01 OF 03

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

Crane Reg. No (Make/Model) _____

Name of Driver/Operator _____

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

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

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 02 OF 03

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

WINCH

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

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

FORMAT NO: HSEP:13-F09

REV NO.: 00

PAGE NO. 03 OF 03

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

Signature of Site I/C of subcontractor :

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

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

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

**POWER SECTOR****INSPECTION OF HEIGHT WORKING**

FORMAT NO: HSEP:13-F10

REV NO.: 00

PAGE NO. 02 OF 02

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

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF WELDING AND GAS
CUTTING**

FORMAT NO: HSEP:13-F11

REV NO.: 00

PAGE NO. 01 OF 02

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

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

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

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

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF ELECTRICAL INSTALLATION**

FORMAT NO: HSEP:13-F12

REV NO.: 00

PAGE NO. 01 OF 02

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

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

**POWER SECTOR****INSPECTION OF ELECTRICAL INSTALLATION**

FORMAT NO: HSEP:13-F12

REV NO.: 00

PAGE NO. 02 OF 02

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

Signature of Site I/C of subcontractor :

**POWER SECTOR****INSPECTION OF ELEVATOR**

FORMAT NO: HSEP:13-F13

REV NO.: 00

PAGE NO. 01 OF 01

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

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

Signature-Subcontractor/ Subcontractor's
Safety Officer

Signature-Site Safety Officer (BHEL)

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

FORMAT NO: HSEP:13-F14

REV NO.: 00

PAGE NO. 01 OF 02

Sub: MEMO for Penalty for non compliances in Safety

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

Safety Area

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

Legend:-

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

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

1 Copy to Site Construction Manager(BHEL)

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

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

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



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

BURNING/WELDING /HOT WORK PERMIT

Area : _____ Date: _____ Time: _____

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

Name of Work Performing Contractor: _____

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

Description of Work: _____

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

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

The following precautions are to be taken:

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

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

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

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

Name of BHEL Safety Representative: _____ Sign: _____

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

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

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

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

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

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

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

Original at BHEL site

Second Copy – BHEL SAFETY

Third Copy : Contractor



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

LIFTING ACTIVITY PERMIT

Area : _____ Date: _____ Time: _____

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

Name of Work Performing Contractor: _____

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

Description of Work: _____

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

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

The following precautions are to be taken:

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

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

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

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

Name of BHEL Safety Representative: _____ Sign: _____

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

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

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

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

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

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

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

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



SAFETY WORK CLEARANCE

Permit no. _____

Project: _____

Emergency Contact Nos: _____

Subcontractor: _____

WORKING AT HEIGHT PERMIT

Area : _____ Date: _____ Time: _____

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

Name of Work Performing Contractor: _____

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

Description of Work: _____

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

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

The following precautions are to be taken:

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

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

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

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

Name of BHEL Safety Representative: _____ Sign: _____

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

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

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

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

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

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

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

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

PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS

1. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided herein:
2. The party desirous of resorting to Conciliation shall send an invitation/notice in writing to the other party to conciliate specifying all points of Disputes with details of the amount claimed. The party concerned shall not raise any new issue thereafter. Parties shall also not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till the conclusion of the Conciliation proceedings. If BHEL is to initiate Conciliation, then, the invitation to Conciliate shall be extended to the concerned Stakeholder in **Format 7** hereto. Where the stakeholder is to initiate the Conciliation, the notice for initiation of Conciliation shall be sent in **Format-8** hereto.
3. The party receiving the invitation/notice for Conciliation shall within 30 days of receipt of the notice of Conciliation intimate its consent for Conciliation along with its counter-claims, if any.
4. The Conciliation in a matter involving claim or counter-claim (whichever is higher) up to Rs 5 crores shall be carried out by sole Conciliator nominated by BHEL while in a matter involving claim or counter-claim (whichever is higher) of more than Rs 5 crores Conciliation shall be carried out by 3 Conciliators nominated by BHEL. The appointment of Conciliator(s) shall be completed and communicated by the concerned Department/Group of BHEL Unit/Division/Region/Business Group to the other party and the Conciliator(s) within 30 days from the date of acceptance of the invitation to conciliate by the concerned party in the **Format-9**. The details of the Claim, and counter-claim, if any, shall be intimated to the Conciliator(s) simultaneously in **Format-5**.
5. The Parties shall be represented by only their duly authorized in-house executives/officers and neither Party shall be represented by a Lawyer.
6. The first meeting of the IEC shall be convened by the IEC by sending appropriate communication/notice to both the parties as soon as possible but not later than 30 days from the date of his/their appointment. The hearings in the Conciliation proceeding shall ordinarily be concluded within two (2) months and, in exceptional cases where parties have expressed willingness to settle the matter or there exists possibility of settlement in the matter, the proceedings may be extended by the IEC by a maximum of further 2 months with the consent of the Parties subject to cogent reasons being recorded in writing.

- 7.** The IEC shall thereafter formulate recommendations for settlement of the Disputes supported by reasons at the earliest but in any case within 15 days from the date of conclusion of the last hearing. The recommendations so formulated along with the reasons shall be furnished by the IEC to both the Parties at the earliest but in any case within 1 month from the date of conclusion of the last hearing.
- 8.** Response/modifications/suggestions of the Parties on the recommendations of the IEC are to be submitted to the IEC within time limit stipulated by the IEC but not more than 15 days from the date of receipt of the recommendations from the IEC.
- 9.** In the event, upon consideration, further review of the recommendations is considered necessary, whether by BHEL or by the other Party, then, the matter can be remitted back to the IEC with request to reconsider the same in light of the issues projected by either/both the Parties and to submit its recommendations thereon within the following 15 days from the date of remitting of the case by either of the Parties.
- 10.** Upon the recommendations by the Parties, with or without modifications, as considered necessary, the IEC shall be called upon to draw up the Draft Settlement Agreement in terms of the recommendations.
- 11.** When a consensus can be arrived at between the parties only in regard to any one or some of the issues referred for Conciliation the draft Settlement Agreement shall be accordingly formulated in regard to the said Issue(s), and the said Settlement Agreement, if signed, by the parties, shall be valid only for the said issues. As regards the balance issues not settled, the parties may seek to resolve them further as per terms and conditions provided in the contract.
- 12.** In case no settlement can be reached between the parties, the IEC shall by a written declaration, pronounce that the Conciliation between the parties has failed and is accordingly terminated.
- 13.** Unless the Conciliation proceedings are terminated in terms of para 22 (b), (c) & (d) herein below, the IEC shall forward his/its recommendations as to possible terms of settlement within one (1) month from the date of last hearing. The date of first hearing of Conciliation shall be the starting date for calculating the period of 2 months.
- 14.** In case of 3 members IEC, 2 members of IEC present will constitute a valid quorum for IEC and meeting can take place to proceed in the matter after

seeking consent from the member who is not available. If necessary, videoconferencing may be arranged for facilitating participation of the members. However, the IEC recommendations will be signed by all members. Where there is more than one (1) Conciliator, as a general rule they shall act jointly. In the event of differences between the Members of IEC, the decision/recommendations of the majority of the Members of IEC shall prevail and be construed as the recommendation of the IEC.

- 15.** The Draft Settlement Agreement prepared by the IEC in terms of the consensus arrived at during the Conciliation proceedings between the Parties shall be given by the IEC to both the parties for putting up for approval of their respective Competent Authority.
- 16.** Before submitting the draft settlement agreement to BHEL's Competent Authority viz. the Board Level Committee on Alternative Dispute Resolution (BLCADR) for approval, concurrence of the other party's Competent Authority to the draft settlement agreement shall be obtained by the other party and informed to BHEL within 15 days of receipt of the final draft settlement agreement by it. Upon approval by the Competent Authority, the Settlement Agreement would thereafter be signed by the authorized representatives of both the Parties and authenticated by the members of the IEC.
- 17.** In case the Draft Settlement Agreement is rejected by the Competent Authority of BHEL or the other Party, the Conciliation proceedings would stand terminated.
- 18.** A Settlement Agreement shall contain a statement to the effect that each of the person(s) signing thereto (i) is fully authorized by the respective Party(ies) he/she represents, (ii) has fully understood the contents of the same and (iii) is signing on the same out of complete freewill and consent, without any pressure, undue influence.
- 19.** The Settlement Agreement shall thereafter have the same legal status and effect as an arbitration award on agreed terms on the substance of the dispute rendered by an arbitral tribunal passed under section 30 of the Arbitration and Conciliation Act, 1996.
- 20.** Acceptance of the Draft Settlement Agreement/recommendations of the Conciliator and/or signing of the Settlement Agreement by BHEL shall however, be subject to withdrawal/closure of any arbitral and/or judicial proceedings initiated by the concerned Party in regard to such settled issues.
- 21.** Unless otherwise provided for in the agreement, contract or the Memorandum of Understanding, as the case may be, in the event of likelihood of prolonged

absence of the Conciliator or any member of IEC, for any reason/incapacity, the Competent Authority/Head of Unit/Division/Region/Business Group of BHEL may substitute the Conciliator or such member at any stage of the proceedings. Upon appointment of the substitute Conciliator(s), such reconstituted IEC may, with the consent of the Parties, proceed with further Conciliation into the matter either de-novo or from the stage already reached by the previous IEC before the substitution.

22. The proceedings of Conciliation under this Scheme may be terminated as follows:

- a. On the date of signing of the Settlement agreement by the Parties; or,
- b. By a written declaration of the IEC, after consultation with the parties, to the effect that further efforts at conciliation are no longer justified, on the date of the declaration; or,
- c. By a written declaration of the Parties addressed to the IEC to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- d. By a written declaration of a Party to the other Party and the IEC, if appointed, to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
- e. On rejection of the Draft Settlement Agreement by the Competent Authority of BHEL or the other Party.

23. The Conciliator(s) shall be entitled to following fees and facilities:

Sl No	Particulars	Amount
1	Sitting fees	Each Member shall be paid a Lump Sum fee of Rs 75,000/- for the whole case payable in terms of paragraph No. 27 herein below.
2	Towards drafting of settlement agreement	In cases involving claim and/or counter-claim of up to Rs 5crores. Rs 50,000/- (Sole Conciliator) In cases involving claim and/or counter-claim of exceeding Rs 5 crores but less than Rs 10 crores. Rs 75,000 (per Conciliator)

Sl No	Particulars	Amount
		In cases involving claim and/or counter-claim of more than Rs 10 crores. Rs 1,00,000/- (per Conciliator) Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on the, Signing of the Settlement Agreement after approval of the Competent Authority or Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.
3	Secretarial expenses	Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC. Where Conciliation is by multi member Conciliators –Rs 30,000/- (one time)- to be paid to the IEC
4	Travel and transportation and stay at outstation Retired Senior Officials of other Public Sector Undertakings (pay scale wise equivalent to or more than E-8 level of BHEL)	As per entitlement of the equivalent officer (pay scale wise) in BHEL.
	Others	As per the extant entitlement of whole time Functional Directors in BHEL. Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.
5	Venue for meeting	Unless otherwise agreed in the agreement, contract or the Memorandum of Understanding, as the case may be, the venue/seat of proceedings shall be the location of the concerned Unit / Division / Region /

Sl No	Particulars	Amount
		Business Group of BHEL. Without prejudice to the seat/venue of the Conciliation being at the location of concerned BHEL Unit / Division / Region / Business Group, the IEC after consulting the Parties may decide to hold the proceedings at any other place/venue to facilitate the proceedings. Unless, Parties agree to conduct Conciliation at BHEL premises, the venue is to be arranged by either Party alternately.

- 24.** The parties will bear their own costs including cost of presenting their cases/evidence/witness(es)/expert(s) on their behalf. The parties agree to rely upon documentary evidence in support of their claims and not to bring any oral evidence in IEC proceedings.
- 25.** If any witness(es) or expert(s) is/are, with the consent of the parties, called upon to appear at the instance of the IEC in connection with the matter, then, the costs towards such witness(es)/expert(s) shall be determined by the IEC with the consent of the Parties and the cost so determined shall be borne equally by the Parties.
- 26.** The other expenditures/costs in connection with the Conciliation proceedings as well as the IEC's fees and expenses shall be shared by the Parties equally.
- 27.** Out of the lump sum fees of Rs 75,000/- for Sitting Fees, 50% shall be payable after the first meeting of the IEC and the remaining 50% of the Sitting Fees shall be payable only after termination of the conciliation proceedings in terms of para 22 hereinabove.
- 28.** The travelling, transportation and stay at outstation shall be arranged by concerned Unit as per entitlements as per Serial No. 4 of the Table at para 23 above, and in case such arrangements are not made by the BHEL Unit, the same shall be reimbursed to the IEC on actuals limited to their entitlement as per Serial No. 4 of the Table at Para 23 above against supporting documents. The IEC Member(s) shall submit necessary invoice for claiming the fees/reimbursements.
- 29.** The Parties shall keep confidential all matters relating to the conciliation proceedings. Confidentiality shall extend also to the settlement agreement,

except where its disclosure is necessary for purposes of its implementation and enforcement or as required by or under a law or as per directions of a Court/Governmental authority/ regulatory body, as the case may be.

- 30.** The Parties shall not rely upon or introduce as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the Disputes that is the subject of the Conciliation proceedings:
- a.** Views expressed or suggestions made by the other party in respect of a possible settlement of the Disputes;
 - b.** admissions made by the other party in the course of the Conciliator proceedings;
 - c.** proposals made by the Conciliator;
 - d.** The fact that the other Party had indicated his willingness to accept a proposal for settlement made by the Conciliator.
- 31.** The Parties shall not present the Conciliator(s) as witness in any Alternative Dispute Resolution or Judicial proceedings in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.
- 32.** None of the Conciliators shall act as an arbitrator or as a representative or counsel of a Party in any arbitral or judicial proceeding in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.
- 33.** The Parties shall not initiate, during the Conciliation proceedings, any arbitral or judicial proceedings in respect of a Disputes that is the subject matter of the Conciliation proceedings except that a Party may initiate arbitral or judicial proceedings where, in his opinion, such proceedings are necessary for preserving his rights including for preventing expiry of period of limitation. Unless terminated as per the provisions of this Scheme, the Conciliation proceedings shall continue notwithstanding the commencement of the arbitral or judicial proceedings and the arbitral or judicial proceedings shall be primarily for the purpose of preserving rights including preventing expiry of period of limitation.
- 34.** The official language of Conciliation proceedings under this Scheme shall be English unless the Parties agree to some other language.

**STATEMENT OF CLAIMS/COUNTER CLAIMS TO BE SUBMITTED TO THE
IEC BY BOTH THE PARTIES**

1. Chronology of the Disputes
2. Brief of the Contract/MoU/Agreement/LOI/LOA
3. Brief history of the Disputes:
4. Issues:
5. Details of Claim(s)/Counter Claim(s):

Sl. No.	Description of claim(s)/Counter Claim	Amount (in INR)Or currency applicable in the contract	Relevant contract clause

6. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract)

Note– *The Statement of Claims/Counter Claims may ideally be restricted to maximum limit of 20 pages. Relevant documents may be compiled and submitted along with the statement of Claims/Counter Claims. The statement of Claims/Counter Claims is to be submitted to all IEC members and to the other party by post as well as by email.*

FORMAT-7

FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY BHEL FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

M/s. (Stakeholder's name)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE CONTRACT BY BHEL**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which arise out of the above- referred Contract/MoU/Agreement/LOI/LOA are reproduced hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring disputes to conciliation.

In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby seek your consent to refer the matter to Conciliation by Independent Experts Committee to be appointed by BHEL. You are invited to provide your consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which you might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA.

Please note that upon receipt of your consent in writing within 30 days of the date of receipt of this letter by you, BHEL shall appoint suitable person(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you
Yours faithfully

Representative of BHEL

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

FORMAT-8

**FORMAT FOR NOTICE INVOKING CONCILIATION CLAUSE BY A
STAKEHOLDER FOR REFERRING THE DISPUTES TO CONCILIATION
THROUGH IEC**

To,

BHEL (Head of the Unit/Division/Region/Business Group)

Subject: **NOTICE FOR INVOCATION OF THE CONCILIATION CLAUSE OF THE
CONTRACT BY A STAKEHOLDER**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Dear Sir/Madam,

As you are aware, with reference to above referred Contract/MoU/Agreement/LOI/LOA, certain disputes have arisen, which, in spite of several rounds of mutual discussions and various correspondences have remained unresolved. The brief particulars of our claims which have arisen out of the above-referred Contract/MoU/Agreement/LOI/LOA are enumerated hereunder:

Sl. No.	Claim description	Amount involved

As you are aware, there is a provision in the captioned Contract/MoU/Agreement/LOI/ LOA for referring inter-se disputes of the Parties to conciliation.

We wish to refer the above-said disputes to Conciliation as per the said Clause of the captioned Contract/MoU/Agreement/LOI/ LOA. In terms of Clause -----of Procedure i.e., Annexure ----- to the Contract/MoU /Agreement / LOI / LOA, we hereby invite BHEL to provide its consent in writing to proceed with conciliation into the above mentioned disputes within a period of 30 days from the date of this letter along with details of counter-claims, if any, which it might have with regard to the subject Contract/ MoU/ Agreement/ LOI/ LOA and to appoint suitable person(s) as Conciliator(s) from the BHEL Panel of Conciliators.

This letter is being issued without prejudice to our rights and contentions available under the contract and law.

Thanking you

Yours faithfully

Representative of the Stakeholder

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

FORMAT FOR INTIMATION TO THE STAKEHOLDER ABOUT APPOINTMENT OF CONCILIATOR/IEC

To,

M/s. (Stakeholder's name)

Subject: **INTIMATION BY BHEL TO THE STAKEHOLDER AND CONCILIATOR(S) ABOUT APPOINTMENT OF CONCILIATOR/IEC**

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Sir,

This is with reference to letter dated ----- regarding reference of the disputes arising in connection with the subject Contract No /MoU/Agreement/LOI/LOA to conciliation and appointment of Conciliator(s).

In pursuance of the said letter, the said disputes are assigned to conciliation and the following persons are nominated as Conciliator(s) for conciliating and assisting the Parties to amicably resolve the disputes in terms of the Arbitration & Conciliation Act, 1996 and the Procedure ---- to the subject Contract/MoU/Agreement/LOI/LOA, if possible.

Name and contact details of Conciliator(s)

a)

b)

c)

You are requested to submit the Statement of Claims or Counter-Claims (strike off whichever is inapplicable) before the Conciliator(s) in Format 5 (enclosed herewith) as per the time limit as prescribed by the Conciliator(s).

Yours faithfully,

Representative of BHEL

CC: To Conciliator(s)... for Kind Information please.

Encl: As above

Note: The Format may be suitably modified, as required, based on facts and circumstances of the case.

GUIDELINES FOR WELDING

IMPORTANT NOTE

THIS GUIDELINES FOR WELDING PROVIDES BROAD BASED GUIDELINES FOR CARRYING OUT WELDING WORK AT SITES. HOWEVER, SITES SHALL ENSURE ADHERENCE TO THE PRIMARY DOCUMENTS LIKE CONTRACT DRAWINGS, FIELD WELDING SCHEDULES, WELDING PROCEDURE SPECIFICATIONS, PLANT / CORPORATE STANDARDS, STATUTORY DOCUMENTS, CONTRACTUAL OBLIGATIONS, AS APPLICABLE AND SPECIAL INSTRUCTIONS, IF ANY, ISSUED BY RESPECTIVE MANUFACTURING UNITS SPECIFIC TO THE PROJECTS.

CHAPTER-A1

WELDING - GENERAL

A1: WELDING-GENERAL

1.0 SCOPE:

- 1.1 This manual deals with activities and information related to welding at site. Where specific documents are supplied by the Manufacturing Units (MUs)/Engineering Centers (ECs), the same shall be adopted.

2.0 DOCUMENTS REFERRED:

- 2.1 The following documents are referred in preparation of this manual.
1. AWS D1.1
 2. AWS D1.6
 3. ASME sections I, II (A&C), V & IX
 4. ASME B31.1
 5. IBR
 6. BHEL Manufacturing Units/Engineering Centers Standards & practices

3.0 PROCEDURE:

- 3.1 The following documents shall be referred as primary documents
1. Contract drawings
 2. Field Welding Schedule or equivalent
 3. Plant / Corporate standards, wherever applicable
 4. Statutory documents
 5. Welding Procedure Specifications
 6. Contractual obligations, if any.

4.0 WELDER QUALIFICATION:

- 4.1 Ensure, personnel qualified as per statutory requirements are engaged, where required.
- 4.2 For welding not under the purview of statutory requirements, qualification of welders shall be as in this manual.
- 4.3 Monitor performance of qualified butt welders as in this manual.
- 4.4 Ensure selection, procurement, storage, drying & issue of welding consumables, as detailed in this manual.
- 4.5 List of approved vendors of general purpose welding electrodes as provided by BHEL-Tiruchy Unit shall be used for selection of brands at sites. Alternatively specific contractual requirements, if any may be followed.
- 4.6 Where Tiruchy list does not cover site requirements, such specific cases may be referred to concerned unit and Head (Quality) of the region.
- 4.7 Welding in-charge shall assign a unique identification for all the butt welds coming under the purview of statutory regulations. Such identification may be traceable through documents like drawings, sketches etc.
- 4.8 A welding "job card" incorporating the welding parameters and heat treatment requirements is recommended to be issued for all critical welds like pressure part welds, piping welds and

ceiling girder welds. The formats of the job card are enclosed for illustration in Annexure I, II, III and IV.

5.0 SELECTION OF ARGON GAS FOR GTAW:

5.1 USE OF ARGON GAS AT SITES:

In the welding process, Argon is used for **SHIELDING** and **PURGING (BACKING)** purpose. The welding process when exposed to air, most metals exhibit a strong tendency to combine with Oxygen, and to lesser extent with Nitrogen, especially when in the molten condition. The rate of oxide formation will vary with different metals, but even a thin film of oxide on the surface of metals to be welded can lead to difficulties. For the most part, the oxides are relatively weak, brittle materials that in no way resemble the metal from which they are formed. A layer of oxide can easily prevent the joining of two pieces by welding. Argon is a shielding gas used in Gas Tungsten Arc Welding (GTAW). It is also used for purging (backing) during the root welding of Gr.91/Gr.92/Stainless steel materials. Argon protects welds against oxidation as well as reduces fume emissions during welding. The compressed argon is supplied in cylinders. The cylinder used for argon will have the body colour of BLUE without band, size of 25 cm dia. & 1.5 m length, capacity of 6.2 m³ and pressure of 137 Kg/Cm² when fully charged at 15°C (approximately).

5.2 PURITY LEVEL OF ARGON

As per IS 5760: 1998 there are 3 grades of argon, namely:

- **Grade 1:** Ultra high purity argon for use in electronics and allied industries and indirect reading vacuum spectrograph.
- **Grade 2:** High purity argon for use in lamp and allied industries.
- **Grade 3:** Commercial grade argon for use in welding industry and for other metallurgical operations.

Accordingly the argon shall comply with the requirements given below:

Sl. No.	CHARACTERISTIC	REQUIREMENT		
		Grade 1	Grade 2	Grade 3
i.	Oxygen, ppm, Max.	0.5	5.0	10.0
ii.	Nitrogen, ppm, Max.	2.0	10.0	300
iii.	Hydrogen, ppm, Max.	1.0	2.0	5.0
iv.	Water vapors, ppm. Max.	0.5	4.0	7.0
v.	Carbon dioxide, ppm, Max.	0.5	0.5	3.0
vi.	Carbon monoxide, ppm, Max.	0.5	0.5	2.0
vii.	Hydrocarbons, ppm, Max.	0.2	0.5	-

5.3 PURCHASE SPECIFICATION FOR ARGON:

Argon gas as per Grade 2 of IS-5760: 1998 with Argon purity level of min. 99.99%. The supply should accompany Test Certificate for the batch indicating compliance to the above requirements.

5.4 HEAT TREATMENT:

- 5.4.1 Preheat, inter pass, post heat and Post Weld Heat Treatment (PWHT) requirements shall be as per applicable documents; where these are not supplied, reference may be made to Welding / Heat Treatment Manual.
- 5.4.2 Prior to PWHT operation, a "job card" containing material specification, weld reference, size, rate of heating, soaking temperature, soaking time and rate of cooling shall be prepared referring to applicable documents, and issued.
- 5.4.3 The PWHT chart shall contain the chart number, Weld Joint No., Temperature recorder details (like Sl. No. make, range, chart speed), date of PWHT, start and end time of operation.
- 5.4.4 The chart shall be evaluated and results recorded on the PWHT job card. Refer Heat Treatment Manual (Document No. AA/CQ/GL/011/ Part II-HTM- Latest) for details.

6.0 EQUIPMENT & INSTRUMENTS:

- 6.1 Equipment/accessories used shall be assessed for fitness prior to use.
- 6.2 Use calibrated thermocouples, temperature measuring instruments and recorders.
- 6.3 Preheating shall be checked and ensured using temperature indicating crayons.

7.0 INSPECTION:

- 7.1 Inspection of welding shall be done as per Chapter A5 of this manual and records maintained as appropriate.
- 7.2 Weld log containing the following information shall be prepared for all completed systems.
 - Project / Unit reference
 - Drawing No.
 - Weld Joint No.
 - FWS/ Equivalent
 - Material specification
 - Consumable used
 - Welder code
 - Date of welding
 - NDE report No. and results (including repair details)
 - PWHT Chart No. and results
 - Remarks, if any.

8.0 SAFETY:

8.1 Safe access to weld area shall be provided.

8.2 Adequate protection shall be provided against wind and rain water entry during welding.

9.0 RECORDS:

9.1 All records, as required, shall be maintained by welding in-charge and handed over to the appropriate authority at the end of the project closure.

Annexure – I: Welding Job Card

Page 1 of 2

Welding Job Card

Project :
Unit No. : Area: Boiler/TG/PCP:
Job Card No. : Date :
FWS Number :
Joint No. :
Drawing No. :
System Description :
Size (Dia. x thick) :
Material Specification :
Consumable used :
Welder No.(s) :
Date of welding :
Filler wire Specification :
Electrode Specification :
Preheat temperature :
Inter pass temperature :
Post Heat temperature :
PWHT temperature :

Welding engineer

Page 2 of 2

Filler wire/Electrode consumption

SMAW ϕ 2.5 mm :
 ϕ 3.15 mm :
 ϕ 4.0 mm :
Date of LPI for RG Plug :
Remarks :

Date of Return :

Annexure – II: Welding Job Card for P91/P92 Welds

<u>JOB CARD</u> <u>(WELDING, HEAT TREATMENT & ND EXAMINATION)</u> <u>FOR P91/P92 WELDS</u>											
Card No.:						Date:					
Project:				Unit No.				Contractor:			
System:						Drawing No.					
PGMA:						DU No.:		Joint No.:			
Material Specification:				+		OD (mm):				Thick(mm)	
Filler metal:		GTAW				SMAW					
Joint fit-up:		Min. WT:				Root gap:				Root mismatch:	
										Log sheet filled:	
										Y / N	
No. of T/Cs:				Location:				Distance from EP edge:			
										mm	
Welders' ID:						M/c No.:					
Preheat Temp.:		°C Minimum				Rate of heating:		°C per hour			
Purging flow rate:				Litres / min.		Purging time:				Minutes	
Shielding flow rate:				Litres / min. for GTAW		Distance bet. dams:				Metres	
Interpass Temp.:		° C Maximum				Rate of cooling:		°C per hour			
Holding Temp. before PWHT:		° C for min. 1 hour									
PWHT:		° C				Rate of heating / cooling:		°C per hour			
Soaking time				Minutes (2.5 minutes per mm)		Cooling to:		300° C			
Preheating started at				Hrs. on		Preheating completed at				Hrs.	
Root welding started at				Hrs.		Root welding completed at				Hrs.	
Welding started at				Hrs.		Welding completed at				Hrs.	
Interpass temp. maintained between						°C and		°C			
Holding temp. reached at				Hrs.		Holding completed at				Hrs.	
No. of T/Cs:				Location							
PWHT started at				Hrs. on		Soaking started at				Hrs.	
Soaking completed at				Hrs.		300°C reached at				Hrs.	
UT Equipment used:						Calibration validity:					
UT carried out on						Result : OK / Not OK					
MPI Equipment used:						Calibration validity:					
MPI carried out on						Result: OK / Not OK					
Hardness test Equipment used:						Calibration validity:					
Hardness test carried out on						Value:					
History of interruption if any, with time:											
<u>Contractor</u>				<u>BHEL</u>				<u>Customer</u>			

Annexure – III: Welding Job Card for T91/T92 Welds

<u>JOB CARD</u> <u>(WELDING, HEAT TREATMENT & ND EXAMINATION)</u> <u>FOR T91/T92 WELDS</u>											
Card No.:						Date:					
Project				Unit No.				Contractor:			
System:						Drawing No.					
PGMA:						DU No.:		Joint No.:			
Material Specification:				+		OD (mm):				Thick(mm)	
Filler metal:		GTAW				SMAW					
Joint fit-up:		Min. t:				Root gap:				Log sheet filled: Y / N	
No. of T/Cs:		Location				Distance from EP edge:				mm	
Welders' ID:						M/c No.:					
Preheat Temp.:		°C Minimum				Rate of heating:		°C per hour			
Purging flow rate:				Litres / min.		Purging time:				Minutes	
Shielding flow rate:				Litres / min. for GTAW		Distance bet. dams:				Metres	
Interpass Temp.:		° C Maximum				Rate of cooling:		°C per hour			
PWHT:		° C				Rate of heating / cooling:		°C per hour			
Soaking time				Minutes (2.5 minutes per mm)				Cooling to:		300° C	
Preheating started at				Hrs. on				Preheating completed at			
Root welding started at				Hrs.				Root welding completed at			
Welding started at				Hrs.				Welding completed at			
Hrs.											
Interpass temp. maintained between						°C and		°C			
Holding temp. reached at						Hrs.		Holding completed at			
Hrs.								Hrs.			
No. of T/Cs:		Location									
PWHT started at						Hrs. on				Soaking started at	
Hrs.										Hrs.	
Soaking completed at						Hrs.				300°C reached at	
Hrs.										Hrs.	
RT carried out on						Result : OK / Not OK					
Hardness test Equipment used						Calibration validity:					
Hardness test carried out on						Value:					
History of interruption if any, with time:											
<u>Contractor</u>				<u>BHEL</u>				<u>Customer</u>			

Annexure – IV: Welding Job Card for T23 Welds

<u>JOB CARD</u> <u>(WELDING, HEAT TREATMENT & ND EXAMINATION)</u> <u>FOR T23 WELDS</u>											
Card No.:						Date:					
Project:				Unit No.				Contractor:			
System:						Drawing No.					
PGMA:						DU No.:		Joint No.:			
Material Specification:				+		OD (mm):				Thick(mm)	
Filler metal:		GTAW				SMAW					
Joint fit-up:		Min. t:				Root gap:				Root mismatch:	
										Log sheet filled:	
Y / N											
No. of T/Cs:				Location:				Distance from EP edge:			
mm											
Welders' ID:						M/c No.:					
Preheat Temp.:		°C Minimum				Rate of heating:		°C per hour			
Purging flow rate:				Litres / min.		Purging time:				Minutes	
Shielding flow rate:				Litres / min. for GTAW		Distance bet. dams:				Metres	
Interpass Temp.:		° C Maximum				Rate of cooling:		°C per hour			
Holding Temp.:		° C for min. 1 hour. for post heating									
PWHT:		° C				Rate of heating / cooling:		°C per hour			
Soaking time				Minutes (2.5 minutes per mm)		Cooling to:		300° C			
Preheating started at				Hrs. on		Preheating completed at				Hrs.	
Root welding started at				Hrs.		Root welding completed at				Hrs.	
Welding started at				Hrs.		Welding completed at				Hrs.	
Interpass temp. maintained between						°C and		°C			
Holding temp. reached at				Hrs.		Holding completed at				Hrs.	
No. of T/Cs				Location							
PWHT started at				Hrs. on		Soaking started at				Hrs.	
Soaking completed at				Hrs.		300°C reached at				Hrs.	
RT carried out on						Result : OK / Not OK					
Hardness test Equipment used						Calibration validity:					
Hardness test carried out on						Value:					
						Result:		OK / Not OK			
History of interruption if any, with time:											
<u>Contractor</u>				<u>BHEL</u>				<u>Customer</u>			

CHAPTER-A2
BASE MATERIALS

1.0 SCOPE:

- 1.1. This chapter contains tabulations of chemical compositions and mechanical properties of various materials generally used at BHEL sites.

2.0 CONTENTS:

CHEMICAL COMPOSITION AND MECHANICAL PROPERTIES

Table A2.1	-	Pipes (ASME)
Table A2.2	-	Tubes (ASME)
Table A2.3	-	Forgings (ASME)
Table A2.4	-	Castings (ASME)
Table A2.5	-	Plates / Sheets (ASTM, ASME& IS)
Table A2.6	-	Pipes (Other specifications)
Table A2.7	-	Tubes (Other specifications)

- 3.0** The data are for general information purposes. The corresponding P numbers are also indicated.

- 4.0** For materials not covered in this chapter, refer the relevant Material Specification Standard. In case it is not available at site, same shall be referred to Head quality of the region.

TABLE-A2.1: PIPES (ASME)

Sl. No.	P. No. /Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W	T.S MPa	Y.S MPa	% E Min.
1	P 1 / 1	SA 106 Gr. B (Remarks: Carbon restricted to 0.25% Max.)	0.30 Max.	0.29-1.06	0.035 Max.	0.035 Max.	0.10 Min.	0.40 Max.	0.40 Max.	0.15 Max.	0.08 Max	-	415	240	30
2	P 1 / 2	SA 106 Gr. C (Remarks: Carbon restricted to 0.25% Max.)	0.35 Max.	0.29-1.06	0.035 Max.	0.035 Max.	0.10 Min.	0.40 Max.	0.40	0.15 Max.	-	-	485	275	30
3	P4/1	SA 335 P 11	0.15 Max	0.30–0.60	0.025	0.025	0.50–1.00	-	1.00–1.50	0.44–0.65	-	-	380	205	30
4	P 4 / 1	SA 335 P 12	0.15 Max.	0.30-0.61	0.025 Max.	0.025 Max.	0.50 Max.	-	0.80-1.25	0.44-0.65	-	-	415	220	30
5	P 5A / 1	SA 335 P 22	0.15 Max.	0.30-0.60	0.025 Max.	0.025 Max.	0.50 Max.	-	1.90-2.60	0.87-1.13	-	-	415	205	30
6	P 15E /1	SA 335 P91	0.08-0.12	0.30-0.60	0.02 Max.	0.01 Max.	0.20-0.50	0.40 Max.	8.00-9.50	0.85-1.05	0.18-0.25	-	585	415	20
7	P15E/1	SA 335 P 92	0.13 Max	0.30-0.60	0.020	0.010	0.50 max	0.40 max	8.50-9.50	0.0-	0.15-0.25	1.5-2.0	620	400	20

TABLE-A2.2: TUBES(ASME)

Sl. No.	P. No. /Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W	T.S MPa	Y.S MPa	% E Min.
1	P 1 / 1	SA 192	0.06-0.18	0.27-0.63	0.035 Max.	0.035 Max.	0.25 Max.	-	-	-	-	-	325	180	35
2	P 1 / 1	SA 210 Gr A1 (Remarks: Carbon restricted to 0.25% Max.)	0.27 Max.	0.93 Max.	0.035 Max.	0.035 Max.	0.10 Max.	-	-	-	-	-	415	255	30
3	P 1 / 1	SA 179	0.06-0.18	0.27-0.63	0.035 Max.	0.035 Max.	-	-	-	-	-	-	325	180	35
4	P 1 / 2	SA 210 Gr C (Remarks: Carbon restricted to 0.30% Max.)	0.35 Max.	0.29-1.06	0.035 Max.	0.035 Max.	0.10 Max.	-	-	-	-	-	485	275	30
5	P 3 / 1	SA 209 T1	0.10-0.20	0.30-0.80	0.025 Max.	0.025 Max.	0.10-0.50	-	-	0.44-0.65	-	-	380	205	30
6	P 4 / 1	SA 213 T11	0.05-0.15	0.30-0.60	0.025 Max.	0.025 Max.	0.50-1.00	-	1.00-1.50	0.44-0.65	-	-	415	205	30
7	P 4 / 1	SA 213 T12	0.05-0.15	0.30-0.61	0.025 Max.	0.025 Max.	0.50 Max.	-	0.80-1.25	0.44-0.65	-	-	415	220	30
8	P 5 A / 1	SA 213 T22	0.05-0.15	0.30-0.60	0.025 Max.	0.025 Max.	0.50 Max.	-	1.90-2.60	0.87-1.13	-	-	415	205	30

TABLE-A2.2: TUBES(ASME) (Contd...)

Sl. No.	P. No. / Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W	T.S MPa	Y.S MPa	% E Min.
9	P 5 B / 1	SA 213 T5	0.15 Max.	0.30-0.60	0.025 Max.	0.025 Max.	0.50 Max.	-	4.00-6.00	0.45-0.65	-	-	415	205	30
10	P 5 B / 1	SA 213 T9	0.15 Max.	0.30-0.60	0.025 Max.	0.025 Max.	0.25-1.00	-	8.00-10.00	0.90-1.10	-	-	415	205	30
11	P 1 5 E / 1	SA 213 T91	0.07-0.14	0.30-0.60	0.02 Max.	0.01 Max.	0.20-0.50	0.40 Max.	8.00-9.50	0.85-1.05	0.18-0.25	-	585	415	20
12	P 8 / 1	SA 213 TP 304 H	0.04-0.10	2.00 Max.	0.045 Max.	0.03 Max.	1.00 Max.	8.00-11.00	18.00-20.00	-	-	-	515	205	35
13	P8/1	SA 213 TP 321H	0.04-0.10	2.00 Max.	0.045 Max.	0.03 Max.	1.00 Max.	9.00-12.00	17.00-19.00	-	-	-	515	205	35
15	P 8 / 2	SA 213 TP 347 H	0.04-0.10	2.00 Max.	0.045 Max.	0.03 Max.	1.00 Max.	9.00-13.00	17.00-19.00	-	-	-	515	205	35
15	Code case 2199	SA213 T23	0.04-0.10	0.10-0.60	0.030	0.010	0.050	--	1.90-2.60	0.05-0.30	0.20-0.30	1.45-1.75	510	400	20
16	15E/1 (Code case 2169)	SA213 T92	0.07-0.13	0.30-0.60	0.020	0.010	0.50	0.40	8.5-9.5	0.30-0.60	0.15-0.25	1.5-2.0	620	440	20
17	P8/1 (Code case 2328 - S30432)	SA 213 UNS S30432 (Super 304H)	0.07-0.13	1.00	0.040	0.010	0.30	7.5-10.5	17.0-19.0	-	-	-	590	235	35

TABLE A2.3: FORGINGS (ASME)

Sl. No.	P. No. / Group No.	Material Specification	Chemical Composition (%)										Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	W, Cb	T.S MPa	Y.S MPa	% E Min.
1	P 1 / 2	SA 105 (Remarks: Carbon restricted to 0.25% Max.)	0.35 Max.	0.60-1.05	0.035 Max.	0.04 Max.	0.1 - 0.35	0.40 Max.	0.30 Max.	0.12 Max.	0.08 Max	-	485	250	30
2	P 4 / 1	SA 182 F11 Class 3	0.10-0.20	0.30-0.80	0.04 Max.	0.04 Max.	0.50 - 1.00	-	1.00-1.50	0.44-0.65	-	-	515	310	20
3	P 4 / 1	SA 182 F 12 Class 2	0.10-0.20	0.30-0.80	0.04 Max.	0.04 Max.	0.10 - 0.60	-	0.80-1.25	0.44-0.65	-	-	485	275	20
4	P 5 A / 1	SA 182 F 22 Class 3	0.15 Max.	0.30-0.60	0.04 Max.	0.04 Max.	0.50 Max.	-	2.00-2.50	0.87-1.13	-	-	515	310	20
5	P 1 5 E / 1	SA 182 F91	0.08-0.12	0.30-0.60	0.02 Max.	0.01 Max.	0.20 - 0.50	0.40 Max.	8.00-9.50	0.85-1.05	0.18-0.25	-	620	415	20
6	P 1 5 E / 1	SA 182 F92	0.7-0.13	0.30-0.60	0.02 Max.	0.01 Max.	0.50 Max.	0.40 Max.	8.50-9.50	0.30-0.60	0.15-0.25	W:1.50-2.00; Cb: 0.04-0.09	620	440	20

TABLE A2.4: CASTINGS (ASME)

Sl. No.	P. No. /Group No.	Material Specification	Chemical Composition (%)								Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	MPa	MPa	% EMin.
1	P 1 / 2	SA 216 WCB (Remarks: Carbon restricted to 0.25% Max.)	0.30 Max.	1.00 Max.	0.04 Max.	0.045 Max.	0.60 Max.	0.50 Max.	0.50 Max.	0.20 Max.	485	250	22
2	P 1 / 2	SA 216 WCC	0.25 Max.	1.20 Max.	0.04 Max.	0.045 Max.	0.60 Max.	0.50 Max.	0.50 Max.	0.20 Max.	485	275	22
3	P 4 / 1	SA 217 WC6	0.20 Max.	0.50-0.80	0.04 Max.	0.045 Max.	0.60 Max.	-	1.00-1.50	0.45-0.65	485	275	20
4	P 5 A / 1	SA 217 WC 9	0.18 Max.	0.40-0.70	0.04 Max.	0.045 Max.	0.60 Max.	-	2.00-2.75	0.90-1.20	485	275	20
5	P 8 / 1	SA 351 CF 8	0.08 Max.	1.50 Max.	0.04 Max.	0.04 Max.	2.00 Max.	8.00-11.00	18.00-21.00	0.50 Max.	485	205	35
6	P 8 / 1	SA 351 CF 8M	0.08 Max.	1.50 Max.	0.04 Max.	0.04 Max.	1.50 Max.	9.00-12.00	18.00-21.00	2.00-3.00	485	205	30
7	P 8 / 1	SA 351 CF 8C	0.08 Max.	1.50 Max.	0.04 Max.	0.04 Max.	2.00 Max.	9.00-12.00	18.00-21.00	0.50 Max.	485	205	30
8	P 8 / 2	SA 351 CH 20	0.04-0.20	1.50 Max.	0.04 Max.	0.04 Max.	2.00 Max.	12.00-15.00	22.00-26.00	0.50 Max.	485	205	30
9	P15E / 1	SA 217 C12A	0.08-0.12	0.30-0.60	0.030 Max.	0.010 Max.	0.20-0.50	0.40 Max.	8.00-10.00	0.85-1.05	585	415	18

TABLE A2.5: PLATES/SHEETS

Sl. No.	P. No./ Group No.	Material Specification	Thickness mm	C	Mn	p	S	Si	Ni	Cr	Mo	V	T.S	Y.S	%E
			(MPa)										(MPa)	Min.	
1	P 1 / 1	ASTM A36	20 incl.	0.25	-	0.04	0.05	0.40	-	-	-	-	400	250	20
			20-40 incl.	0.25	0.80-1.20			0.40	-	-	-	-			
			40-65 incl.	0.26	0.80-1.20			0.40	-	-	-	-			
			65-100 incl.	0.27	0.85-1.20			0.15-0.40	-	-	-	-			
			over 100	0.29	0.85-1.20			0.15-0.40	-	-	-	-			
2	P 1 / 1	SA 516 Gr 60	12.5 incl	0.21	0.55-0.98	0.035	0.035	0.13-0.45	-	-	-	-	415	220	25
			12.5-50 incl	0.23	0.79-1.30				-	-	-	-			
			50-100 incl	0.25					-	-	-	-			
			100-200 incl	0.27					-	-	-	-			
			over 200	0.27					-	-	-	-			
3	P 1 / 2	SA516 Gr70	12.5 incl	0.27	0.79-1.30	0.035	0.035	0.13-0.45	-	-	-	-	485	260	21
			12.5-50 incl	0.28					-	-	-	-			
			50-100 incl	0.3					-	-	-	-			
			100-200 incl	0.31					-	-	-	-			
			over 200	0.31					-	-	-	-			
4	P 1 / 2	SA299 Gr.A	<25	0.26	0.84-1.52	0.035	0.035	0.13-0.45	-	-	-	-	515	275	19
			>25	0.28	0.84-1.62				-	-	-	-			
5	P 1 / 2	SA515 Gr70	<25	0.31	1.30	0.035	0.035	0.13-0.45	-	-	-	-	485	260	21
			25-50 incl	0.33					-	-	-	-			
			50-100 incl	0.35					-	-	-	-			
			100-200 incl	0.35					-	-	-	-			
			>200	0.35					-	-	-	-			
6	P311	SA204 Gr A	<25 incl	0.18	0.98	0.025	0.025	0.13-0.45	-	-	0.41-0.64	-	450	255	23
			>50 incl	0.21					-	-		-			
			>100 incl	0.23					-	-		-			
			>100	0.25					-	-		-			
7	P312	SA204 Gr B	<25 incl	0.20	0.98	0.025	0.025	0.13-0.45	-	-	0.41-0.64	-	485	275	21
			>50 incl	0.23					-	-		-			
			>100 incl	0.25					-	-		-			
			>100	0.27					-	-		-			
8	P411	SA 387 Gr 12 Class 2	<125 incl	0.04-0.17	0.35-0.73	0.025	0.025	0.13-0.45	-	0.74-1.21	0.40-0.65	-	450	275	22
			>125	0.17											
9	P5N1	SA387 Gr 22 Class 2	<125 incl	0.04-0.15.	0.25-0.66	0.025	0.025	0.50.		1.88-2.62	0.85-1.15	-	515	310	18
			>125	0.17											
10	P15EI1	SA387 Gr 91	all thickness	0.06-0.15	0.25-0.66	0.025	0.012	0.18-0.56	0.43	7.90-9.60	0.80-1.10	0.16-0.27	585	415	18

TABLE A2.5: PLATES/SHEETS (Contd...)

Sl. No.	P.No./ Group No.	Material Specification	Thickness mm	C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S	Y.S	%E
	(MPa)	(MPa)	Min.												
11	P811	SA240 TYPE 304	all thickness	0.07	2	0.045	0.03	0.75	8.00-10.50	17.5.-19.5.0	-	-	515	205	40
12	P 1 / 1	ASTM A572 Gr50	<40 incl	0.23	1.35	0.04	0.05	0.40	-	-	-	-	450	345	17
			>40					0.15-0.40	-	-	-0.01-0.1				
13	P 1 / 1	IS 2062 E250 Gr.A	all thickness	0.23	1.5	0.045	0.045	0.4	-	-	-	-	410	230	23
14	P 1 / 1	IS 2062 E250 Gr.BR BO	all thickness	0.22	1.5	0.045	0.045	0.4	-	-	-	-	410	230	23
15	P 1 / 1	IS 2062 E250 GrC	all thickness	0.2	1.5	0.04	0.04	0.4	-	-	-	-	410	230	23
16	P 1 / 1	IS 2062 E350 Gr A.BR,BO	all thickness	0.2	1.55	0.045	0.045	0.45	-	-	-	-	490	320	22
17	P 1 / 1	IS 2062 E350 GrC	all thickness	0.2	1.55	0.04	0.04	0.45	-	-	-	-	490	320	22
18	P 1 / 1	IS 2062 E450BR	all thickness	0.22	1.65	0.045	0.045	0.45	-	-	-	-	570	450	20
19	P 1 / 1	BSEN10025 Gr 420N	all thickness	0.2	1.0-1.7	0.03	0.025	0.6	0.8	0.3	0.1	0.2	500	320	18

TABLE A2.6: PIPES (OTHER SPECIFICATION)

Sl. No.	Equivalent P. No. /Group No.	Material Specification	Chemical Composition (%)									Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S Kg / mm ²	Y.S Kg / mm ²	% EMin.
1	P1/1	DIN St. 35.8	0.17 Max.	0.40-0.80	0.04 Max.	0.04 Max.	0.10-0.35	-	-	-	-	36.70-48.96	24	25
2	P1/1	DIN St. 45.8	0.21 Max.	0.45-1.20	0.04 Max.	0.04 Max.	0.10-0.35	-	-	-	-	41.80-54.10	26	21
3	P1/1	BS 3602 / 410	0.21 Max.	0.40-1.20	0.045 Max.	0.045 Max.	0.35 Max.	-	-	-	-	41.82-56.10	25	22
4	P1/1	BS 3602 / 460	0.22 Max.	0.80-1.40	0.045 Max.	0.045 Max.	0.35 Max.	-	-	-	-	46.90-61.20	28.60	21
5	P4/1	BS 3604 620-460 HFS	0.10-0.15	0.40 Max.	0.04 Max.	0.04 Max.	0.10-0.35	-	0.70-1.10	0.45-0.65	-	46.90- 62.22	18.36	22
		or CDS 620-440	0.10-0.18	0.40-0.70	0.04 Max.	0.04 Max.	0.10-0.35	-	0.70-1.10	0.45-0.65	-	44.90- 60.20	29.58	22
6	P5/1	BS 3604 622 HFS or CDS	0.08-0.15	0.40-0.70	0.04 Max.	0.04 Max.	0.50 Max.	-	2.00-2.50	0.90-1.20	-	48.80	26.80	17
7	-	BS 3604 HFS 660 Or CDS 660	0.15 Max.	0.40-0.70	0.04 Max.	0.04 Max.	0.10-0.35	-	0.25-0.50	0.50-0.70	0.22-0.30	47.30	30	17
8	P5B/2	X20CrMoV121D IN17175	0.17-0.23	≤ 1.00	0.030 Max.	0.030 Max.	≥ 0.50	0.30-0.80	10.00-12.50	0.80-1.20	0.25-0.35	70-86	50	17

TABLE A2.7: TUBES (OTHER SPECIFICATIONS)

Sl. No.	Equivalent P. No. /Group No.	Material Specification	Chemical Composition (%)									Mechanical Properties (Min.)		
			C	Mn	P	S	Si	Ni	Cr	Mo	V	T.S Kg / mm ² (MPa)	Y.S Kg / mm ² (MPa)	% E Min.
1	P1/1	DIN St. 35.8	0.17 Max.	0.40- 0.80	0.04 Max.	0.04 Max.	0.10- 0.35	-	-	-	-	36.70- 48.96	24	25
2	P1/1	DIN St. 45.8	0.21 Max.	0.40- 1.20	0.04 Max.	0.04 Max.	0.10- 0.35	-	-	-	-	41.80- 54.06	26	21
3	P1/1	BS 3059 / 360	0.17 Max.	0.40- 0.80	0.045 Max.	0.045 Max.	0.35 Max.	-	-	-	-	36.70- 51.00	22	24
4	P1/1	BS 3059 / 440	0.12- 0.18	0.90- 1.20	0.040 Max.	0.035 Max.	0.10- 0.35	-	-	-	-	44.88- 59.20	25	21
5	P3/1	15 Mo3 DIN17175	0.12- 0.20	0.40- 0.80	0.035 Max.	0.035 Max.	0.10- 0.35	-	-	0.25- 0.35	-	45.90- 61.20	27.50	22
6	P4/1	13 Cr Mo 4- 5DIN17175	0.10- 0.18	0.40- 0.70	0.035 Max.	0.035 Max.	0.10- 0.35	-	0.70- 1.10	0.45- 0.65	-	44.88- 60.18	29.60	22
7	P4 /1	BS 3059 / 620	0.10- 0.15	0.40- 0.70	0.040 Max.	0.040 Max.	0.10- 0.35	-	0.70- 1.10	0.45- 0.65	-	46.90- 62.20	18.40	22
8	P5/1	10 Cr Mo 9- 10DIN17175	0.08- 0.15	0.40- 0.70	0.035 Max.	0.035 Max.	0.50 Max.	-	2.00- 2.50	0.90- 1.20	-	45.90- 61.20	28.60	20
9	P5/1	BS 3059 (622) - 440	0.08- 0.15	0.40- 0.70	0.04 Max.	0.04 Max.	0.50 Max.	-	2.00- 2.50	0.90- 1.20	-	44.90- 60.18	17.85	20
10	P5/1	BS 3059 (622) - 490	0.08- 0.15	0.40- 0.70	0.040 Max.	0.040 Max.	0.50 Max.	-	2.00- 2.50	0.90- 1.20	-	49.98- 65.00	28.05	20
11	-	14 Mo V 63 DIN17175	0.10- 0.18	0.40- 0.70	0.035 Max.	0.035 Max.	0.10- 0.35		0.30- 0.60	0.50- 0.70	0.22- 0.32	46.90- 62.22	32.60	20
12	P5B/2	X20CrMoV121 DIN17175	0.17- 0.23	≤ 1.00	0.030 Max.	0.030 Max.	≥ 0.50	0.30- 0.80	10.00- 12.50	0.80- 1.20	0.25- 0.35	70-86	50	17

**CHAPTER A3: WELDING
MATERIAL SPECIFICATION AND
CONTROL**

SECTION A3.1-WELDING MATERIAL SPECIFICATION AND CONTROL

1.0 SCOPE:

1.1. This chapter details out the welding material specification and controls at sites.

2.0 CONTENTS:

1. Table- A3.1 - Weld Metal Chemical Composition.
2. Table - A3.2 - Mechanical property requirement for all-weld metal.
3. Receipt inspection of welding electrodes/filler wires.
4. Storage and identification of welding electrodes/filler wires.
5. Drying and holding of welding electrodes.
6. Selection and issue of welding electrodes/filler wires.
7. Table-A3.3 - Selection of GTAW filler wire, SMAW electrodes for butt welds in tubes, pipes, headers.
8. Table-A3.4 - Selection of electrodes for welding attachments to tubes.
9. Table-A3.5 - Selection of electrodes, preheat, PWHT for attachment to attachment welds.
10. Table-A3.6 -Selection of electrodes for welding nozzle attachments, hand hole plate, RG plug etc. to headers, pipes.
11. Table-A3.7 –Selection of filler wire and electrodes for non-pressure parts(including structures)
12. Table-A3.8 -A numbers
13. Table-A3.9 -F numbers
14. SFA Classification

3.0 For welding consumables not covered in this chapter, relevant details may be obtained from the concerned Manufacturing Units.

Table-A3.1
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements % ^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
E 6010	5.1	0.20	1.20	1.00	NS	NS	0.30	0.20	0.30	0.08	NS	Combined Limit for Mn+Ni+Cu+Mo+V=1.75
E 6013	5.1	0.20	1.20	1.00	NS	NS	0.30	0.20	0.30	0.08	NS	
E 7018	5.1	0.15	1.60	0.75	0.035	0.035	0.30	0.20	0.30	0.08	NS	
E 7018-1	5.1	0.15	1.60	0.75	0.035	0.035	0.30	0.20	0.30	0.08	NS	
E 7018-A1	5.5	0.12	0.90	0.80	0.03	0.03	NS	NS	0.40- 0.65	NS	NS	
E 8018-B2	5.5	0.05- 0.12	0.90	0.80	0.03	0.03	NS	1.00- 1.50	0.40- 0.65	NS	NS	
E 9018-B3	5.5	0.05- 0.12	0.90	0.80	0.03	0.03	NS	2.00- 2.50	0.90- 1.20	NS	NS	
E 9015-B91	5.5	0.08- 0.13	1.20	0.30	0.01	0.01	0.80	8.00- 10.50	0.85- 1.20	0.15- 0.30	0.04 - 0.25	W: 1.50-2.00; Nb: 0.02-0.08 B:0.006; Al: 0.04; N: 0.03- 0.08
E9015-B92	5.5	0.08- 0.15	1.20	0.60	0.020	0.015	1.0	8.0-10.0	0.30- 0.70	0.15- 0.30	0.25	
E9018-B23/ E9015-B23	5.5	0.04- 0.12	1.00	0.60	0.015	0.015	0.5	1.9-2.9	0.30	0.15- 0.30	0.25	W: 1.50-2.00; Nb: 0.02-0.10 B:0.006; Al: 0.04; N: 0.05
E 308	5.4	0.08	0.50- 2.50	1.00	0.04	0.03	9.00- 11.00	18.00- 21.00	0.75	NS	0.75	
E 308-L	5.4	0.04	0.50- 2.50	1.00	0.04	0.03	9.00- 11.00	18.00- 21.00	0.75	NS	0.75	

Table-A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements % ^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
E 309	5.4	0.15	0.50- 2.50	1.00	0.04	0.03	12.00- 14.00	22.00- 25.00	0.75	NS	0.75	
E 309-L	5.4	0.04	0.50- 2.50	1.00	0.04	0.03	12.00- 14.00	22.00- 25.00	0.75	NS	0.75	
E 347	5.4	0.08	0.50- 2.50	1.00	0.04	0.03	9.00- 11.00	18.00- 21.00	0.75	NS	0.75	Cb+Ta 8XC Min. to 1.00 Max.
E316	5.4	0.08	0.5-2.5	1.00	0.04	0.03	11.0- 14.0	17.0- 20.0	2.0-3.0	NS	0.75	
E2209-16	5.4	0.04	0.5-2.0	1.00	0.04	0.03	7.5-9.5	21.5- 23.5	2.5-3.5	NS	0.75	N:0.08-0.20
ENiCrFe-3	5.11	0.10	5.0-9.5	1.00	0.03	0.015	59.0 min	13.0- 17.0	NS	NS	0.50	Fe: 12.0; Ta+ Cb: 1.0- 2.5; Ti: 1.0; others: 0.5
ENiCrFe-7	5.11	0.05	5.0	0.75	0.03	0.015	Rem	28.0- 31.5	0.5	NS	0.50	Fe: 7.0-12.0; Ta+ Cb: 1.0-2.5; others: 0.5
ENi-CI	5.15	2.00	2.50	4.00	NS	0.03	85 ^d min	NS	NS	NS	2.5 ^e	Fe Al others 8.0 1.0 Total 1.0
ENiFe-CI	5.15	2.00	2.50	4.00	NS	0.03	45 ^d -60	NS	NS	NS	2.5 ^e	Fe Al others Rem ^f 1.0 Total 1.0
ER70S-2	5.18	0.07	0.90- 1.40	0.40- 0.70	0.025	0.035	0.15	0.15	0.15	0.03	0.50 ^b	Ti Zr Al 0.05- 0.02- 0.05- 0.15 0.12 0.15
ER70S-A1	5.28	0.12	1.30	0.30- 0.70	0.025	0.025	0.20	NS	0.40- 0.65	NS	0.35	Others : 0.50
E8018-G	5.5	0.08	1.0-1.8	0.5	0.025	0.025	0.5-1.20	NS	0.5	NS	NS	

Table-A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements % ^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
ER80S-B2	5.28	0.07- 0.12	0.40- 0.70	0.40- 0.70	0.025	0.025	0.20	1.20- 1.50	0.40- 0.65	NS	0.35 ^c	Total other Elements 0.50
ER90S-B3	5.28	0.07- 0.12	0.40- 0.70	0.40- 0.70	0.025	0.025	0.20	2.30- 2.70	0.90- 1.20	NS	0.35 ^c	Total other Elements 0.50
ER80S-D2	5.28	0.07- 0.12	1.60- 2.10	0.50- 0.80	0.025	0.025	0.15	NS	0.40- 0.60	NS	0.50 ^c	Total other Elements 0.50
ER90S-B9	5.28	0.07- 0.13	1.20	0.15- 0.30	0.01	0.01	0.80	8.00- 10.50	0.80- 1.20	0.15- 0.23	0.20	Total other Elements 0.50
ER 308	5.9	0.08	1.00- 2.50	0.30- 0.65	0.03	0.03	9.00- 11.00	19.50- 22.00	0.75	NS	0.75	
ER 309	5.9	0.12	1.00- 2.50	0.30- 0.65	0.03	0.03	12.00- 14.00	23.00- 25.00	0.75	NS	0.75	
ER 309-L	5.9	0.03	1.00- 2.50	0.30- 0.65	0.03	0.03	12.00- 14.00	23.00- 25.00	0.75	NS	0.75	
ER316L	5.9	0.03	1.0-2.5	0.30- 0.65	0.03	0.03	11.0- 14.0	18.0- 20.0	2.0-3.0	NS	0.75	---
ER 347	5.9	0.08	1.00- 2.50	0.30- 0.65	0.03	0.03	9.00- 11.00	19.00- 21.50	0.75	NS	0.75	Cb+Ta 10XC Min. to 1.0 Max.
ER2209	5.9	0.03	0.5-2.0	0.90	0.03	0.03	7.5-9.5	21.5- 23.5	2.5-3.5	NS	0.75	N:0.08-0.20

Table-A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

Electrode/ Consumable	SFA No.	Weight, %										Other Elements %^a
		C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu	
ERNiCr-3	5.14	0.10	2.5-3.5	0.50	0.03	0.015	67.0 min	18.0-22.0	NS	NS	0.50	Fe: 3.0; Cb+Ta: 2.0-3.0; Ti: 0.75; Other: 0.5
ERNiCrFe-7A	5.14	0.04	1.0	0.50	0.02	0.015	Rem.	28.0-31.5	0.50		0.30	Fe: 7.0-11.0; Cb+Ta: 0.5-1.0; Ti: 1.0; Other: 0.5; Co: 0.12; Al: 1.10
YT 304H	--	Proprietary GTAW rod for Super 304H										
THERMANIT 304H Cu	--											
TGS2CW	--											
YT-HCM2S		Proprietary GTAW rod for T23										
2CrWV-TIG	--											
9CRWV TIG	--											
THERMANIT MTS 616	--	Proprietary GTAW rod for Gr.92										

TABLE – A3.1 (Contd...)
WELD METAL CHEMICAL COMPOSITION

Notes:

- a) Other elements listed without specified values shall be reported, if intentionally added. The total of these latter unspecified elements and all other elements not intentionally added shall not exceed 0.50%.
- b) The maximum weight percent of copper in the rod or electrode due to any coating plus the residual copper content in the steel shall be 0.50.
- c) The maximum weight percent of copper in the rod or electrode due to any coating plus the residual copper content in the steel shall comply with the stated value.
- d) Nickel plus incident Cobalt.
- e) Copper plus incident Silver.
- f) "Rem" stands for remainder.
- g) Manufacturer's certification to have met the requirements of ASME Sec. II Part C is acceptable in cases where the chemical analysis are not reflected.
- h) Single values are maximum.
- i) NS – Not Specified

TABLE-A3.2
MECHANICAL PROPERTY REQUIREMENT FOR ALL-WELD METAL

Electrode	SFA No.	Tensile Strength Ksi / MPa	Yield Strength at 0.2% of Proof Stress, Ksi/ MPa	Elongation In 2 inch (50.8 mm) %
E6010	5.1	60 / 430	48 / 330	22
E6013	5.1	60 / 430	48 / 330	17
E7018	5.1	70 / 490	58 / 400	22
E7018-1 ^a	5.1	540	58 / 400	22
E7018-A1	5.5	70 / 490	57 / 390	22
E8018-G ^b	5.5	570	450	19
E8018-B2	5.5	80 / 550	67 / 460	19
E9018-B3	5.5	90 / 620	77 / 530	17
E9015-B91	5.5	90 / 620	77 / 530	17
E9015-B92	5.5	90/620	77/530	17
E9018-B23	5.5	90/620	77/530	17
E308	5.4	80 / 550	-	35
E308L	5.4	75 / 520	-	35
E309	5.4	80 / 550	-	30
E309L	5.4	75 / 520	-	30
E347	5.4	75 / 520	-	30
E316	5.4	75/520	--	30
E2209	5.4	100/690	--	22
ENiCrFe-3	5.11	80/550	--	30
ENiCrFe-7	5.11	80/550	--	30
ENi-CI	5.15	40-65 / 276-448	38-60 / 268-414	3-6
ENiFe-CI	5.15	58-84 / 400 -579	43-63 / 294 -434	6-18

- a. These electrodes shall meet the lower temperature impact requirement of average minimum. (27 Joules at – 45° C) and other properties at 620±20°C for 300 minutes.
- b. These electrodes shall meet the impact requirement of average minimum (20 Joules at + 25° C) and other properties at 550±10°C for 60 minutes.

Table- A3.2 (Contd...)

MECHANICAL PROPERTY REQUIREMENT FOR ALL-WELD METAL

Electrode	SFA No.	Tensile Strength Ksi / MPa	Yield Strength at 0.2% of Proof Stress, Ksi / MPa	Elongation In 2 inch (50.8 mm) %
ER70S-6	5.18	70/480	58/400	22
ER70S-A1	5.28	75/515	58/400	19
ER80S-B2	5.28	80 / 550	68 / 470	19
ER90S-B3	5.28	90 / 620	78 / 540	17
ER80S-D2	5.28	80 / 550	68 / 470	17
ER90S-B9	5.28	90 / 620	60 / 410	16
ER308	5.9	These values are not required in the test certificate		
ER308L	5.9			
ER309	5.9			
ER309L	5.9			
ER347	5.9			
ER316	5.9			
ER2209-16	5.9			
ERNiCr-3	5.14	80/550	--	
ERNiCrFe-7A	5.14	85/590	--	

NOTE:

- a) Single values are minimum.
- b) Manufacturer's certification to have met the requirements of ASME-Section II Part C is acceptable in cases where the mechanical properties are not reflected.
- c) 1Ksi is approximately equal to 6.89 MPa.

Section A3.2- Receipt Inspection of Welding Electrodes / Filler Wires

- 1.0 All electrodes/filler wires received at site stores shall be segregated for type and size of electrode.
- 2.0 Ensure that electrode packets received are free from physical damage.
- 3.0 Where electrodes are damaged, the same shall be removed from use.
- 4.0 Only electrodes identified in the "list of approved vendors of welding electrodes" shall be accepted.
- 5.0 Where filler metals are supplied by manufacturing unit, inspect for damages, if any.
- 6.0 Ensure availability of relevant test certificates. Refer tables of chemical compositions and mechanical properties for acceptance.
- 7.0 Endorse acceptance/rejection on the test certificate.

Section A3.3- Storage & Identification of Welding Electrodes/Filler Wires

1.0 SCOPE:

1.1 This procedure is applicable for storage of welding electrodes/filler wires used at sites.

2.0 PROCEDURE:

2.1 Only materials accepted (based on receipt inspection) shall be taken into account for storage.

2.2 STORAGE FACILITY:

2.2.1 The storage facility shall be identified.

2.2.2 Access shall be made available to authorized personnel.

2.2.3 The storage area shall be clean and dry.

2.2.4 Steel racks may be used for storage. Avoid usage of wooden racks for storing inside the storage room.

2.2.5 Maintain the temperature of the storage facility above the ambient temperature. This can be achieved by the use of appropriate heating arrangements.

2.3 The electrodes/filler wire shall be segregated and identified for

a. Type of electrode e.g. E7018.

b. Size of electrode e.g. Dia. 3.15 mm.

2.4 Identification of filler wires:

2.4.1 On receipt of GTAW filler wires, check AWS No. or brand name embossed and retain the same identification throughout.

Section A3.4-Drying and Holding of Welding Electrodes

1.0 SCOPE:

- 1.1 This section details activities regarding drying and holding of welding electrodes used at sites.

2.0 PROCEDURE:

- 2.1 While handling, avoid contact of oil, grease with electrodes. Do not use oily or wet gloves.
- 2.2 It is recommended that not more than two days' requirements electrodes are dried.

3.0 GTAW Filler Wires:

- 3.1 These wires do not require any drying.

4.0 Covered Electrodes:

4.1 Drying and holding :

- 4.1.1 Identify drying oven and holding oven.
- 4.1.2 They shall preferably have a temperature control facility upto 400°C for drying oven and 200°C for holding oven.
- 4.1.3 A calibrated thermometer shall be provided for monitoring temperature.
- 4.2 On opening a packet of electrodes, segregate and place them in the drying oven. Mix-up of electrodes shall be avoided.
- 4.2.1 After loading, raise the drying oven temperature to the desired range as per table in 4.2.5.
- 4.2.2 Note the time when the temperature reaches the desired range. Maintain this temperature for the duration required as per Table in 4.2.5.
- 4.2.3 On completion of drying, the electrodes shall be transferred to holding oven immediately and maintained at minimum temperature of 150°C till issue.
- 4.2.4 The electrode shall not be subjected to more than three cycles of drying.
- 4.2.5 Maintain a register containing following details:

Sl. No.	Date	AWS number/Specification	Batch No./Size	Dia.	Qty.	Drying temperature Start time	Drying Temperature end time	Remarks

Drying and Holding Parameters

AWS Classification	Drying (*)		Minimum Holding Temperature °C (@)
	Temperature °C	Time (Hours)	
E7018	250 - 300	2	150
E7018-1	250 - 300	2	150
E7018-A1	250 - 300	2	150
E8018-G	250 - 300	2	150
E8018-B2	250 - 300	2	150
E9018-B3	250 - 300	2	150
E9018-B23	250 - 300	2	150
E9015-B91	250 - 300	2	150
E9015-B92	250 - 300	2	150
E308, E309, E310 E316& E347	250 - 300	1	150
ENiCrFe-3	250 - 300	2	150
ENiCrFe-7	250 - 300	2	150

Note: (*) - Guideline has been given however, supplier's recommendations shall be followed.

(@) - Maintain the temperature in the oven till issue.

4.2.4 After issue, maintain the electrodes in a portable oven at a minimum temperature of 65°C till use. This is not applicable for E6013 (Rutile) electrodes, however the following instruction shall be followed for E6013 electrodes:

- (1) Rutile electrodes require some moisture in the coating and they would not require drying. If they become damp, re-drying at around 120 to 150°C for 1 hour will be sufficient.
- (2) These electrodes with potassium silicate binder can be used on both DCEP/DCEN polarities and on AC. E6013 electrodes generally have better arc striking and stability characteristics with an easily detachable slag.

4.3 Unused, returned electrodes shall be segregated and reused only after repeating drying and holding cycles.

Section A3.5- Selection and Issue of Welding Electrodes / Filler Wires

1.0 SCOPE:

- 1.1. This procedure details methods for selection and issue of welding electrodes/filler wires for site operations.

2.0 PROCEDURE:

2.1 Selection:

- 2.1.1 The type of filler wire/electrode for welding shall be based on the details given in the contract documents like Field Welding Schedule, drawings, Welding Procedure Specifications as supplied by the concerned manufacturing units.
- 2.1.2 Where not specified by the manufacturing units, selection shall be based on the tables enclosed (Table A3.3 to Table A3.7. as applicable).
- 2.1.3 Where electrodes/ filler wires are not covered in the documents mentioned in 2.1.1 and 2.1.2, refer to the concerned manufacturing units.

2.2 Issue:

- 2.2.1 Issue of welding electrodes / filler wires shall be based on authorised welding electrodes issue voucher.
- 2.2.2 It is recommended to restrict quantity issued to not more than 4 hours' requirements.
- 2.2.3 Re-dried low hydrogen electrodes shall be carried to the work spot in a portable oven.
- 2.2.4 Maintain the temperature in the portable oven at the work spot above 65°C.
- 2.2.5 Unused electrodes shall be segregated and reused only after repeating drying and holding cycles.

Table- A3.3
SELECTION OF GTAW FILLER WIRE, SMAW ELECTRODE FOR
BUTT WELDS IN TUBES, PIPES AND HEADERS

Material	Welding Process	P1 Gr 1/ P1 Gr 2	P3 Gr 1	P4 Gr 1	P5A Gr 1	P15 E Gr 1	T23	T92/P92	P8	P8 SA 213 UNS S 30432	DIN14MoV6 3 or equivalent
P1 Gr 1	GTAW	ER 70S-A1									
P1 Gr 2	SMAW	E7018-1 Note 1									
P3 Gr 1	GTAW	ER 70S-A1	ER 70S-A1								
	SMAW	E7018-1	E7018-A1								
P4 Gr 1	GTAW	ER 70S-A1	ER 70S-A1	ER 80S-B2							
	SMAW	E7018-1	E7018-A1	E8018-B2							
P5A Gr 1	GTAW	ER 70S-A1	ER 70S-A1	ER 80S-B2	ER 90S-B3	ER 90S-B3	ER90S-B3				
	SMAW	E7018-1	E7018-A1	E8018-B2	E9018-B3	E9018-B3	E9018-B3				
P15 E Gr.1 Gr.91	GTAW					ER90S-B9	TGS2CW/ 2CrWVTIG/ YT-SCM2S	ER90S-B9			
	SMAW					E9015-91	E9018-B23	E9015-B91			
T23	GTAW						TGS2CW/ 2CrWVTIG/YT- SCM2S	TGS2CW/ 2CrWVTIG/ YT-SCM2S			
	SMAW						E9018-B23	E9018-B23			

Table- A3.3 (Contd...)

Material	Welding Process	P1 Gr 1 P1 Gr 2	P3 Gr 1	P4 Gr 1	P5A Gr 1	P15 E Gr 1	T23	T92/P92	P8	P8 SA 213 UNS S 30432	DIN14MoV63 or equivalent
P15 E Gr.1 Gr.92	GTAW							9CrWV-TIG/ Themanit- MTS616			
	SMAW							E9015-B92			
P8	GTAW			ERNi Cr3	ERNiCr3	ERNiCr3	ERNiCr3	ERNiCrFe7A	ER347		
	SMAW			ENiC rFe3	ENiCrFe3	ENiCrFe3	ENiCrFe3	ENiCrFe7	E347		
P8 SA 213 UNS S30432	GTAW									YT304H/ THERMANIT 304H Cu	
DIN14MoV63 or equivalent	GTAW				ER 90S- B3						ER90S-B3
	SMAW				E9018-B3						E9018-B3

Note-1: E7018-A1 for P1 Gr2 + P1 Gr2 when PWHT is involved.

Table- A3.4
SELECTION OF ELECTRODES FOR WELDING ATTACHMENTS TO TUBES

Tube Material	Attachment Material			
	P1 Group 1	P4 Group 1	P5A Group 1	P8
P1 Group 1 P1 Group 2	E 7018	E 7018	E 7018	E 309
P3	E 7018-A1	E 7018-A1	E 7018-A1	E 309
P4 Group 1	E 8018-B2	E 8018-B2	E 8018-B2	E 309
P5A Group 1	E 9018-B3	E 9018-B3	E 9018-B3	E 309
P8 including SA 213 UNS S30432		E 309	E 309	E 347
P15E Gr.1 (Gr. 91/92)			E9018-B3	ENiCrFe-3
SA213T23			E9018-B3	ENiCrFe-3

Table- A3.5
SELECTION OF ELECTRODES, PREHEAT, PWHT
FOR ATTACHMENT TO ATTACHMENT WELDS
(Seal Bands, High Crown Bars, End Bars, End Bar Lifting Lugs and Collector Plates etc.)

Material (Note 2)	Welding Requirements	P1	P3	P4	P5 A	P8 Group 1	P8 Group 2	P 15E / 1
P1	Electrode Preheat PWHT	E7018 Nil Nil	-	E 7018 150°C 650 – 670°C	-	-	-	-
P3	Electrode Preheat PWHT	E7018 150°C (Note 1) For Thickness>16mm: 620-650°C	E7018-A1 150°C For Thickness>16mm: 620- 650°C	-	-	-	-	-
P4	Electrode Preheat PWHT	E7018 150°C (Note 1) For Thickness>13mm: 650-670°C	E7018-A1 150°C For Thickness>13mm: 650- 670°	E8018-B2 150°C (Note 1) For Thickness>13mm: 650-670°C	-	-	-	-
P5 A	Electrode Preheat PWHT	-	-	E8018-B2 150°C (Note 1) For Thickness>13: 680- 710°C	E9018-B3 150°C (Note 1) For Thickness>13:680- 710°C	-	-	-
P8	Electrode Preheat PWHT	E309 Nil Nil	-	E309 Nil Nil	E309 Nil Nil	E347 Nil Nil	E309 Nil Nil	-
P 15E/ 1	Electrode Preheat PWHT	-	-	-	E9018-B3 220°C 730-760 °C	ENi Cr Fe3 220°C (only on P15E side) 730-760 °C	ENi Cr Fe3 220°C (only on P15E side) 730-760 °C	E9015-B91 220°C 740-770 °C

Note – 1 : Preheat is not required for P3/P4 up to 16 mm & for P5 A up to 13 mm, if PWHT is carried out.

Note - 2: For load carrying members, PWHT is required irrespective of thickness.

Table- A3.6
SELECTION OF ELECTRODES FOR WELDING NOZZLE ATTACHMENTS, HAND HOLE PLATE,
RG PLUG ETC. TO HEADERS, PIPES

Header, Pipe Material	Attachment Material					
	P1	P3	P4	P5 A	P15 E/1	P8
P1	E7018-1	E7018-1	E7018-1	-	-	ENiCrFe3
P4	E7018-1	E7018-A1	E8018-B2	E8018-B2	-	-
P5 A	-	-	E8018-B2	E9018-B3	E9018-B3	ENiCrFe3
P15 E/1	-	-	-	E9018-B3	E9015-B91	ENiCrFe3
DIN 14MoV63 or equivalent	-	-	-	E9018-B3	-	ENiCrFe3

Table – A3.7
SELECTION OF ELECTRODES FOR NON-PRESSURE PARTS
(INCLUDING STRUCTURES) (NOTE 1)

Material	SMAW Electrodes	SAW Wires	CO ₂ Wires
P1 + P1 (IS2062 E250)	For butt welds ≤ 6 mm: E 6013 (only for Ducts) > 6 mm: E 7018 For fillets ≤8 mm : E 6013 >8 mm: E 7018	EL 8 EM 12 K EL 8 EM 12 K	E 71 T - 1
Corten Steel + P1	E 6013 or E 7018	EM 12 K	
Corten Steel + Corten Steel	E 8018 – B2	EB 2	E 81 T 1 – B2
IS2062 E350+E350/ E250	E7018-1	EM 12 K	NA
IS2062 E450+E450	E8018-G	EG	NA
SA 204 Gr.A	E7018-A1	NA	NA

Note 1: E 6013 Electrodes can be used for all non-load carrying welds of all thickness of IS 2062 plates up to 20 mm thickness and 8 mm fillets

TABLE- A3.8
A NUMBERS
CLASSIFICATION OF FERROUS WELD METAL ANALYSIS FOR
PROCEDURE QUALIFICATION

A. No.	Types of Weld Deposit	Analysis, % (Note 1)					
		C	Cr	Mo	Ni	Mn	Si
1	Mild steel	0.20	–	–	–	1.60	1.00
2	Carbon-Molybdenum	0.15	0.50	0.40-0.65	–	1.60	1.00
3	Chrome (0.4% to 2%)-Molybdenum	0.15	0.40-2.00	0.40-0.65	–	1.60	1.00
4	Chrome (2% to 6%)-Molybdenum	0.15	2.00-6.00	0.40-1.50	–	1.60	2.00
5	Chrome (6% to 10.5%)-Molybdenum	0.15	6.00-10.50	0.40-1.50	–	1.20	2.00
6	Chrome-Martensitic	0.15	11.00-15.00	0.70	–	2.00	1.00
7	Chrome-Ferritic	0.15	11.00-30.00	1.00	–	1.00	3.00
8	Chromium-Nickel	0.15	14.50-30.00	4.00	7.50-15.00	2.50	1.00
9	Chromium-Nickel	0.30	19.00-30.00	6.00	15.00-37.00	2.50	1.00
10	Nickel to 4%	0.15	–	0.55	0.80-4.00	1.70	1.00
11	Manganese-Molybdenum	0.17	–	0.25-0.75	0.85	1.25-2.25	1.00
12	Nickel-Chrome-Molybdenum	0.15	1.50	0.25-0.80	1.25-2.80	0.75-2.25	1.00

Note 1: Single values shown above are maximum.

Table A3.9
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR
QUALIFICATION

	ASME Specification No.	AWS Classification No.
1	SFA-5.1	EXX20
1	SFA-5.1	EXX22
1	SFA-5.1	EXX24
1	SFA-5.1	EXX27
1	SFA-5.1	EXX28
1	SFA-5.4	EXXX(X)-26
1	SFA-5.5	EXX20-X
1	SFA-5.5	EXX27-X
2	SFA-5.1	EXX12
2	SFA-5.1	EXX13
2	SFA-5.1	EXX14
2	SFA-5.1	EXX19
2	SFA-5.5	E(X)XX13-X
3	SFA-5.1	EXX10
3	SFA-5.1	EXX11
3	SFA-5.5	E(X)XX10-X
3	SFA-5.5	E(X)XX11-X
4	SFA-5.1	EXX15
4	SFA-5.1	EXX16
4	SFA-5.1	EXX18
4	SFA-5.1	EXX18M
4	SFA-5.1	EXX48
4	SFA-5.4 other than austenitic and duplex	EXXX(X)-15
4	SFA-5.4 other than austenitic and duplex	EXXX(X)-16
4	SFA-5.4 other than austenitic and duplex	EXXX(X)-17
4	SFA-5.5	E(X)XX15-X
4	SFA-5.5	E(X)XX16-X
4	SFA-5.5	E(X)XX18-X
4	SFA-5.5	E(X)XX18M
4	SFA-5.5	E(X)XX18M1

Table- A3.9 (Contd...)
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
5	SFA-5.4 austenitic and duplex	EXXX(X)-15
5	SFA-5.4 austenitic and duplex	EXXX(X)-16
5	SFA-5.4 austenitic and duplex	EXXX(X)-17
6	SFA-5.2	All classifications
6	SFA-5.9	All classifications
6	SFA-5.17	All classifications
6	SFA-5.18	All classifications
6	SFA-5.20	All classifications
6	SFA-5.22	All classifications
6	SFA-5.23	All classifications
6	SFA-5.25	All classifications
6	SFA-5.26	All classifications
6	SFA-5.28	All classifications
6	SFA-5.29	All classifications
6	SFA-5.30	INMs-X
6	SFA-5.30	IN5XX
6	SFA-5.30	IN3XX(X)
Aluminium and Aluminium-Base Alloys		
21	SFA-5.3	E1100
21	SFA-5.3	E3003
21	SFA-5.10	ER1100
21	SFA-5.10	R1100
21	SFA-5.10	ER1188
21	SFA-5.10	R1188
22	SFA-5.10	ER5183
22	SFA-5.10	R5183
22	SFA-5.10	ER5356
22	SFA-5.10	R5356
22	SFA-5.10	ER5554
22	SFA-5.10	R5554
22	SFA-5.10	ER5556

TABLE- A3.9 (Contd...)
F NUMBERS GROUPING OF ELECTRODES AND WELDING RODS FOR QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
22	SFA-5.10	R5556
22	SFA-5.10	ER5654
22	SFA-5.10	R5654
23	SFA-5.3	E4043
23	SFA-5.10	ER4009
23	SFA-5.10	R4009
23	SFA-5.10	ER4010
23	SFA-5.10	R4010
23	SFA-5.10	R4011
23	SFA-5.10	ER4043
23	SFA-5.10	R4043
23	SFA-5.10	ER4047
23	SFA-5.10	R4047
23	SFA-5.10	ER4145
23	SFA-5.10	R4145
23	SFA-5.10	ER4643
23	SFA-5.10	R4643
24	SFA-5.10	R206.0
24	SFA-5.10	R-C355.0
24	SFA-5.10	R-A356.0
24	SFA-5.10	R357.0
24	SFA-5.10	R-A357.0
25	SFA-5.10	ER2319
25	SFA-5.10	R2319
Copper And Copper Alloys		
31	SFA-5.6	ECu
31	SFA-5.7	ERCu
32	SFA-5.6	ECuSi
32	SFA-5.7	ERCuSi-A

TABLE- A3.9 (Contd...)
F NUMBERS
GROUPING OF ELECTRODES AND WELDING RODS FOR QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
33	SFA-5.6	ECuSn-A
33	SFA-5.6	ECuSn-C
33	SFA-5.7	ERCuSn-A
34	SFA-5.6	ECuNi
34	SFA-5.7	ERCuNi
34	SFA-5.30	IN67
35	SFA-5.8	RBCuZn-A
35	SFA-5.8	RBCuZn-B
35	SFA-5.8	RBCuZn-C
35	SFA-5.8	RBCuZn-D
36	SFA-5.6	ECuAl-A2
36	SFA-5.6	ECuAl-B
36	SFA-5.7	ERCuAl-A1
36	SFA-5.7	ERCuAl-A2
36	SFA-5.7	ERCuAl-A3
37	SFA-5.6	ECuNiAl
37	SFA-5.6	ECuMnNiAl
37	SFA-5.7	ERCuNiAl
37	SFA-5.7	ERCuMnNiAl
Nickel And Nickel Alloys		
41	SFA-5.11	ENi-1
41	SFA -5.11	ENiCrFe-3 & ENiCrFe-7A
41	SFA-5.14	ERNi-1
41	SFA-5.14	ERNiCr-3 & ENiCrFe-7A
41	SFA-5.30	IN61
42	SFA-5.11	ENiCu-7
42	SFA-5.14	ERNiCu-7
42	SFA-5.14	ERNiCu-8
42	SFA-5.30-7	IN60

TABLE- A3.9 (Contd...)
F NUMBERSGROUPING OF ELECTRODES AND WELDING RODS FOR
QUALIFICATION

F.No.	ASME Specification No.	AWS Classification No.
45	SFA5.11	ENiCrMo-11
45	SFA5.14	ERNiCrMo-1
45	SFA5.14	ERNiCrMo-8
45	SFA5.14	ERNiCrMo-9
45	SFA5.14	ERNiCrMo-11
45	SFA5.14	ERNiFeCr-1
Hard-Facing Weld Metal Overlay		
71	SFA-5.13	E Co Cr – A & All classifications
72	SFA-5.21	ER Co Cr – A & All classifications

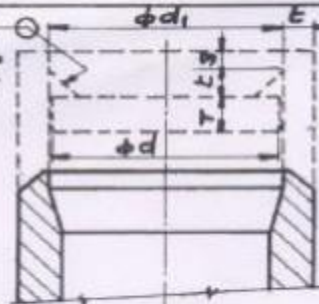


SELECTION CHART FOR DUMMY END COVERS FOR HYDRAULIC TEST

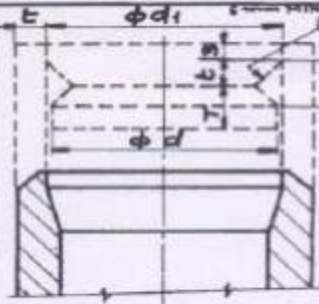
THICKNESS $T = 0.5 d_1 \sqrt{f}$ (ISO-REC. R 831/1968) $f = 1900 \text{ kg/cm}^2$
 ROUNDED OFF TO THE NEXT NEAREST RATIONALISED PLATE SIZE.

TIRUCHY

MIN. 6mm
 $\phi d = d_1 - 1 \text{ mm}$
 (ROUNDED OFF TO THE NEXT INTEGER)



CASE WHEN $T \leq 20$



CASE WHEN $T > 20$

THICKNESS T in mm	MATERIAL
6 to 20	BM-C20
21 to 63	BM-C16
ABOVE 63	ASTM-A36

THICKNESS OF DUMMY END COVERS FOR HYDRAULIC TEST (T)

TEST PRESSURE (kg/cm ²)	30	45	60	75	90	105	120	135	150	165	180	210	240	270	300	350
15	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
25	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	8
30	5	5	5	5	5	5	5	5	5	6	6	6	8	8	8	8
35	5	5	5	5	5	5	6	6	6	6	8	8	8	8	8	10
40	5	5	5	5	6	6	6	8	8	8	8	8	8	10	10	10
45	5	5	5	6	6	6	8	8	8	8	8	10	10	10	10	12
50	5	5	6	6	8	8	8	8	8	10	10	10	10	12	12	12
55	5	6	6	8	8	8	8	10	10	10	10	10	12	12	12	14
60	5	6	8	8	8	8	10	10	10	10	12	12	12	14	14	14
65	5	6	8	8	8	10	10	10	10	12	12	12	14	14	14	16
70	6	8	8	8	10	10	10	12	12	12	12	14	14	14	16	16
75	6	8	8	10	10	10	12	12	12	12	14	14	16	16	16	20
80	6	8	8	10	10	12	12	12	12	14	14	14	16	16	20	20
85	8	8	10	10	10	12	12	14	14	14	14	16	16	20	20	20
90	8	8	10	10	12	12	14	14	14	14	16	16	20	20	20	20
95	8	10	10	12	12	12	14	14	16	16	16	20	20	20	20	25
100	8	10	10	12	12	14	14	16	16	16	20	20	20	20	25	25
125	10	12	12	14	16	16	20	20	20	20	20	25	25	25	32	32
150	12	14	16	16	20	20	20	25	25	25	25	32	32	32	32	36
175	12	16	20	20	20	25	25	25	32	32	32	32	32	36	36	40
200	14	20	20	25	25	25	32	32	32	32	32	36	40	40	56	56
250	20	20	25	32	32	32	36	36	36	40	40	56	56	56	56	56
300	20	25	32	32	36	36	40	56	56	56	56	56	56	63	63	65
350	25	32	32	36	40	56	56	56	56	56	56	63	63	70	75	80
400	32	32	40	56	56	56	56	56	63	63	63	70	75	80	85	90
450	32	36	56	56	56	56	63	63	63	70	70	80	85	90	95	100
500	36	40	56	56	56	63	63	70	75	75	80	85	90	95	100	110

MICROFILMED ON

ROLL 00037 FRAME 528

PREPARED BY

Dr. S. S. Srinivasan

CHECKED BY

Dr. S. S. Srinivasan

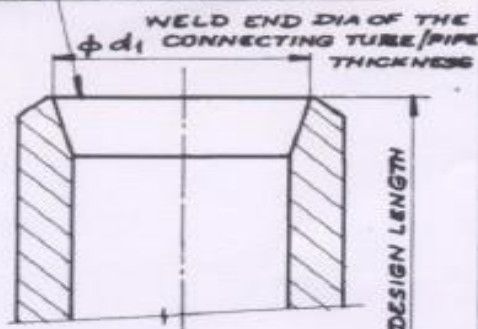
40-B-006, 2887



NIPPLES-FREE END DETAILS.

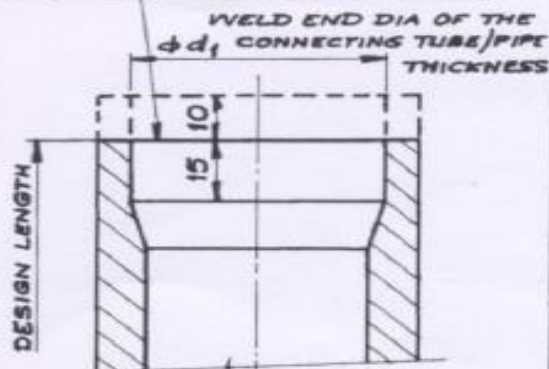
(FOR HEADERS ONLY.)

INDICATE STYLE NR 'D' - d1
TO BPS NR 710004-74 (LAT. REV.)



STRAIGHT NIPPLES WHICH
DO NOT REQUIRE ANY ALLO-
-WANCE. (NO SHOP HYD. TEST.)

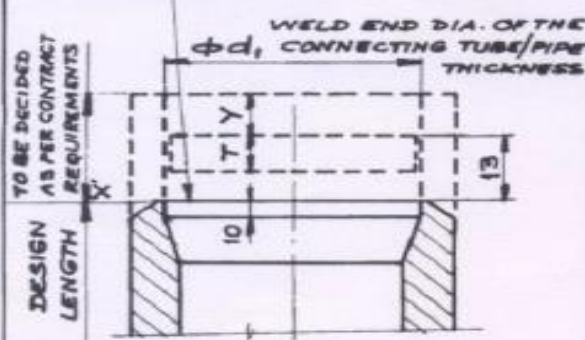
INDICATE STYLE NO 'C' - d₁
TO BPS NO. 710004-74 (LAT. REV.)



STRAIGHT & BENT NIPPLES
WHICH REQUIRE 10 mm ALLOW-
-WANCE. (NO SHOP HYD. TEST.)

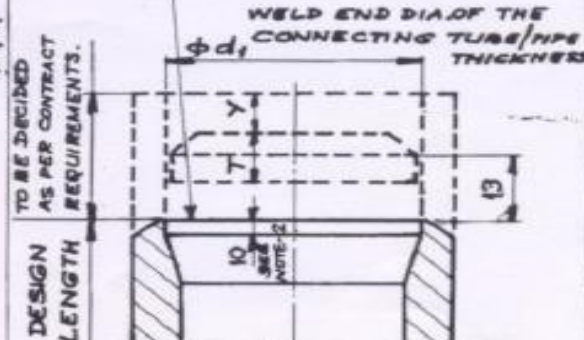
CASE WHEN $T \leq 20$

A) INDICATE STYLE NR 'C' - d,
TO SPS NO 710004-74 (LAT. REV.)



CASE WHEN $T \geq 20$

INDICATE STYLE NO 'C' - d₁
TO BPS NO 710006-74 (LAT. REV.)



STRAIGHT & BENT NIPPLES THAT ARE HYD: TESTED AT SHOPS. (WHETHER THEY REQUIRE ANY ALLOWANCE OR NOT)

NOTE: 1. FOR VALUES OF T BY FOR DIFFERENT SIZES OF NIPPLES AT VARIOUS TEST PRESSURES REFER DRG. NO 40-R-000-2837.

2. IN CASE THE THICKNESS REQUIRED FOR THE DUMMY
END COVER IS MORE THAN 25mm THE INSIDE HEIGHT
OF MACHINING (WHICH IS NOW 10mm) WILL BE INCREASED
ACCORDINGLY.

△ MICROFILMED BY 4.1
ROLL 00037 FRAME 53

PREPARED BY

CHECKED BY.

Quantum C.

in water

40-B-006-2899

CHAPTER A6 - PROCEDURE FOR WELDER QUALIFICATION

SECTION A6.1-PROCEDURE FOR WELDER QUALIFICATION FOR NON-IBR APPLICATIONS

1.0 SCOPE:

1.1 This chapter details the procedure for qualification of welder and performance monitoring.

2.0 CONTENTS:

1. Qualification of Welder.
2. Table- A6.1 - Welder Qualification Requirements for non-IBR applications.
3. Figure-A6.1 - Structural Tack Weld Specimen.
Figure- A6.2 - Break test.
Figure- A6.3 - Weld Positions.
Figure- A6.4 - 6G position
Figure- A6.5 - Flat position
Figure- A6.6 - Vertical position
Figure- A6.7 - Horizontal position
Figure- A6.8 - Overhead position
Figure- A6.9- Plate Butt Weld Specimen.
Figure- A6.10- Pipe Butt Weld Specimen.
4. Record of Welder Performance Qualification Tests.
5. Welder performance monitoring.

SECTION A6.2-QUALIFICATION OF WELDER

1.0 BASE METAL:

1.1 For selection refer Tables provided in Chapter II (Base Materials) of this manual.

2.0 TEST COUPON:

2.1 Depending on the range to be qualified, choose the appropriate test coupon from Table – A6.1

2.2 For plate butt welds, details of edge preparation shall be as per Figure-A6.9.

2.3 For pipe butt welds, details of edge preparation shall be as per Figure-A6.10.

2.4 For structural tack welds, refer Figure-A6.1.

3.0 REQUIREMENT OF TESTS:

3.1 For Structural Tack Welders:

3.1.1 Break Test as per Figure-A6.2.

3.2 For Plate and Pipe Butt welders:

3.2.1 100 % Radiographic examination of test welds shall be carried out. Procedure and acceptance criteria shall be as per NDE Manual (BHEL:PS:NDEM – Latest)

4.0 ESSENTIAL VARIABLES :

4.1 Changes to the following variables require requalification.

4.1.1 **Process:** Example: Change from GTAW to SMAW or vice versa.

4.1.2 **Joint:** A change from one type of bevel to another. Example: 'V' bevel to 'U' bevel.

4.1.3 **Base Metal :** A change in thickness or pipe diameter beyond the limits as prescribed in Table- A6.1

4.1.4 **Filler Metal:** A change from one F number to another F-number, except as specified in Table-A6.1.

4.1.5 **Positions:** This procedure envisages qualification of welders to perform in all positions. Deviation to this is not recommended.

4.1.6 **Gas:** This procedure envisages test to pre-prescribed gas as for production welds. Deviation to this is not recommended.

4.1.7 Electrical Characteristics:

a) AC to DC and vice versa.

b) In DC, DCEN (Electrode Negative) to DCEP (Electrode Positive) and vice versa.

4.1.8 **Technique:** This procedure envisages only use of uphill progression technique.

Acceptance Criteria:

Structural Tack Welding:

- No cracks.
- No lack of fusion.
- Undercut not exceeding 1 mm.
- Not more than 1 porosity (max. diameter of porosity 2 mm).

Plate/Pipe Welding:

Visual Inspection:

- a) No cracks.
- b) No lack of fusion or incomplete penetration.
- c) Not more than 1 porosity in a length of 100 mm of length of weld (max. porosity diameter 2mm).

5.0 VALIDITY:

- 5.1 When a welder meets the requirements of this procedure, the validity will be for a maximum of 2 years from the date of test, limited to validity specified by statutory authority, as applicable. The validity may be extended by one year each time, based on satisfactory performance, with sufficient back up records.

6.0 REQUALIFICATION :

- 6.1 Requalification is required for the following :
- a) Where there is a specific reason to doubt the skill of the welder.
 - b) Due to non-engagement of the welder for a continuous period of 6 months.

7.0 RECORDS:

The welding in charge at site shall maintain the following records:

- a) Record of Welder Performance qualification Test (as per Annexure V).
- b) Register of qualified welders (employer-wise) containing the following details:
 - 1) Name of welder.
 - 2) Age.
 - 3) Tested for pipe / tube / plate / tack.
 - 4) Performance Test No.
 - 5) Validity.
 - 6) Welder Code.
 - 7) Remarks.

The above register shall be updated for deletions also. Copies of welder identity card (including details as in 7 b and relevant variables qualified) and pertinent radiography reports.

8.0 ENCLOSURES :

1. Table –A6.1: Welder Qualification Requirements.
2. Record of Welder Performance Qualification Test.
3. Figure-A6.1: Structural Tack Weld Specimen.
4. Figure-A6.2: Break Test.
5. Figure-A6.3: Weld Positions.
6. Figure- A6.4 - 6G position
7. Figure- A6.5 - Flat position
8. Figure- A6.6 - Vertical position
9. Figure- A6.7 - Horizontal position
10. Figure- A6.8 - Overhead position
11. Figure-A6.9: Plate Butt Weld Specimen.
12. Figure-A6.10: Pipe Butt Weld Specimen

ANNEXURE - V: RECORD OF WELDER PERFORMANCE QUALIFICATION TEST

WELDER/TACK WELDER QUALIFICATION TEST RECORD -NON IBR									
Site :			Test Record No. :			 Joint Details  Affix welder photo			
Contractor Name :			DATE :						
NAME Sri.									
ID NO :									
WPS No. :			Rev :						
Variables			Recorded Actual values used in Qualification			Qualification Range			
Process / Type									
Electrode (Single or Multiple)									
Current / Polarity									
Position									
Weld Progression									
Backing									
Material / Specification			to						
Thickness : (Plate)									
Groove									
Fillet									
Thickness : (Pipe / Tube)									
Groove									
Fillet									
Diameter : (Pipe)									
Groove									
Fillet									
Filler Rod / Electrode									
SFA No									
AWS Class									
F.No									
Gas / Flux Type :									
Pre-heat temp :			Inter-pass Temp :			Post-heat Temp :			
VISUAL INSPECTION									
ACCEPTABLE :		YES		or		NO		DATE :	
Guided Bend Test Results									
Type			Result		Type			Result	
Fillet Test Results									
Appearance						Fillet Size			
Fracture Test root Penetration						Macroetch			
Inspected by						Test Number			
Organization						Date			
RADIOGRAPHIC TEST RESULTS									
Report No/Date			Result		Report No/Date			Result	
Reviewed by						Reviewer Level :			
NDT Company Name :						Date			
We certify that the statement in this record is correct and that the test weld were prepared, welded and tested in accordance with requirements.									
This is valid upto									
Contractor :			Signature :			Date :			
BH&L :			Signature :			Date :			
Customer :			Signature :			Date :			

TABLE – A6.1
WELDER QUALIFICATION REQUIREMENTS (FOR NON-IBR APPLICATIONS)

Sl. No.	Test For	Base ⁶ Metal Note 1	Test Coupon Dimension OD, t	Electrode ⁶ to be used Note 2, 4	Weld Positions	Reference Figure	Range Qualified Dia. & T	Position Qualified	Electrode Qualified Note 2, 4
1	Structural tack	P1 Gr 1	t=10mm or 12mm	(E6013) F2 (E7018) F4	3F&4F 3F&4F	Fig. A6.1 A6.2 & A6.3	T-Unlimited T-Unlimited	All All	F2, F1 F4 & Below
2	Plate Welder (Structural)	- do -	t≥25mm	F4	3G & 4G	Fig.A6.7 & A6.8	T≥3.0 mm*	All	F4 & Below
			t<25mm	F4	3G & 4G		T>3.0 mm*≤2t	All	F4 & Below
3	Plate Welder (Other than structural)	- do -	t≥13mm	F4	2G, 3G & 4G	Fig.A6.6 , A6.7 & A6.8	T-Unlimited OD≥600mm	All	F4 & Below
			t<13mm	F4	2G, 3G & 4G		T≤2t OD≥600mm	All	F4 & Below
4	Pipe/Tube Welder	- do -	OD<25mm	F4	6G	Fig.A6.4	Test piece Dia.& above 25mm & above 73mm & above	All	F4 & Below
			OD≥25mm & ≤73mm	F4	6G			All	F4 & Below
			OD>73mm	F4	6G			All	F4 & Below
			t<13mm	F4	6G		T≤2t	All	F4 & Below
			t≥13mm	F4	6G		T-Unlimited	All	F4 & Below

* Also qualifies for welding fillet welds on material of unlimited thickness.

TABLE – A6.1 (contd...)

NOTES:

1. For P grouping refer Chapter II.
2. For F grouping refer Chapter III.
3. Base material limitation:
 - a. Where test coupons belong to P1 thro' P15E, welder is qualified for base materials P1 thro' P15E.(ASME Sec IX QW 423, Alternate base material for welder qualification)
It means, if a welder is qualified with carbon steel material, he is also qualified for alloy steel and vice versa.
 - b. Use appropriate F group electrodes.
4. Qualification in one F number, qualifies for that F-number only, except as stated below in A, B, C & D.
 - A. Qualification in F4 qualifies for F4 and below.
 - B. Qualification in F5 qualifies for F5 only.
 - C. Qualification in any of F41 thro' F45 qualifies for F41 thro' F45.
 - D. For non-ferrous materials, the base materials shall be typical of production material and appropriate filler materials shall be selected. Qualification is limited to the base material, process and filler F group. Diameter and thickness limitations apply as per Table –A6.1

OD = outer diameter, t = thickness of test coupon; T = thickness qualified.
5. Where qualification is for GTAW followed by SMAW, the welder is also qualified up-to 6 mm thickness by GTAW process.
6. Base material indicated is carbon steel; for other base materials, corresponding electrodes are to be chosen. Also for GTAW process, the corresponding filler wire should be chosen.

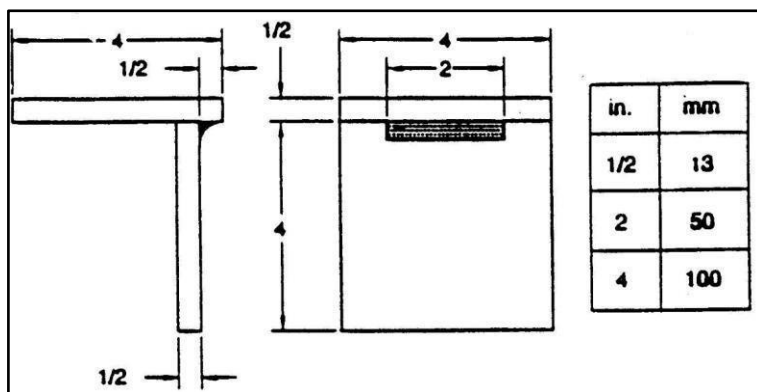


Figure A6.1 – Structural Tack Weld Specimen

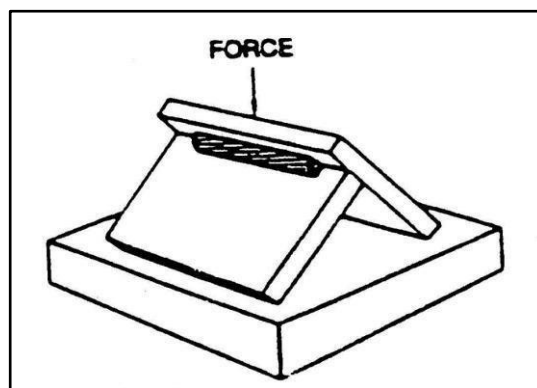


Figure A6.2 – Break Test

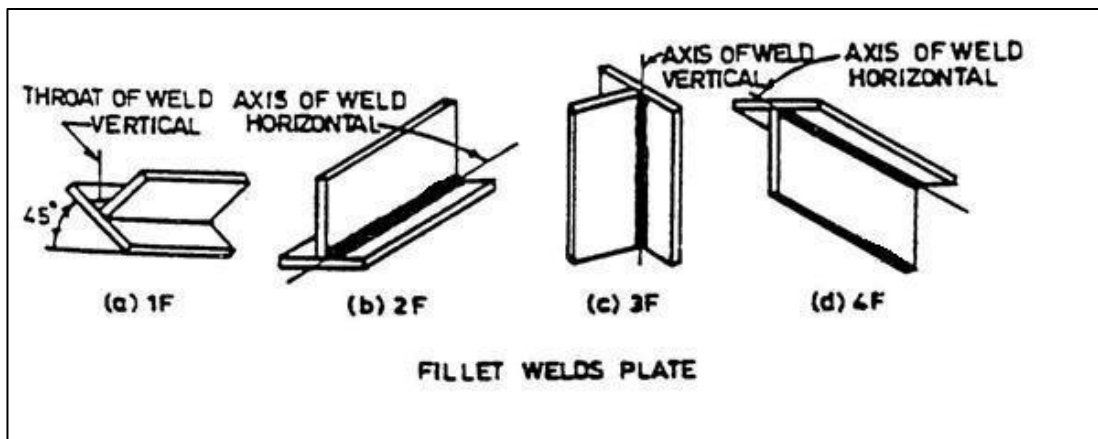


Figure A6.3 - Weld Positions

SECTION A6.3-PROCEDURE FOR WELDER QUALIFICATION FOR IBR APPLICATIONS

1.0 SCOPE

- 1.1 These requirements shall apply to testing of welders/welding operators engaged in the manufacture and welding connected with site fabrication, erection and repair of boilers and piping of ferrous material under the purview of IBR.

2.0 DEFINITION

Welder: one who performs manual or semiautomatic welding.

3.0 ENGAGING OF CERTIFIED WELDERS

All welders engaged on welding of boilers or piping under fabrication, erection and repair at site shall possess a valid certificate as required by IBR, as per Form XIII issued by the Competent Authority under IBR.

4.0 QUALIFICATION TEST AND ISSUE OF CERTIFICATE

Every welder shall be duly tested and qualified at site to the satisfaction of BHEL/Customer. Every welded test piece for the examination of welders/welding operator shall be stamped by BHEL with an identification mark on either side of the weld. After satisfactory completion of the tests, BHEL shall issue a Certificate/ID Card to each Qualified Welder as per the Format given in Figure no. A6.9.

4.1 Each welder shall have basic knowledge on the following:

- i. Weld edge preparation
- ii. Working of welding equipment.
- iii. Properties of material to be welded – cold and hot working, thermal conductivity, fusion point, oxidation (for welders engaged in alloy steel welding).
- iv. Electro-technical principles viz. kinds of current, striking arc voltage, welding arc voltage, etc.
- v. Weld defects, their causes and prevention.
- vi. Electrodes for different types of materials, welds and joints in different positions.

4.2 MATERIAL FOR TESTS – The material of plates, tubes, pipes and electrodes used for these tests shall conform to the requirements given below:

4.2.1 TEST WELDS FOR QUALIFICATION

(a) PLATE WELDING –

- i. One weld joint of two pieces of boiler quality plates with double 'V' or double 'U' grooves over a minimum length of 300 mm shall be made in the following positions (size of plates to be welded being not less than 229 mm x 381 mm x 16 mm each):
 - (1) Flat position (figure A6.5) - Plate in a horizontal plane with the weld metal deposited from above.

- (2) Horizontal Position (figure A6.6) – Plate in a vertical plane with the axis of the weld horizontal.
- (3) Vertical Position (figure A6.7)- Plate in a vertical plane with the axis of the weld vertical
- (4) Overhead Position (figure A6.8) – Plate in a horizontal plane with the weld metal deposited from underneath.

Qualification in Horizontal position shall automatically qualify Flat position. Qualification in Vertical position shall automatically qualify Flat and Horizontal positions. Also, qualification in Overhead position shall automatically qualify Flat, Horizontal and Vertical positions.

(b) For Pipe Welding –6G-Position:

Tube/Pipe with its axis inclined at 45 Deg. to horizontal. Welding shall be done without rotating the Tube/ pipe. Refer FigureA6.4.

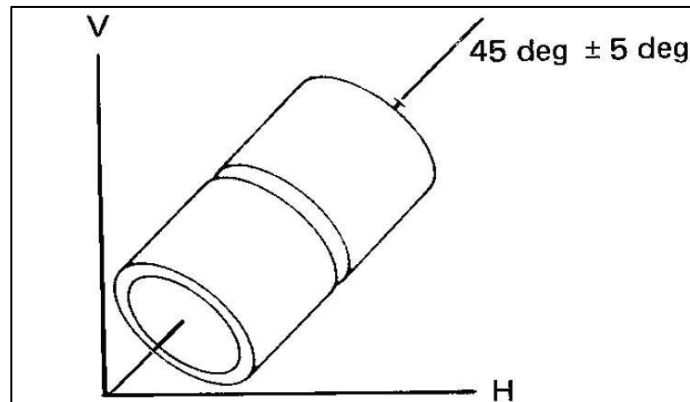


Figure A6.46G-Position

5.0 VALIDITY OF CERTIFICATE

- a) Certificate issued to a welder shall remain valid for a period of twenty-four months from the date of issue, provided that the welder has, subsequent to the test, been continuously (gap not more than six months) employed on the class and type of work for which he is qualified.
- b) The certificate may be extended, after the validity period, for another twenty-four months after conducting the re-qualification tests in-line with the initial Qualification tests.
- c) In case of unsatisfactory performance of the Certified Welder as observed by the site engineer, the welder shall be re-qualified as per the requirements prior to engaging in subsequent welding works.
- d) A welder qualified for a type and process of higher grade of steel can be allowed to weld the lower grade of steel.
- e) A welder qualified on groove weld shall automatically qualify for fillet and socket welds.

6.0 EXAMINATION OF TEST SPECIMENS FOR QUALIFICATION TESTS

- (a) The test specimens shall be visually examined as per Cl 6.0 of Chapter A7 of this Manual.
- (b) After visual examination, the test specimen shall be subjected to radiographic examination as per the requirements specified in NDE Manual (BHEL:PS:NDEM-Latest).

7.0 MAINTENANCE OF RECORDS

Records of Qualified welders shall be maintained by the site engineer till the closure of the project. At the time of project closure, these records shall be handed over to the customer, if required by the Contract.

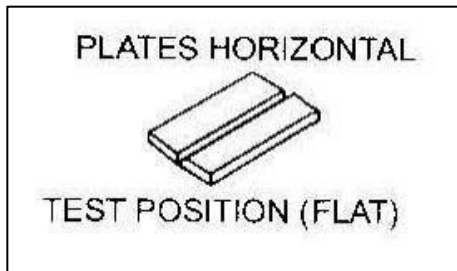


Figure A6.5 Flat position

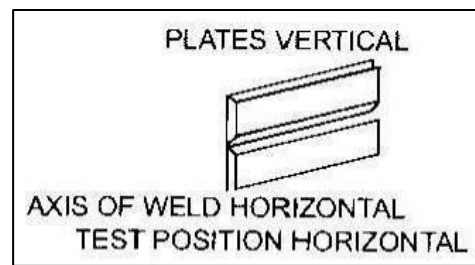


Figure A6.6 Horizontal Position

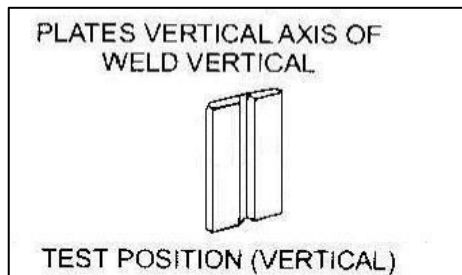


Figure A6.7 Vertical Position

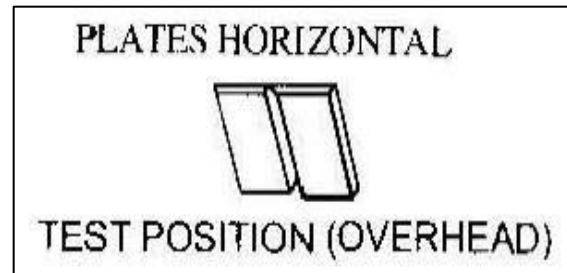


Figure A6.8 Overhead Position

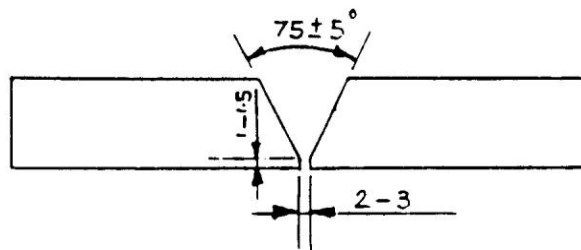
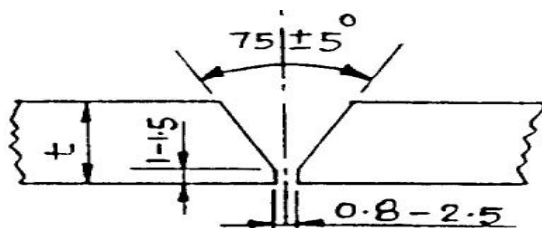
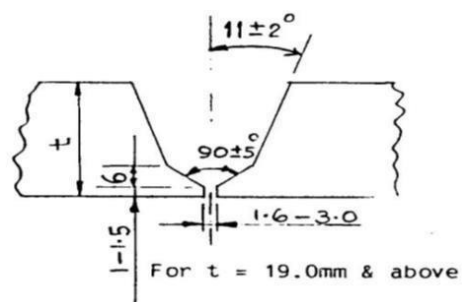


Figure A6.9- Plate butt weld specimen



(A) for T upto 19 mm



(B) For T = 19.0mm & Above

Figure – A6.10 – Pipe Butt Weld Specimen

WELDER PERFORMANCE QUALIFICATION (WPQ)- For IBR				Affix the Welder Recent Photo	
Performance Test No. :		Date :			
Welder's Name :			ID No. :		
Contractor :					
Test Description					
Identification of WPS followed				Type :	
Test Coupon(TC) /Production Weld (PW):		Welding process(es) used :			
Specification of base metal (s)				Thickness :	
Testing Conditions and Qualification Limits					
Welding Variables		Actual Values		Range Qualified	
Backing (metal, weld metal, double welded, flux)					
Pipe Diameter					
Base metal P-No or Code case to P.No or Code case					
Filler metal or Electrode SFA No					
Filler metal or Electrode Classification					
Filler metal or Electrode F.Number					
Deposit thickness for each process					
Position Qualified					
Vertical progression (Uphill or downhill)					
Inert gas backing for GTAW					
Current type / polarity					
RESULTS					
Guided Bend Test :					
Type	Result	Type	Result	Type	Result
N.A	N.A	N.A	N.A	N.A	N.A
N.A	N.A	N.A	N.A	N.A	N.A
Visual examination results		ACCEPTABLE			
Radiographic test results		Lab.Name			
Fillet Weld - Fracture test		Length & %age of defects			
Macro examination		Fillet size			
Concavity/convexity					
Welding test conducted by					
Welding test witnessed by					
We certify that the statements in this record are correct and that the test coupons were prepared, welded and tested in accordance with the requirements.					
This is valid up to					
CONTRACTOR			BHEL		
Name :					
Signature :					
Date :					
Engineer			Erection Engineer		

Figure A6.11: BHEL issued Welder Qualification Certificate

SECTION A6.4-WELDER PERFORMANCE MONITORING

1.0 PURPOSE:

- 1.1 This procedure deals with monitoring the performance of welders engaged at sites.
This procedure is applicable where radiography is performed.

2.0 PROCEDURE:

- 2.1 The welder performance shall be monitored on a calendar month basis.
 - 2.2 Extent of radiography shall be representative of weekly outputs of the welder.
 - 2.3 Quantum of radiography shall be as per contractual requirements.
 - 2.4 Evaluation of welds radiographed shall be as per NDE manual or other documents as specifically applicable.
 - 2.5 **Welder performance evaluation:**
 - 2.5.1 **For welds having diameter ≤ 88.9 mm:**
 - 2.5.1.1 The percentage of defects shall be calculated as a percentage of number of unaccepted welds to those radiographed.
 - 2.5.1.2 Upto and including 5% defects: Performance is satisfactory else unsatisfactory.
 - 2.5.2 **For welds having diameter >88.9 mm and plate welds:**
 - 2.5.2.1 The percentage of defects shall be calculated as a percentage of length of defects to the length radiographed.
 - 2.5.2.2 Upto and including 2.5% defects: performance is satisfactory else unsatisfactory.
 - 2.6 When a welder gives unsatisfactory performance for a continuous period of 3 months, he shall be re-qualified.
 - 2.6..1 Requalification of welder shall be called for when there is a specific reason to question his ability to make acceptable welds. This shall override requirements of clause 2.6.
 - 2.7 Welds produced during any month shall be radiographed and evaluated latest by 10th of the succeeding month.
 - 2.7..1 Under circumstances when clause 2.7 is not satisfied for any particular welder, he may be disengaged from the job till such time his performance is evaluated for the month in study.
 - 2.7..2 Site in-charge may waive the restriction imposed in 2.7.1 reviewing the situations for non-compliance with Cl.2.7 and may allow engagement of the welder in question for a period not exceeding one successive month to the month in study.
- ### 3.0 RECORDS:
- 3.1 Welding in-charge shall prepare and maintain Welder Performance Records, welder-wise as per the Annexure VI.

ANNEXURE VI: WELDERS PERFORMANCE MONITORING RECORD

[illegible]

Note : 1. Upto and including 5% defects., performance is satisfactory else unsatisfactory.

2. Upto and including 2.5% defects, performance is satisfactory else unsatisfactory.

CHAPTER – A7

INSPECTION OF WELDING

1.0 SCOPE:

- 1.1 This procedure provides details for performing visual inspection of weld fit-ups, welding in progress and completed welds.

2.0 REFERENCE:

- 2.1 Contract drawings.
2.2 Field Welding Schedule (supplied by Units) or equivalent.
2.3 Welding Procedure Specification, where supplied.
2.4 Indian Boiler Regulations (for boilers erected in India)

3.0 GENERAL REQUIREMENTS:

- 3.1 Ensure that the components to be welded are in accordance with the contract drawings, Welding Schedule and other relevant documents.
3.2 The condition of welded surfaces to be inspected shall be clean and dry.
3.3 There shall be sufficient lighting to allow proper interpretation of visual inspection.

4.0 WELD FIT-UP INSPECTION:

- 4.1 The surface to be welded shall be smooth and free from deep notches, irregularities, scale, rust, oil, grease and other foreign materials.
4.2 Positive Material Identification (PMI) shall be carried out for all alloy steel and stainless steel materials for the parent metal before fit-up and for weld after welding. However, in case of tubes random PMI check shall be done on the parent metal and on 10% of the welds made by each welder per day. The procedure recommended by the PMI equipment manufacturer shall be followed for testing.
4.3 Piping, tubing and headers to be joined shall be aligned within allowable tolerances on diameters, wall thicknesses and out-of-roundness as below:

Maximum permissible misalignment at bore

Bore (mm)	Max. Misalignment (mm)	
	For GTAW	For SMAW
Up to 100	1.0	1.0
Over 100 to 300	1.6	1.6
Over 300	1.6	2.4

- 4.4 While fit up, components to be welded shall not show any appreciable off-set or misalignment when viewed from positions apart.
4.5 The root opening of components to be joined shall be adequate to provide acceptable penetration.
4.6 On fillet welds, the parts to be joined shall be brought as close to contact as practical, although in most instances a small opening between the parts is desirable.
4.7 Weld area shall be protected from drafts and wind, to maintain inert gas shield.

5.0 CHECKS DURING WELDING OPERATION:

- 5.1 Ensure the required minimum preheat temperature is maintained during welding. Preheating shall be done using resistance heating or induction heating or LPG burners. Preheating by cutting/ heating torches is not permitted.
- 5.2 Ensure correct electrode / filler metal is used for welding.
- 5.3 Tack welds shall be examined by the welder before they are incorporated in the final weld.
- 5.4 Ensure proper drying / holding of electrodes prior to use.
- 5.5 Ensure inter pass temperature mentioned in WPS is not exceeded during welding.
- 5.6 Ensure proper cleaning of weld between beads.

6.0 CHECKS ON THE COMPLETED WELD:

- 6.1 There shall be no visible cracks, pin-holes or incomplete fusion.
- 6.2 The weld surface must be sufficiently free of coarse ripples, grooves, overlaps, abrupt ridges and valleys, visible slag inclusions, porosity and adjacent starts and stops.
- 6.3 Undercuts shall not exceed 0.8 mm (0.4 mm for tubes) or 10% of wall thickness whichever is less.
- 6.4 Where inside surface is readily accessible, the same shall be inspected for excess penetration and root concavity. The permissible limits are given below:
 - Root concavity: max of 2.5 mm or 20% of thickness at weld, whichever is lesser, provided adequate reinforcement is present.
 - Excess penetration: up to and including 3.2 mm.
- 6.5 For plate butt welds, the weld reinforcement shall not exceed 3.2 mm.
- 6.6 For circumferential joints in piping and tubing the maximum weld reinforcements permitted are given below :

Maximum Permissible Reinforcements (ASME Sec I –PW 35)

Thickness of base metal in mm	Reinforcement in mm
Up to 3.0	2.5
Over 3 to 5	3.0
Over 5 to 13	4.0
Over 13 to 25	5.0
Over 25 to 50	6.0
Over 50	Max of 6.0 or 1/8 of weld width

- 6.7 There shall be no overlaps. The faces of fillet welds are not excessively convex or concave and the weld legs are of proper length.
- 6.8 In case of weld joints in pressure parts and joints like ceiling girder, the weld joint shall be suitably identified.

CHAPTER – A9
SAFE PRACTICES IN WELDING

(This is included for information purposes only)

1.0 This covers many of the basic elements of safety general to arc welding processes. It includes many, but not all, of the safety aspects related to structural welding. The hazards that may be encountered and the practices that will minimize personal injury and property damage are reviewed here.

2.0 Electrical Hazards

2.1 Electric shock can kill. However, it can be avoided. Live electrical parts should not be touched. Read and understand the manufacturer's instructions and recommended safe practices. Faulty installation, improper grounding, and incorrect operation and maintenance of electrical equipment are all sources of danger.

2.2 **All electrical equipment and the work-pieces should be grounded.** A separate connection is required to ground the work-piece. The work lead should not be mistaken for a ground connection.

2.3 To prevent shock, the work area, equipment, and clothing should be kept dry at all times. Dry gloves and rubber soled shoes should be worn. The welder should stand on a dry board or insulated platform.

2.4 Cables and connections should be kept in good condition. Worn, damaged or bare cables should not be used. In case of electric shock, the power should be turned off immediately. If the rescuer must resort to pulling the victim from the live contact, non-conducting materials should be used. A physician should be called and CPR continued until breathing has been restored, or until a physician has arrived.

3.0 Fumes and Gases

3.1 Many welding, cutting, and allied processes produce fumes and gases which may be harmful to one's health. Fumes and solid particles originate from welding consumables, the base metal, and any coating present on the base metal. Gases are produced during the welding process or may be produced by the effects of process radiation on the surrounding environment. Everyone associated with the welding operation should be aware of the possible effects of over-exposure to fumes and gases range from irritation of eyes, skin, and respiratory system to more severe complications. Effects may occur immediately or at some later time. Fumes can cause symptoms such as nausea, headaches, dizziness, and metal fumes fever. Sufficient ventilation, exhaust at the arc,

or both, should be used to keep fumes and gases from breathing zones and the general work area.

4.0 Noise

- 4.1 Excessive noise is a known health hazard. Exposure to excessive noise can cause a loss of hearing. This loss of hearing can be either full or partial, and temporary or permanent. Excessive noise adversely affects hearing capability. In addition, there is evidence that excessive noise affects other bodily functions and behaviour. Personal protective devices such as ear muffs or ear plugs may be employed. Generally, these devices are only accepted when engineering controls are not fully effective.

5.0 Burn Protection

- 5.1 Molten metal, sparks, slag, and hot work surfaces are produced by welding, cutting and allied process. These can cause burns if precautionary measures are not used.
- 5.2 Workers should wear protective clothing made of fire resistance material. Pant cuffs or clothing with open pockets or other places on clothing that can catch and retain molten metal or sparks should not be worn. High top shoes or leather leggings and fire resistant gloves should be worn. Pant legs should be worn over the outside of high top boots. Helmets or hand shields that provide protection for the face, neck, and ears, should be worn, as well as head covering to protect. Clothing should be kept free of grease and oil. Combustible materials should not be carried in pockets. If any combustible substance is spilled on clothing it should be replaced with fire resistance clothing before working with open arc or flame.
- 5.3 Appropriate eye protection should be used at all times. Goggles or equivalent also should be worn to give added eye protection.
- Insulated gloves should be worn at all times when in contact with hot items or handling electrical equipment.

6.0 Fire Prevention

- 6.1 Molten metal, sparks, slag, and hot work surfaces are produced by welding, cutting, and allied processes. These can cause fire or explosion if precautionary measures are not used.
- 6.2 Explosions have occurred where welding or cutting has been performed in spaces containing flammable gases, vapours, liquid, or dust. All combustible material should be removed from the work area. Where possible, move the work to a location well

away from combustible materials. If neither action is possible, combustibles should be protected with a cover or fire resistant material. All combustible materials should be removed or safely protected within a radius of 35 ft. (11m) around the work area.

- 6.3 Welding or cutting should not be done in atmospheres containing dangerously reactive or flammable gases, vapours, liquid, or dust. Heat should not be applied to a container that has held an unknown substance or a combustible material whose contents when heated can produce flammable or explosive vapours. Adequate ventilation should be provided in work areas to prevent accumulation of flammable gases, vapours or dusts. Containers should be cleaned and purged before applying heat.

7.0 Radiation

- 7.1 Welding, cutting and allied operations may produce radiant energy (radiation) harmful to health. Everyone should acquaint themselves with the effects of this radiant energy.
- 7.2 Radiant energy may be ionizing (such as X-rays) or non-ionizing (such as ultraviolet, visible light, or infrared). Radiation can produce a variety of effects such as skin burns and eye damage, if excessive exposure occurs.
- 7.3 Some processes such as resistance welding and cold pressure welding ordinarily produce negligible quantities of radiant energy. However, most arc welding and cutting processes (except submerged arc when used properly), laser welding and torch welding, cutting, brazing, or soldering can produce quantities of non-ionizing radiation such that precautionary measures are necessary.
1. Welding arcs should not be viewed except through welding filter plates.
 2. Transparent welding curtains are not intended as welding filter plates, but rather, are intended to protect passersby from incidental exposure.
 3. Exposed skin should be protected with adequate gloves and clothing as specified.
 4. The casual passersby to welding operations should be protected by the use of screens, curtains, or adequate distance from aisles, walkways, etc.
 5. Safety glasses with ultraviolet protective side shields have been shown to provide some beneficial protection from ultraviolet radiation produced by welding arcs.

CHAPTER - B2
ERECTION WELDING PRACTICES FOR
SA335 P91/P92, SA182 F91/F92 &
SA217 C12A MATERIALS

1.0 SCOPE:

- 1.1. This document details out the practices to be adopted during erection of SA335 P91/P92, SA182 F91/F92 and SA 217 C12A materials.

2.0 MATERIAL:

- 2.1 Pipe materials shall be identified as follows:-
- 1) Colour codes given by the MUs.
 - 2) Hard Stamping: Specification, Heat No, Size.
 - 3) Paint / Stencil: WO DU, as per the relevant drawing & document.
- 2.2 When any defect like crack, lamination, and deposit noticed during visual examination the same shall be confirmed by Liquid Penetrant Inspection. If confirmed, it shall be referred to unit.

3.0 ERECTION:

3.1 Edge Preparation and fit up:

- 3.1.1 Cutting of P91/P92/F91/F92 material shall be done by band saw / hacksaw / machining / grinding only. Edge preparation (EP) shall be done by grinding/machining. During machining /grinding, care shall be taken to avoid excessive pressure to prevent heating up of the pipe edges.
- 3.1.2 All Edge Preparations done at site shall be subjected to Liquid Penetrant Inspection (LPI). Weld build-up on Edge Preparation is prohibited.
- 3.1.3 The weld fit-up shall be carried out properly to ensure proper alignment and root gap. Neither tack welds nor bridge piece shall be used to secure alignment. Partial root weld of minimum 25mm length by GTAW at minimum 4 locations and fit-up by a clamping arrangement is recommended. Use of site manufactured clamps for fit up is acceptable. The necessary purging and preheat shall be done as per clause 3.3 and 5.0 respectively. Welding shall be done employing IBR qualified welders only.
- 3.1.4 The fit-up shall be as per the drawing. Root gap shall be 2 to 2.5mm and root mismatch shall be within 1.6mm. Suitable reference punch marks shall be made on both the pipes (at least on three axis).
- a) At 200 mm from the EP for UT.
 - b) At 1000 mm from the EP for identifying weld during PWHT.

3.2 Fixing of thermocouple (TC) and heating elements during preheating and PWHT:

- 3.2.1 Heat Treatment Manual (AA/CQ/GL/011/ PART II-HTM-Latest), Chapter 1, Clause no. 3.1.1, 3.1.5, 3.2.1, 3.2.2 & 3.2.6 shall be referred for guidelines for fixing of thermocouples and heating elements on the jobs

3.3 Arrangement for purging:

3.3.1 Argon gas conforming to Gr 2 of IS 5760 (latest) shall be used for purging the root side of weld. The purging dam (blank) shall be fixed on either side of the weld bevel prior to pre-heating. The dam shall be fixed inside the pipe and it shall be located away from the heating zone. Purging shall be done for root welding (GTAW) followed by two filler passes of SMAW in case of butt welds. Purging is not required in the case of nozzle and attachment welds, when they are not full penetration joints.

3.3.2 The flow rate which shall be maintained during purging is 10 to 26 litres/minute. Purging shall be started from inside of pipe when root temperature reaches 220°C. Continuous and adequate Argon Gas shall be provided to ensure complete purging in the root area. The minimum pre-flushing time for purging before start of welding shall be 5 minutes, irrespective of the pipe size.

3.3.3 Wherever possible, solid purging gas chambers shall be used which shall be removed after welding. If not possible, only water-soluble paper is to be used. Plastic foils that are not water-soluble are NOT acceptable.

3.3.4 Using Aluminium dam arrangement:

In order to retain the Argon gas at the inside of the pipe near root area of the weld joint, the purging dams made of Aluminium (or other suitable material like mild steel) and permanent gaskets may be provided during the weld fit-up work similar to one as indicated in the Figure B2.1. The Aluminium discs shall be firmly secured with a thin wire rope. After completion of the root welding followed by two filler passes, the disc shall be pulled outwards softly.

CAUTION: ENSURE REMOVAL OF PURGE DAM ARRANGEMENT AFTER WELDING

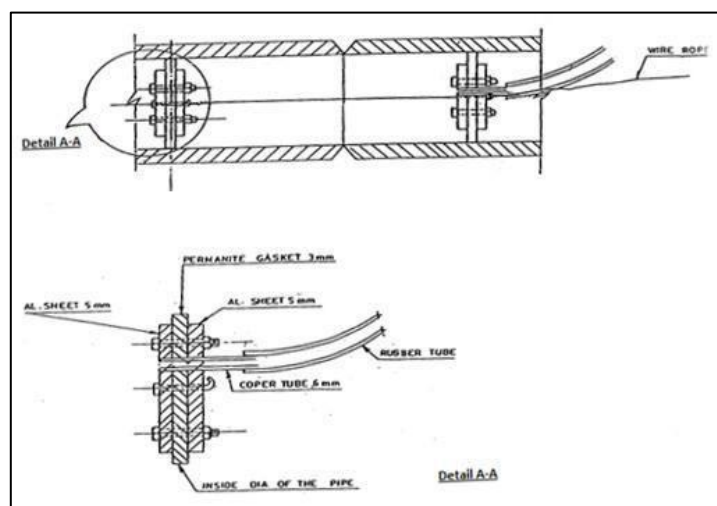


Figure B2.1

3.3.5 Using water soluble paper:

The dams can be made of water-soluble paper/water soluble tissue paper for creating the purging chamber. The advantage in such dam arrangement is that dissolving in water can flush the dams. The following are different methods used.

The Purge damming process illustrated as below:

- 3.3.5.1. For small diameter pipes, simply stuff water soluble paper/water soluble tissue paper into each section to be joined (Refer Figure B2.2).

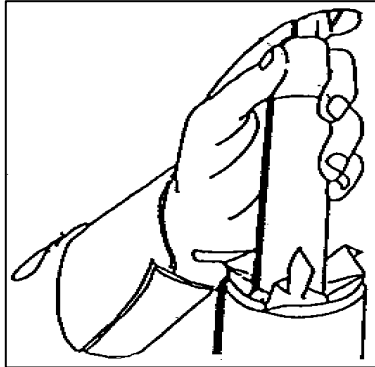


Figure B2.2

- 3.3.5.2. For larger pipes, cut out a circular aluminium foil disc slightly larger than the diameter and shape it to the inside pipe circumference. (A small hole may be punched in the paper to ensure complete evacuation of air when purging) (Refer Figure B2.3).

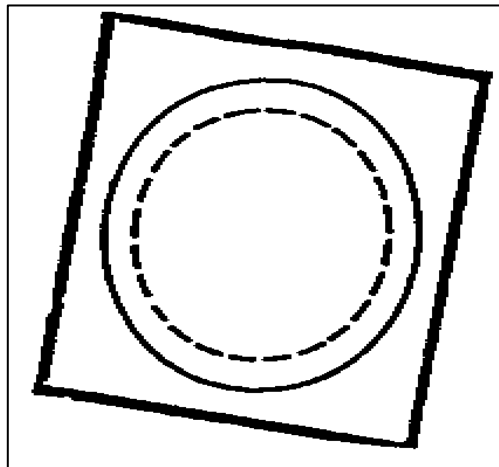


Figure B2.3

- 3.3.5.3. Position the disc within the pipe and tape in place with water soluble paper. Repeat procedure for other section. Insert the backing gas into the joint with a needle valve and make root pass in the usual manner (Refer Figure B2.4).

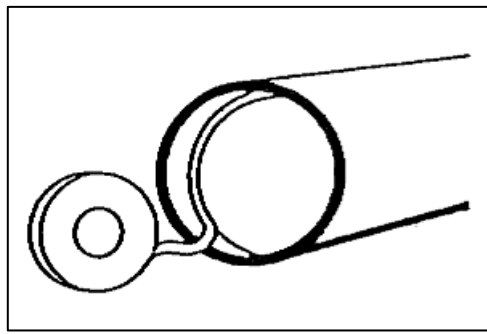


Figure B2.4

- 3.3.5.4. For pipes larger than 508 mm diameter, simply splice two sheets of water soluble paper together with water soluble tape as per Figure B2.5 and repeat procedure as shown in Figure B2.3 and B2.4 above.

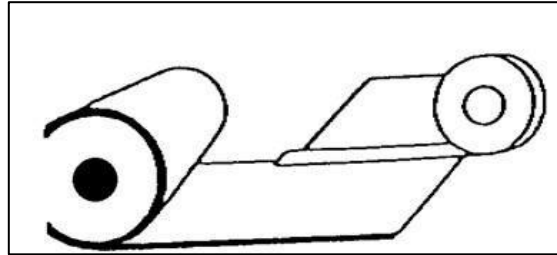


Figure B2.5

4.0 WELDING / WELDERS QUALIFICATION:

Welders Qualified as per IBR and qualified at site with Gr.91/Gr.92 material only shall be engaged. Welders log book shall be maintained and welders performance shall be monitored by site engineer. The applicable WPS as per FWS shall be followed for welder qualification and welding.

5.0 PREHEATING:

Heat Treatment Manual (AA/CQ/GL/011/ PART II-HTM-Latest), Chapter 1, Clause 3.1 shall be referred for guidelines for preheating.

6.0 WELDING:

- 6.1 Root Welding shall be done using GTAW process (as per WPS) five minutes after the start of argon purging. Filler wire shall be cleaned and free from rust or oil. Argon Purging shall be continued till minimum two filler passes of SMAW.
- 6.2 The inter-pass temperature shall not exceed 350°C. After completion of welding bring down the temp to 80–100°C and hold it at this temperature for one hour minimum. The PWHT shall commence after completing one hour of holding.

7.0 STORAGE OF WELDING CONSUMABLES:

Refer Chapter A3, Section A-3.4 of this Manual for guidelines which shall be followed for receipt, storage, drying & holding and issue of welding consumables.

CAUTION: No LPI / Wet MPI/UT shall be carried out on weld before PWHT

8.0 POST WELD HEAT TREATMENT:

8.1 Heat Treatment Manual (AA/CQ/GL/011/ PART II-HTM– Latest), Chapter 1, Clause no. 3.2 shall be referred for guidelines on PWHT. In addition, the below requirements and precautions shall also be followed:

8.2 Welding and PWHT shall be monitored every one hour by site authorized personnel.

8.3 Preventive measures during power failure and non-functioning of equipment: No interruption is allowed during welding and PWHT. Hence all the equipment for the purpose of power supply, welding, heating etc., shall have alternative arrangements. (Diesel generator for providing power to the welding and heating equipment, standby welding and heating equipment, reserve thermocouple connections, gas burner arrangement for maintaining temperature etc.). Following preventive measures shall be adopted until normal power supply or backup power supply through diesel generator is restored.

8.3.1 Interruption during start of preheating:

In case of any power failure/interruption during preheating, the weld fit-up shall be insulated and brought to room temperature. After the electric supply resumes the joint shall be preheated as per Clause No: 5.0.

8.3.2 Interruption during GTAW / SMAW:

Maintain a preheat temperature of 220°C minimum using LPG gas burners till the welding is restarted. In case, preheat temperature is not maintained, an inter-stage stress relieving shall be carried out followed by visual inspection to ensure that no surface cracks are present in the weld, prior to restart of the welding.

8.3.3 Interruption during cooling cycle: After SMAW welding completion and cooling to holding temperature at 80 to 100°C, care shall be taken to avoid faster cooling rate by providing adequate insulation. The required temperature of 80 – 100°C shall be maintained by gas burner arrangements till power resumes / start of PWHT (within 8 hours).

8.3.4 Interruption during post weld heat treatment; Heat treatment Manual (AA/CQ/GL/011/ PART II-HTM– Latest), Chapter 1, clause no. 3.2.5 shall be referred for guidelines to be followed for interruption during PWHT.

8.3.5 In all the above cases (8.3.1 to 8.3.4), the temperature measurement on the weld joint shall be recorded using calibrated gauges/instruments at regular intervals of 15 minutes in the log book by Site Engineer.

8.4 Caution:

The PWHT temperature recorded in the chart shall not deviate from the specified values since any deviations to the specified soaking temperature Range, will adversely affect the mechanical properties of the weldment and may lead to rejection of the weldment. The weld Joints should be kept dry and no water/liquid is allowed to come in contact with the weld or preheated portion of pipe under any circumstances, till PWHT is completed.

9.0 CALIBRATION:

All equipment like recorder, thermocouple, compensating cable, oven thermostat etc. shall have valid calibration carried at BHEL approved laboratories. The calibration reports shall be reviewed and accepted by welding In-charge at site prior to use.

10.0 NONDESTRUCTIVE EXAMINATION (Refer NDE Manual AA/CQ/GL/011/ Part III- NDEM latest):

10.1 All NDE shall be done after PWHT only. Prior to testing all welds shall be smoothly ground. All welds (fillet & butt) shall be subjected to MPI (MPI shall be done by YOKE type only). In addition to MPI, butt-welds and all full penetration welds shall be examined by UT.

UT procedure shall be as per BHE: NDT: PB: UT21 with additional requirements as in (a) through (e):

- a) The calibration blocks used shall be of the same product form and material specification or equivalent P-Number grouping as one of the materials being examined. P-Nos. 1, 3, 4, 5A through 5C, and 15A through 15F materials are considered equivalent for this purpose.
- b) The UT equipment shall be calibrated prior to use and should be of 'digital type' capable of storing calibration data as well as ultrasonic test results as per procedure number BHE: NDT: PB: UT-21.
- c) All recordable indications shall be stored in memory of – either the digital flaw detector or a PC for review at a later period.
- d) The equipment calibration data for specific weld as well as the hard copy of 'Static echo-trace pattern' – showing the flaw-echo amplitude with respect to DAC, flaw depth, projection surface distance (probe position) and beam-path shall be attached to UT test report. This hard-copy of echo-trace with equipment calibration data shall form part of test documentation.
- e) The examination as well as evaluation shall be performed by a qualified Level II personnel, and a test report shall be issued. Any defect noticed during NDT shall be marked with marker.

11.0 REPAIR OF WELD JOINTS:

11.1 Weld repair at root:

If any surface defect is revealed at the time of visual inspection during root welding, the following steps shall be followed:

1. Maintain the temperature at 80-100°C for 1 hour.
2. Perform inter-stage PWHT.
3. Remove the defect by grinding.
4. After complete removal of defect, preheat the weld area to 220°C minimum and re weld with GTAW before starting SMAW, if required.

11.2 Weld repair on completion:

11.2.1 Any defect observed on the weld shall be brought to the notice of Siteengineer. Any repair on weld shall be carried out with their approval only.

11.2.2 If any defects are noticed on the fully completed weld while performing UT after completion of PWHT, the depth of the defect shall be located from the weld outside surface. The defect area shall be marked and repaired as below:

- a) The weld shall be removed by grinding (gouging not permitted) such that the area for repair welding shall be free from sharp corners and provided with sufficient slope towards the weldface sides.
- b) Surface examination (MPI/LPI) on the ground area shall be performed to ensure complete defect removal before re-welding. Repair welding shall be carried as per the applicable WPS as for original welding.

12.0 HARDNESS SURVEY:

Hardness shall be measured using portable hardness tester. The equipment used for the hardness measurement shall be calibrated as recommended by the equipment manufacturer.

The surface shall be cleaned and prepared as per hardness test instrument manufacturer's recommendation prior to hardness survey. Hardness survey shall be done on each joint at three locations along the circumference. At each location three readings shall be taken on weld and parent metal. The readings on the parent metal shall be taken within 15mm from the edge of the weld. All the hardness values shall be recorded.

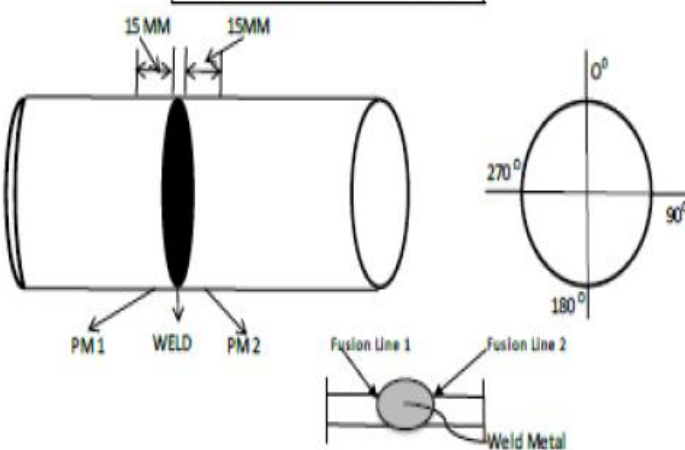
The hardness of the weld metal and the base metal in the soak band (heating band), excluding welding heat-affected zone shall be between 160HB & 300HB for Gr.91 and Gr.92 joints. The hardness measurements shall be recorded in the format as given in Annexure IX. Joints having hardness above 300HB shall be re-heat treated

and hardness shall be checked again. If hardness is still more, the case shall be referred to concerned MUs/ECs. In case Hardness falls below 160HB also, the case shall be referred to the concerned MUs/ECs.

Cautionary note: To achieve meaningful and consistent hardness results, below recommendations should be followed:

- The accuracy of the instrument shall be verified prior to use.
- The surface to be tested shall be reasonably flat and free of scale and oxides, grease, paint, etc.
- Prior to hardness test, the de-carburized surface layer with a thickness up to 0.8mm shall be removed by grinding/buffing, without encroaching the specified minimum wall thickness of the pipe/tube.

ANNEXURE IX – HARDNESS MEASUREMENT

		BHARAT HEAVY ELECTRICALS LTD	
T91/T92/P91/P92/F91/F92/C12A HARDNESS TESTING PROTOCOL			
PROJECT NAME :	UNIT No. :	Customer Name :	
Report No.:	Date :	Contractor :	
Description :	Specn :	Stage of test : After PWHT	
Calibration Block No.:	Equipment details:		
PGMA :	Model No :		
JOINT NO. :			
Location	PM 1	WELD	PM 2
Readings	AVERAGE OF 3 READINGS	AVERAGE OF 3 READINGS	AVERAGE OF 3 READINGS
12 O'Clock/ 0°			
3 O'Clock/ 90°			
6 O'Clock/ 180°			
9 O'Clock/ 270°			
PM: PARENT MATERIAL (15 MM FROM THE WELD FUSION LINE). ALL AVERAGE READINGS SHOULD BE LESS THAN THE PERMISSIBLE HARDNESS VALUE.			
HARDNESS TEST LOCATIONS SKETCH 			
Gap between successive reading shall be 1mm in the same spot			
RECOMMENDATION / RESULT : ACCEPTED / NOT ACCEPTED / RE-PWHT			
	AGENCY	NAME	SIGNATURE & DATE
INSPECTED BY	CONTRACTOR		
CHECKED BY	BHEL		
WITNESSED BY	CUSTOMER		

13.0 COMBINATION WELDING:

For other combination of materials with Gr.91/Gr.92, the applicable WPS for the same shall be obtained from concerned MUs/ECs.

14.0 DEMAGNETIZATION:

Refer NDE Manual BHEL:PS:NDM:latest Chapter 1.10

15.0 TRAINING:

15.1 The personnel engaged in P91 piping fabrication shall be trained in the following areas.

- a. Method and care to be taken during fit-up.
- b. Argon gas root purging arrangement.
- c. Fixing of thermocouple and wires.
- d. Arrangements for Pre/Post heating requirements and methods.
- e. Adjustment of heating pads/cables at the time of controlling the temperature within specified tolerance limits during welding or PWHT in case of induction heating.
- f. Good knowledge of the WPS requirements.
- g. Handling of P91 welding consumables and re-drying conditions.
- h. Special precautions to be taken during the power/equipment failure.
- i. Weld joints of dissimilar thickness / material specification.
- j. Weld defect control and weld repair systems.

15.2 **Specific training for welders:**

- a. The qualified welders who will be engaged in P91 welding shall be given training on pipe joints simulated with P91 welding and heating cycle conditions.
- b. The acquaintance on welding positions, as applicable shall be given using P91 pipes and P91 welding consumables.
- c. Welding techniques and instructions on Dos and DON'Ts of P91 welding.
- d. Welders only who are qualified on P91 welding alone shall be engaged.
- e. Whenever new welders have to be engaged they shall undergo all the training as above and shall be qualified with P91 material only.

16.0 CONTROL ON WELDERS:

The welder during welding at site follow the following procedures. The welder shall interact with the HT operator (Induction equipment operator) to ensure that preheat and inter-pass temperature during welding are maintained as per requirements. The

welder shall not mix the welding electrodes with that of the other welder. At the end of the shift, the unused electrodes shall be returned to the stores.

17.0 PERSONNEL / CONTRACTORS ENGAGED FOR HEATING CYCLES (HT OPERATOR):

17.1 The Personnel / Contractor shall have adequate heat treat experience on P91 or similar material.

17.2 HT operator shall be aware of the following:

- a. The equipment used and its working principle and operation.
- b. The procedures to be followed in using heating equipment.
- c. Procedure to be followed in case of power failure or equipment non-functioning so that heating cycle is not disrupted.
- d. Calibration of equipment.
- e. Method of fixing thermocouples and compensating cables leading to HT recorder.
- f. Fixing of heating pads or elements on the pipe joints and also in maintaining the temperature within the specified limits.

18.0 NDE PERSONNEL QUALIFICATIONS:

All NDE personnel performing NDT like UT & MPI/LPI shall be qualified in accordance with BHEL Procedure meeting the requirements of recommended practice SNT-TC-1A. MPI & LPI shall be carried out by level I qualified personnel and shall be evaluated by level II qualified personnel. However UT examination and evaluation shall be done by level II qualified personnel.

19.0 LEVEL OF SUPERVISION

Site In charge shall be responsible for the completion of all activities from weld fit-up to final clearance of weld joints after satisfactory NDE and acceptance by BHEL/Customer/IBR.

20.0 DO'S AND DON'T'S DURING P 9 1 /P 92 /F9 1 /F92 /C1 2 A WELDING.HEAT TREATMENT AND NDE AT CONSTRUCTION SITE:

20.1 DO ' S:

- a. Cutting by Band saw/Hack saw/Machining.
- b. Pipes Edge Preparation by machining. Machining shall be done without excessive pressure to prevent heating up of pipe
- c. Grinding may be done on exceptional cases after approval and taking adequate care to prevent overheating.

- d. Thermocouple wire (hot/Cold junctions) shall be welded with capacitor discharge portable spot-welding equipment.
- e. Reserve Thermocouples shall be made available, in case of failure of connected thermocouple elements.
- f. Ensure adequate Argon Gas for complete purging of air inside the pipe before starting GTAW root welding.
- g. Ensure Preheating at 220 °C minimum before GTAW root welding.
- h. Start preheating only after clearance from Welding engineer / Quality assurance engineer for weld fit-up and alignment of the joint as well as fixing of Thermocouple connections (for Induction heating)
- i. Do visual inspection on root weld maintaining weld preheating temp.
- j. Continue Argon purging until the GTAW root welding followed by minimum two filler passes of SMAW, is completed.
- k. Perform partial root welding to facilitate fit-up if necessary.
- l. Ensure proper use of TIG wires as identified by color coding or suitable hard punching.
- m. Keep the GTAW wires in absolutely clean condition and free from oil, rust, etc.
- n. Dry the SMAW electrodes before use.
- o. Ensure the inter-pass temperature is less than 350°C.
- p. Hold at 80-100°C for a period of Minimum 1 hour before the start of PWHT.
- q. Record entire heating cycle on Chart through recorders.
- r. Exercise control during grinding of weld and adjoining base metal while removing surface/sub-surface defects or during preparation for NDE.
- s. Ensure no contact with moisture during preheat, welding, post heat and PWHT of Weld Joints.
- t. Ensure removal of argon purging arrangements after welding.
- u. Use short Arc only. The maximum weaving shall be limited to 1.5 times the Dia. of the electrode.

20.2 **DO N' T' s:**

- a. Avoid Oxy-Acetylene flame cutting.
- b. Avoid Weld-build up to correct the weld end-d1 or to set right the lip of the weld bevel.
- c. Avoid Arc strike on materials at the time of weld fit up or during welding.
- d. Do not Tack weld the Thermocouple wires with Manual Arc/TIG welding.
- e. NO GTAW root welding without thorough purging of root area.
- f. Do not use Oxy-acetylene flame heating for any heating requirements.
- g. Do not use Thermal chucks on the weld groove.

- h. Do not stop argon purging till completion of GTAW root welding and two layers of SMAW.
- i. No Tack welding or Bridge piece welding is permitted.
- j. Do not use unidentified TIG wires or electrodes.
- k. Do not exceed the maximum interpass temperature indicated in WPS
- l. Do not allow moisture, rain, water, cold wind, cold draft etc. to come in contact with the weld zone or heating zone during the entire cycle from preheat to PWHT.
- m. Do not exceed the limits of PWHT soaking temperature.
- n. Do not Interrupt the Welding/heating cycle except for unavoidable power failures
- o. Do not use un-calibrated equipment for temperature measurement during heating, welding, post weld, heat treating etc.

21.0 DOCUMENTATION:

The documentation shall be as per the approved Quality Plan.

CHAPTER – B3
ERECTION WELDING PRACTICES
FOR SA 213 T91/T92 MATERIALS

1.0 SCOPE:

- 1.1 This document details out the practices to be adopted during welding of SA213 T91/T92 material.

2.0 MATERIAL:

- 2.1 Tube materials shall be identified as follows:-

- a) Colour codes given by the Manufacturing Units (MU).
- b) Paint / Stencil: WO DU, as per the relevant drawing & document.

- 2.2 When any defect like crack, lamination, and deposit noticed during visual examination, the same shall be confirmed by Liquid Penetrant Inspection. If confirmed, it shall be referred to unit.

3.0 ERECTION:

3.1 Edge preparation and Fit up:

- 3.1.1 Cutting of T91/T92 material shall be done by band saw/hacksaw/machining/ grinding only. Edge preparation (EP) shall be done by grinding/machining. During machining/ grinding, care should be taken to avoid excessive pressure to prevent heating of the tube edges.

- 3.1.2 The weld fit-up shall be carried out to ensure proper alignment and root gap. Neither tack welds nor bridge pieces shall be used to secure alignment. Use site fabricated clamps for fit up. Ensure that coil load does not come on stubs/header. Coil load shall be transferred to the crown plate/ end bar assembly. The necessary purging and preheat shall be done as per clause 3.3 and 5.0 respectively.

3.2 Fixing of thermocouple (TC) and heating elements during preheating and PWHT

- 3.2.1 Heat Treatment Manual (AA/CQ/GL/011/ PART II-HTM-Latest), Chapter 1, Clause no. 3.1.1, 3.1.5, 3.2.1, 3.2.2, 3.2.6 & 3.2.7 shall be referred for guidelines for fixing of thermocouples and heating elements on the jobs.

3.3 Arrangement for purging:

- 3.3.1 Argon gas with requisite quality shall be used for purging the root side of weld. The purging dam (water soluble paper) shall be fixed on header nipple side of the weld bevel prior to fit-up and pre-heating. Purging is to be done from cross over tube downstream end. (Refer Figure B3.2 and B3.3). Ensure that atmospheric air is completely purged out through the root gap before starting welding and welding can be continued with Argon backing. The flow rate which shall be maintained for purging is 6 to 8 litres per minute.

- 3.3.2 When root temperature reaches 220°C, start purging through cross over tube downstream end for 5 minutes. Then the root gap is to be covered by insulating material. Continuous and adequate argon gas shall be provided to ensure complete

purging in the root area. Only water-soluble paper is to be used. Plastic foils that are not water-soluble are NOT acceptable.

3.3.3 Usage of water soluble paper:

3.3.3.1 The dams can be made of water-soluble paper /water soluble tissue paper for creating the purging chamber. The advantage in such dam arrangement is that the dissolving paper dam gets flushed during hydraulic test. The following is the method to be used:

3.3.3.2 Stuff the water-soluble paper/ water soluble tissue paper into the Header Nipples at a distance of 60mm(approximately) from the weld end as per attached Figure B3.1

4.0 WELDING/WELDERS QUALIFICATION:

4.1 Welders Qualified as per IBR and qualified at site with Gr.91/Gr.92 material only shall be engaged. Welders log book shall be maintained and welders performance shall be monitored by site engineer. The applicable WPS as per FWS shall be followed for welder qualification and welding.

5.0 PREHEATING (Bunching of tubes can be followed):

5.1 Heat Treatment Manual (AA/CQ/GL/011/ PART II-HTM-Latest), Chapter 1, Clause 3.1 shall be referred for guidelines for preheating.

6.0 WELDING:

6.1 Welding shall be done as per the WPS. Filler wire shall be clean and free from rust or oil. Argon Purging shall be continued till completion of welding in case of full GTAW and for minimum two filler passes of SMAW in case of GTAW + SMAW.

7.0 POST WELD HEAT TREATMENT (PWHT) – RESISTANCE HEATING

METHOD(Bunching of tubes can be followed):

7.1 Heat Treatment Manual (AA/CQ/GL/011/ PART II-HTM– Latest), Chapter 1, Clause no. 3.2.12 shall be referred for guidelines on PWHT.

8.0 HARDNESS SURVEY:

8.1 100% hardness survey shall be conducted on welds and parent material in first five coils. Based on satisfactory results, the hardness survey can be reduced to 10% covering each heat treatment cycles as per FWS requirement. The equipment recommended to measure the hardness is EQUOTIP or equivalent. Portable equipment used in the hardness measurement shall be calibrated.

8.2 The surface shall be cleaned and prepared as per hardness test instrument manufacture's recommendation prior to hardness survey. Hardness survey of weld and parent metal (both tubes) shall be carried out. The hardness shall be between 160HB & 300HB. The hardness measurements shall be recorded in the format as given in Annexure IX. Joints having hardness above 300HB shall be re-heat treated and hardness shall be checked again. If hardness is still more, the case shall be

referred to concerned MUs. In case Hardness falls below 160HB also, the case shall be referred to the concerned MUs.

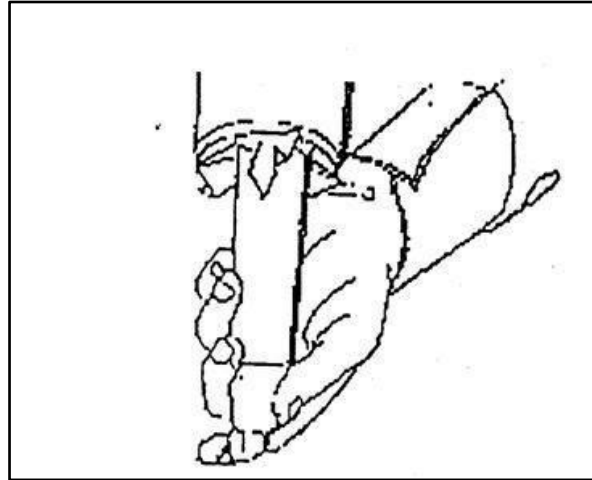


Figure B3.1: Insertion of Water Soluble Tissue paper

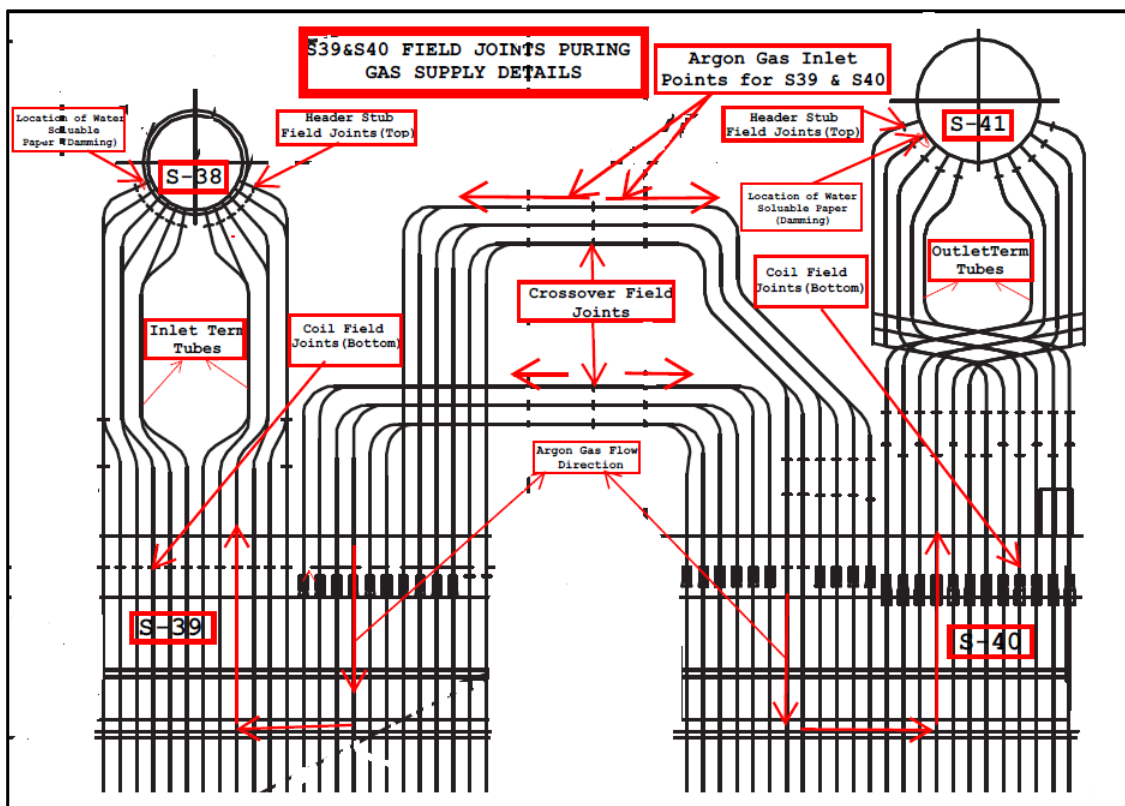


Figure B3.2: Purging Arrangement for SH Header Field Joints

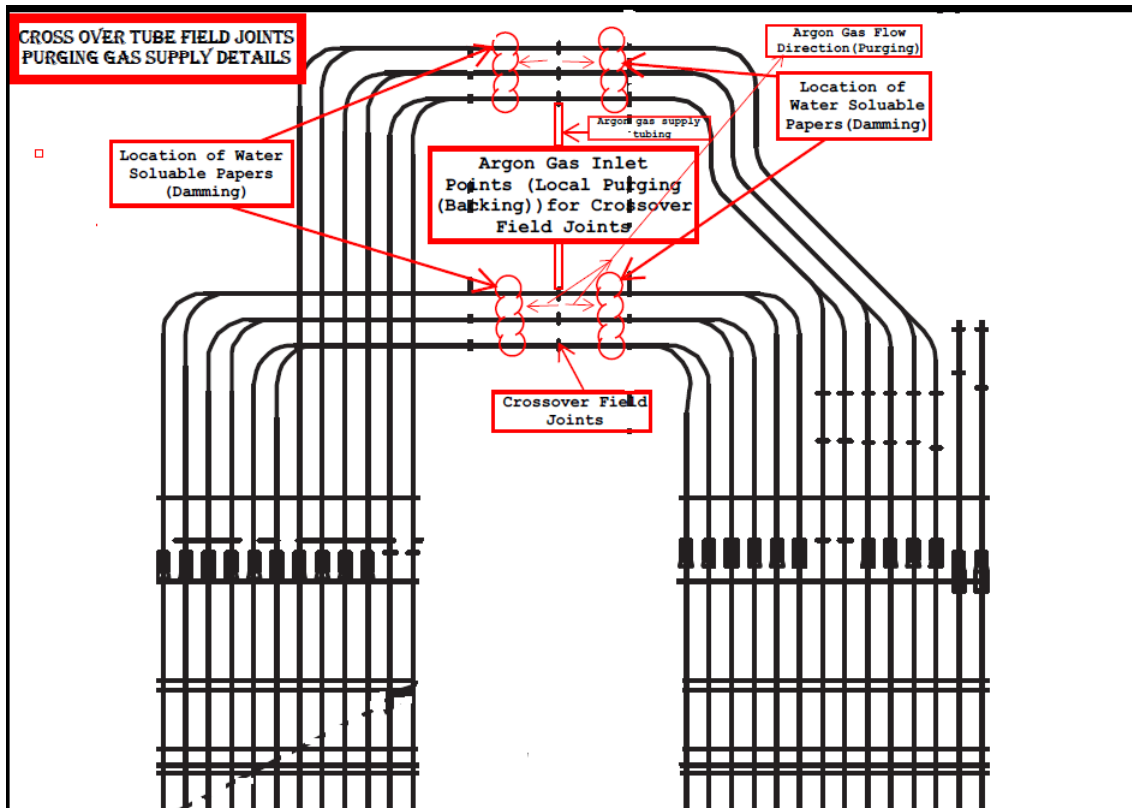


Figure B3.3: Purging Arrangement for Cross Over Tube Field Joints

CHAPTER –B4
ERECTION WELDING PRACTICES
FOR SA213 T23 MATERIAL

1.0 SCOPE:

1.1 This procedure is applicable for the welding of T23 tubes at sites.

2.0 Ensure the availability of the following items/characteristics before preparing the joint for welding:

- a) LPG gas (for heating in case of interruption in preheating)
- b) Grinding machine
- c) Mini cutter
- d) Conical grinder
- e) Proper illumination
- f) Thermal chalk or pyrometer
- g) Torch light
- h) Portable Oven
- i) Hacksaw and chisel

3.0 PROCEDURE:

The following procedure shall be followed for T23 Welding at Site:

- 3.1 Clean the edges of the tube, both OD & ID by buffing upto 30 mm from the edge of the tube.
- 3.2 Create a purging dam on both tubes at about 200 to 250 mm away from the joint before fit-up.
- 3.3 Fit-up the tubes for butt joint with a root gap of 2 to 2.5 mm and ensure a land of 1 to 1.5 mm.
- 3.4 Set up Argon purging for the tube to tube butt joint.
- 3.5 Carryout preheating by wrapping heating pads/coils uniformly for a width of 200 mm on both sides of the joint. Each tube should be provided with a thermocouple (K type) at a distance of 75 mm from the joint.(Refer Figure B4.1, B4.2 & B4.3)
- 3.6 Preheat the joint to a minimum of 200°C and ensure the same with a thermal chalk or a pyrometer before the start of welding.
- 3.7 Ensure drying of SMAW electrodes at 250 to 300°C for 2 hours and keep them at a temperature of 150°C in a Holding oven after drying.
- 3.8 The electrodes shall be maintained dry at 65 to 100 °C in a portable oven after issue from the holding oven till use.
- 3.9 Perform welding as per applicable WPS using IBR qualified welders.
- 3.10 Ensure the welding of root and second pass by TIG welding process and further layers by SMAW process. Alternatively, the entire joint may be welded by TIG process using the applicable WPS.
- 3.11 Maintain the Interpass temperature at 350°C max. Ensure the same using thermal chalk or pyrometer after each pass of welding.
- 3.12 Conduct post heating on the completed weld at 250 to 280°C for a minimum of 1 hour immediately after completion of welding and then allow the joint to cool in air to ambient temperature.(Refer Figure B4. 4)

- 3.13 Perform RT to ensure that the joints are defect free.
- 3.14 If RT reveals any unacceptable defect, cut the joint and put a spool piece in place for a minimum length of 200 mm. Repeat the procedure from step 3.1 to 3.13.
- 3.15 Perform PWHT on the weldment within 7 days after post heating.
- 3.16 Use only calibrated PWHT accessories (thermocouples, temperature recorder, etc.).
- 3.17 Use only ceramic resistance pads with low voltage heating arrangement for PWHT.
- 3.18 Ensure the PWHT arrangement to meet the following conditions;
- 3.19 When heat treating butt welds, the width of the circumferential heating band on either side of the weld must be at least 3 times the width of the widest part of the weld groove but not less than twice the thickness of the thicker part welded. The width of the insulation band shall be at least twice the total width of the heating band.
- 3.20 Ensure wrapping of heating pads, location of thermocouples before covering with insulation.(referFigure B4.5& B4.6)
- 3.21 PWHT shall be carried out with 1 thermocouple per joint.
- 3.22 PWHT time and temperature shall be as per applicable WPS.
- 3.23 Measure hardness on the joint and ensure it to be within 160 to 260 HB. If hardness exceeds 260 HB, PWHT shall be repeated and hardness checked. The total no. of PWHT cycles shall not exceed 3 times for a joint.
- 3.24 In case the hardness measures above 260HB even after 3 PWHT cycles, cut the joint and put a spool piece in place for a minimum length of 200 mm. Repeat the procedure from step 3.1 to 3.23. In case the hardness measures below 160HB, it shall be referred to the MUs.

4.0 DOCUMENTATION:

Record the details of welding carried out in correlation to welders, heat treatment and NDE reports.



Figure B4.1: Preheating by Resistance coil winding



Figure B4.2: K - Type Thermocouple



Figure B4.3: Preheating arrangement with thermocouples in place



Figure B4.4: Post heating arrangement



Figure B4.5: Heating pads in place for PWHT



Figure B4.6: PWHT in progress

GUIDE LINES FOR HEAT TREATMENT

IMPORTANT NOTE

THIS GUIDELINES FOR HEAT TREATMENT PROVIDES BROAD BASED GUIDELINES FOR CARRYING OUT HEAT TREATMENT WORKS AT SITES. HOWEVER, SITES SHALL ENSURE ADHERENCE TO THE PRIMARY DOCUMENTS LIKE CONTRACT DRAWINGS, FIELD WELDING SCHEDULES, WELDING PROCEDURE SPECIFICATIONS, PLANT / CORPORATE STANDARDS, STATUTORY DOCUMENTS, CONTRACTUAL OBLIGATIONS, AS APPILCABLE AND SPECIAL INSTRUCTIONS, IF ANY, ISSUED BY RESPECTIVE MANUFACTURING UNITS SPECIFIC TO THE PROJECTS.

Table of Contents

Chapter	Description	Page No.
	Cover Sheet	1
	Important Note	2
	Table of Contents	3
1	Heat Treatment Procedure - Boiler and Auxiliaries	4
2	Heat Treatment Procedure - Piping with Turbine & Auxiliaries	19
	List of Annexures	21
	List of Tables	21
	List of Figures	21

CHAPTER-1
HEAT TREATMENT PROCEDURE -
BOILER AND AUXILIARIES

1.0 SCOPE:

- 1.1 This procedure provides information, method and control for Pre-Heat, Post Heat and Post Weld Heat Treatment (PWHT) of welds of boiler and piping components at sites.

2.0 DOCUMENTS:

- 2.1 The following documents are referred in preparation of this procedure:

- ASME Sec I & Sec IX
- ASME B31.1
- Indian Boiler Regulations
- AWS D1.1
- BHEL Welding Manual (AA/CQ/GL/011/ Part I-WM – Latest)

- 2.2 The following are to be referred as Primary Documents:

- Contract drawings
- Field Welding Schedule or equivalent
- Plant / Corporate standards, wherever supplied
- Welding procedure specification
- Contractual obligations, if any

- 2.2.1 Where parameter for Pre-Heat, Post Heat and PWHT are not available in the primary documents, reference may be made to this procedure.

- 2.2.2 Where such parameters are not contained either in the primary documents or in this procedure, reference may be made to Manufacturing Units.

3.0 PROCEDURE:

3.1 Preheating & Post heating:

- 3.1.1 Prior to start of preheating, ensure that surfaces are clean and free from grease, oil and dirt.

Preheating temperature shall be maintained as per applicable WPS. Preheating shall be checked and recorded, using thermal chalks/ crayons or pyrometers in case of tubes other than T91/T92/T23. For all other components including T91/T92/T23 tube joints, the preheat temperature shall be ensured by using a calibrated chart recorder and two calibrated thermocouples fixed at 0° and 180° positions on both sides of the joint. Preheating shall be checked at a distance of 1.5 times the part thickness or 75mm (whichever is greater) from weld end. The thermocouple shall be fixed using the capacitor discharge welding machine. The preheating arrangements shall be inspected and approved by site engineer.

- 3.1.1.1 Bunching of tubes for Preheating:

Where a bunch of closely placed tube welds (e.g. Super Heater / Reheater Coils) requires to be preheated, the same may be grouped together as if they form a single component. The maximum number of tubes bunched together in such cases shall be limited to 12. Each joint

within the bunch shall have at least one thermocouple fixed near the joint for preheat monitoring.

- 3.1.2 When parts of two different thicknesses are welded together, the preheating requirements of the thicker part shall govern.
- 3.1.3 When parts of two different P numbers are joined together, the material requiring higher preheat shall govern (please refer Tables A2.1 to A2.7 of Welding Manual, AA/CQ/GL/011/ PART I-WM – Latest, for P numbers).
- 3.1.4 In case of any power interruption during welding, the joint shall be wrapped with dry thermal insulating blankets to ensure slow and uniform cooling. **Requirement of uninterrupted power supply shall be ensured for materials like Gr.91, 92 & 23 and BS EN 10025**
- 3.1.5 Preheating & Post Heating Methods:
 - 3.1.5.1 Preheating & Post heating shall be applied by any of the methods given below:
 - a) Electrical resistance heating
 - b) Induction heating
 - c) LPG burners
 - 3.1.5.2 Preheating/post heating using cutting/ heating torches with oxy-acetylene flame is not permitted.
- 3.1.6 In addition, the following requirements shall also be followed:
 - 3.1.6.1 Alternate burner arrangements shall be made for preheating/post heating during power failure to maintain the required temperature.
 - 3.1.6.2 Two additional spare thermocouples shall be fixed for emergency use.
 - 3.1.6.3 Preheating/Post heating shall be done locally BY heating a circumferential band covering the parent material away from the weld groove by induction or electrical resistance heating. The heating element (Coil/Finger/Ceramic Pad) placed on the heating band shall be closely packed without any gaps between the element. The area shall be free of grease, oil etc. prior to preheating/post heating.
- 3.2 **Post Weld Heat Treatment (PWHT):**
 - 3.2.1 PWHT shall be done by locally heating a circumferential band covering the entire weld and adjacent area of base metal, by induction or electrical resistance heating. The heating element (coil/ finger element/ pad) placed on the heating band shall be closely packed without any gaps between the elements. The area shall be free of grease, oil etc. prior to PWHT.
 - 3.2.1.1 Unless otherwise specified in the FWS/WPS, the PWHT parameters shall be as per the Tables 1.1, 1.2, 1.3, 1.4.
 - 3.2.2 **Heating and Insulation band for PWHT:**

- 3.2.2.1 When heat treating butt joints, width of the circumferential heating band on either side of the weld must be at least 3 times the width of the widest part of the weld groove; but not less than twice the thickness of the thicker part being welded. When heat treating nozzles and attachment welds, the width of the heating band beyond the welding to be heat treated on either side of weld shall be at least 3 times the base material thickness. The heating band shall extend axially around the entire vessel. Width of the insulation band on either side shall be at least twice the width of the heating band.
- 3.2.2.2 In case of fin welded panels where circumferential winding of the coil is not possible heating elements shall be placed on both sides of the panels
- 3.2.3 Post weld heat treatment temperature cycle shall be measured and monitored by use of thermocouples with calibrated recorders.
- 3.2.4 Where the soaking temperature is found to be lesser than specified, the PWHT cycle shall be repeated.
- 3.2.5 In case of interruption during PWHT, the following actions shall be taken depending on the stage during which interruption has occurred.
- 1) **During heating cycle**
Repeat the whole operation from beginning.
 - 2) **During soaking**
Heat treat subsequently for balance soaking. If the balance soaking time required is less than 15 minutes, soaking time shall be maintained for 15 minutes minimum.
 - 3) **During cooling (above 300 °C).**
If the Rate of Cooling (ROC) during interruption meets the specified rate, cool subsequently at the required rate. Otherwise, reheat to the soaking temperature, hold for 15 minutes and then cool at the specified rate.
- 3.2.6 **Fixing of thermocouple (TC) during preheating, post heating and PWHT:**
- 3.2.6.1 Thermocouples shall be fixed on the job using capacitor discharge welding method. Thermocouple leads shall be attached within 6 mm of each other. A Welding Procedure Specification shall be prepared, describing the low-energy capacitor discharge equipment, the combination of materials to be joined, and the technique of application. No preheating is required. Also Qualification of the welding procedure is not required. The energy output of the welding process shall be limited to 125 W-sec. After temporary attachments are removed, the areas shall be examined by LPI.
- Following are the equipment / facilities for heating cycles.
- (1) Thermo couples: Ni-Cr / Ni-Al of 0.5 mm gauge size (K-Type).
 - (2) Temperature Recorders: 6 Points / 12 Points/ 24 Points.

3.2.6.2 Following are guidelines regarding number and placement of thermocouples:

- Minimum of two thermocouples shall be placed for each joint, 180° apart.
- Thermocouples shall be located at a distance of approximately 1.5 times the parent metal thickness from the weld centre.
- Additionally, one point of the temperature recorder shall be used for recording ambient temperature.
- For placement of thermocouples on P91/P92/F91/F92/C12A Figure 1.1 shall be referred for preheating and Figure 1.2 shall be referred for PWHT.

3.2.6.3 Thermocouple leads shall be suitably insulated to protect the ends from direct radiation from heating elements.

3.2.6.4 The temperature variation between any two thermocouples shall be within 50°C for temperature above 300°C during heating and cooling.

3.2.7 Bunching of tubes for PWHT:

3.2.7.1 Where a bunch of closely placed tube welds (e.g. Super Heater / Reheater Coils) require to be Post weld heat treated, the same may be grouped together as if they form a single component. The maximum number of tubes bunched together in such cases shall be limited to 12. Each joint within the bunch shall have at least one thermocouple fixed near the joint for PWHT temperature monitoring.

3.2.8 Soaking Time:

3.2.8.1 Unless otherwise specified in the FWSMPS, the soaking time shall be calculated as 2.5 minutes per mm of thickness with 30 minutes minimum for tube welds and 60 minutes minimum for other welds. For P1 material, the soaking time shall be calculated as 2.5 minutes per mm of thickness upto 50mm with an additional 15 minutes for every 25mm thickness above 50mm.

3.2.8.2 The following guidelines shall be used to determine the thickness and subsequent selection of the soaking time of PWHT:

- (a) For full penetration butt welds, the nominal thickness is the thinner of the parts being joined.
- (b) For full penetration corner welds, the nominal thickness is the depth of the weld.
- (c) For partial penetration groove and material repair welds, the nominal thickness is the depth of the weld. The total depth of partial or full penetration groove welds made from both sides shall be taken as the sum of the depth of both sides at a given location.
- (d) For fillet welds, the nominal thickness is the weld throat. When a fillet weld is used in conjunction with a groove weld, the nominal thickness is the total of groove depth and fillet throat thickness.

3.2.8.3 Soaking time is to be reckoned from the time temperature of the joint crosses the recommended lower temperature of the cycle, to the time it comes down below the same recommended lower temperature of the cycle.

3.2.9 **Heating and Cooling Rates:**

3.2.9.1 Wherever not specified, the heating rate above 300°C and cooling rate after soaking upto 300°C shall be as follows: This is applicable for all materials except Gr.91/Gr.92 materials for which Cl. 3.2.11.3 shall be referred.

Thickness of Material	Maximum Heating Rate Above 300°C	Maximum Cooling Rate Upto 300°C
≤ 25 mm	220°C/hour	220°C/hour
> 25 ≤ 50 mm	110°C/hour	110°C/hour
> 50 ≤ 75 mm	75°C/hour	75°C/hour
> 75mm	55°C/hour	55°C/hour

3.2.10 **PWHT Job Card:**

3.2.10.1 Prior to start of PWHT operations, a job card shall be prepared including details of weld reference, soaking time, soaking temperature, maximum rates of heating and cooling, temperature recorder details and date of PWHT as per Annexure I of this manual except Gr.91/Gr.92/Gr.23 materials. For P91/P92/F91/F92/C12A/T91/T92/T23 materials Annexures II, III, IV in Chapter A1 of Welding Manual - AA/CQ/GL/011/ PART I-WM – Latest, as applicable, shall be referred.

3.2.10.2 Obtain the clearance for post weld heat treatment cycle from the site engineer.

3.2.10.3 On completion of PWHT, the actual parameters shall be recorded on the job card.

3.2.10.4 A chart number shall be given to each chart and attached to the job card.

3.2.11 **Heat Treatment of P91/P92/F91/F92/C12A welds:**

3.2.11.1 A minimum of four thermocouples shall be placed such that at least two are on the weld and the other two on the base material on either side of the weld within the heating band, 180° apart, at a distance of 50mm (approximately) from the center of the weld joint as per Figure 1.2. Two standby thermocouples shall also be provided on the weld (to be used in case of any failure of the thermocouple).

3.2.11.2 The PWHT temperature shall be 740-770°C and the soaking time shall be 2.5 minutes per mm of weld thickness, subject to a minimum of one hour. All records shall be reviewed by site Engineer prior to PWHT clearance. Heating shall be done by Induction heating only. However for thickness upto 32 mm, Resistance heating may also be used.

3.2.11.3 The rate of heating / cooling (above 300 ° C):-

Thickness up to 50 mm -	110°C / hour (max)
Thickness 50 to 75mm -	75°C / hour (max)
Thickness above 75mm -	55°C / hour (max)

- 3.2.11.4 Welding and PWHT shall be monitored every one hour by site engineer. Job card for PWHT shall be maintained as per Annexure II, Chapter A1 of Welding Manual - AA/CQ/GL/011/ PART I-WM – Latest.

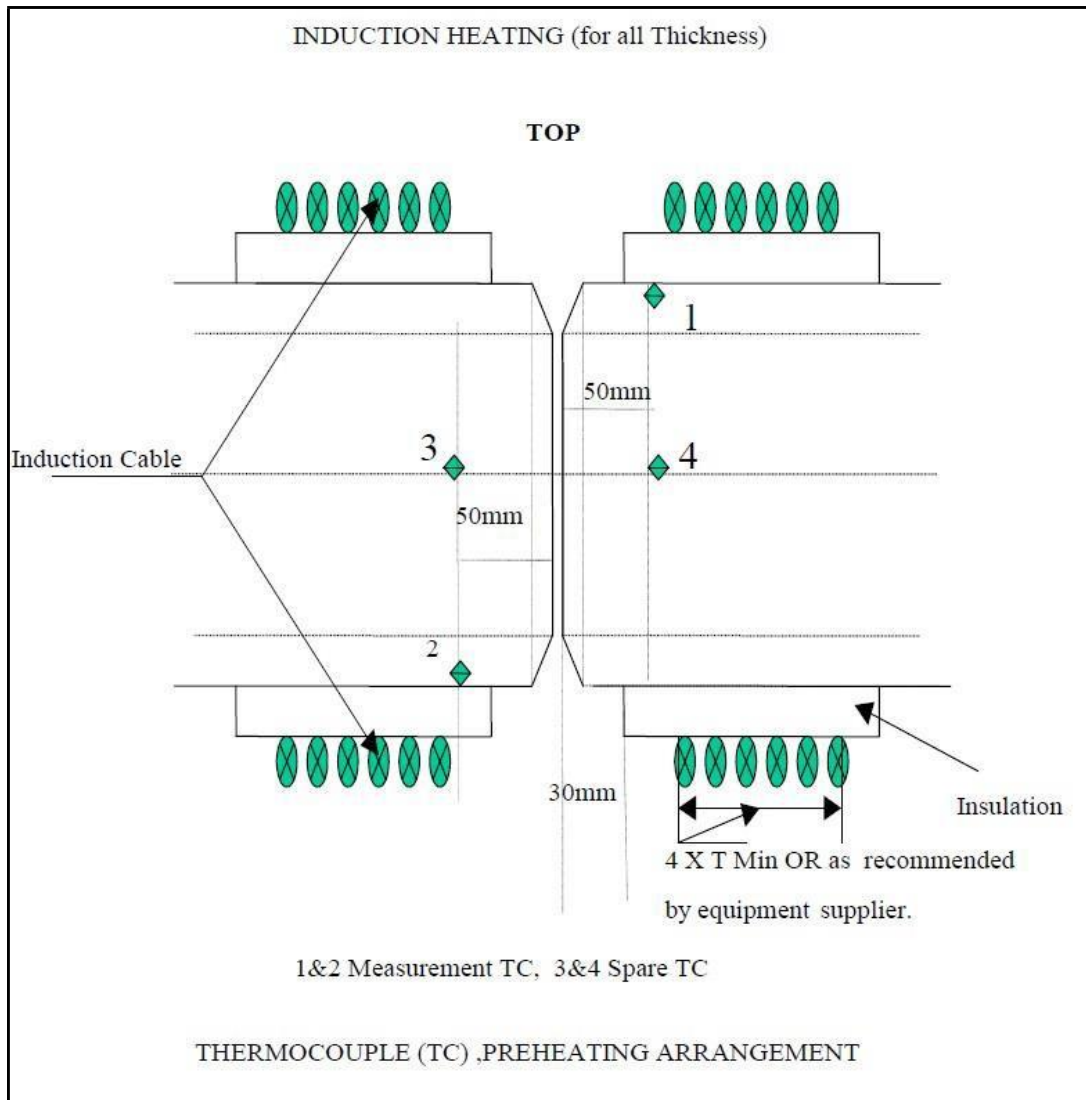


Figure 1.1: Placement of Thermocouples on P91/P92/F91/F92/C12A materials for Preheating

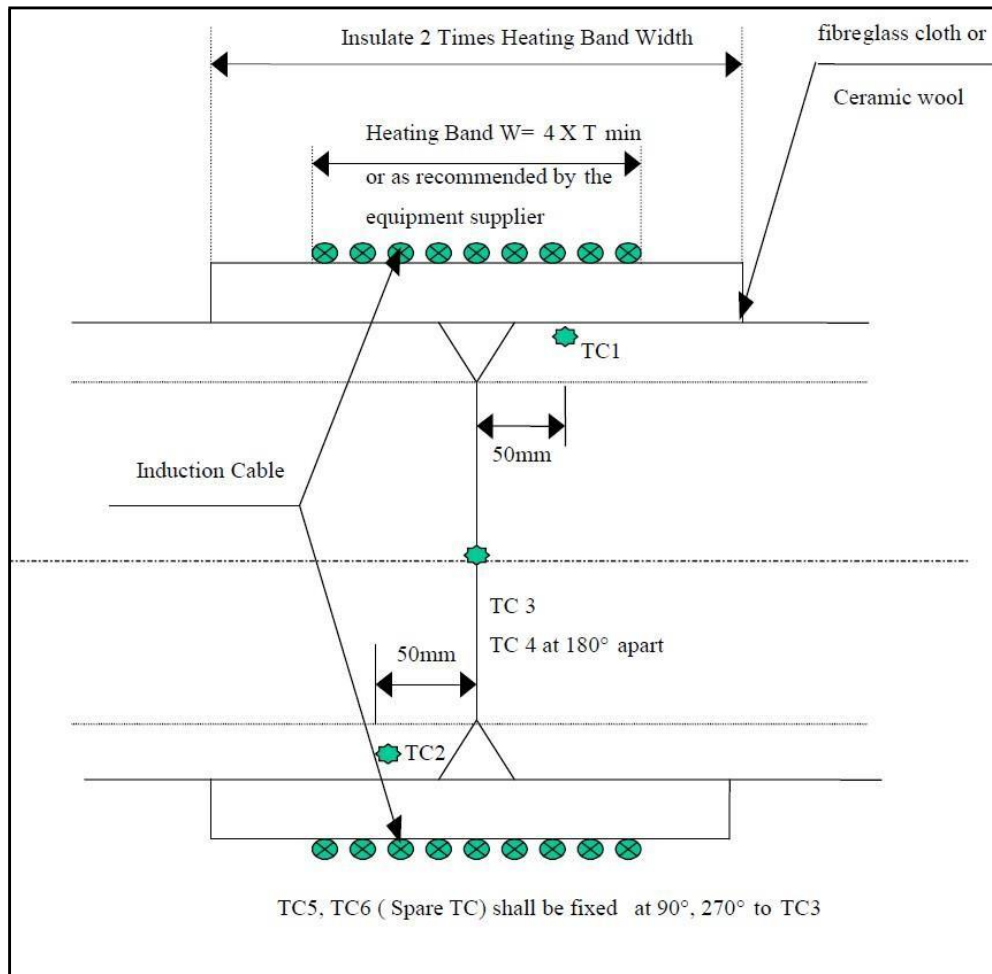


Figure 1.2: Placement of Thermocouples on P91/P92/F91/F92/C12A materials for PWHT

3.2.12 Heat Treatment of T91/T92/T23 welds:

- 3.2.12.1 Heat treatment controls of T91/T92 welds shall be as detailed in Cl. 3.2.1 to Cl.3.2.10 of this Manual.
- 3.2.12.2 Figure 1.2 & 1.3 of this manual shall be referred for Resistance heating coil arrangement for Preheating and PWHT of T91/T92 tube assembly.
- 3.2.12.3 The PWHT temperature shall be 730-760°C and the soaking time shall be 2.5 minutes per mm of weld thickness, subject to a minimum of 30minutes. All records shall be reviewed by site Engineer prior to PWHT clearance.
- 3.2.12.4 The rate of heating / cooling (above 300 ° C) for T91/T92 welds shall not exceed 140°C/hour.
- 3.2.12.5 Heat treatment controls of T23 welds shall be as detailed in Chapter B4 of Welding Manual - AA/CQ/GL/011/ PART I-WM – Latest.

3.3 Heat Treatment of Components /Systems other than Boiler and Piping:

- 3.3.1 Preheating, post heating and PWHT methodologies and parameters shall be as recommended by the concerned equipment suppliers.

3.4 Heat Treatment Operator Requirements:

The operator for the Heat Treatment shall be a qualified technician and shall be conversant in the operation & maintenance of heat treatment machines & process. He shall be trained by the concerned Site Engineer in order to operate and maintain the equipment and carry out the process properly.

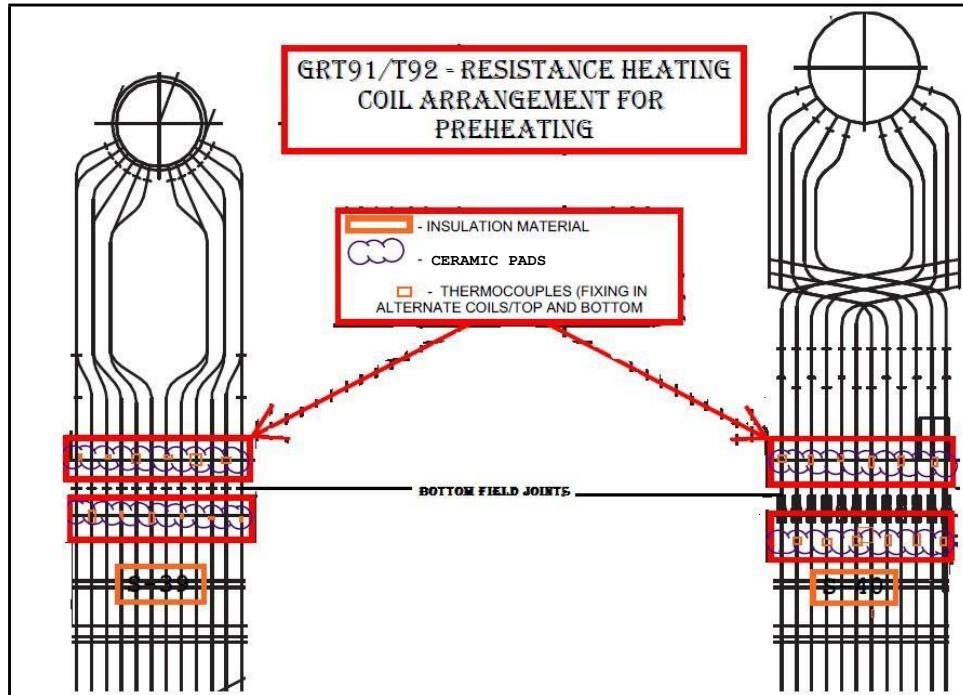


Figure 1.3: Resistance heating Coil arrangement for Preheating of T91/T92 tube assembly

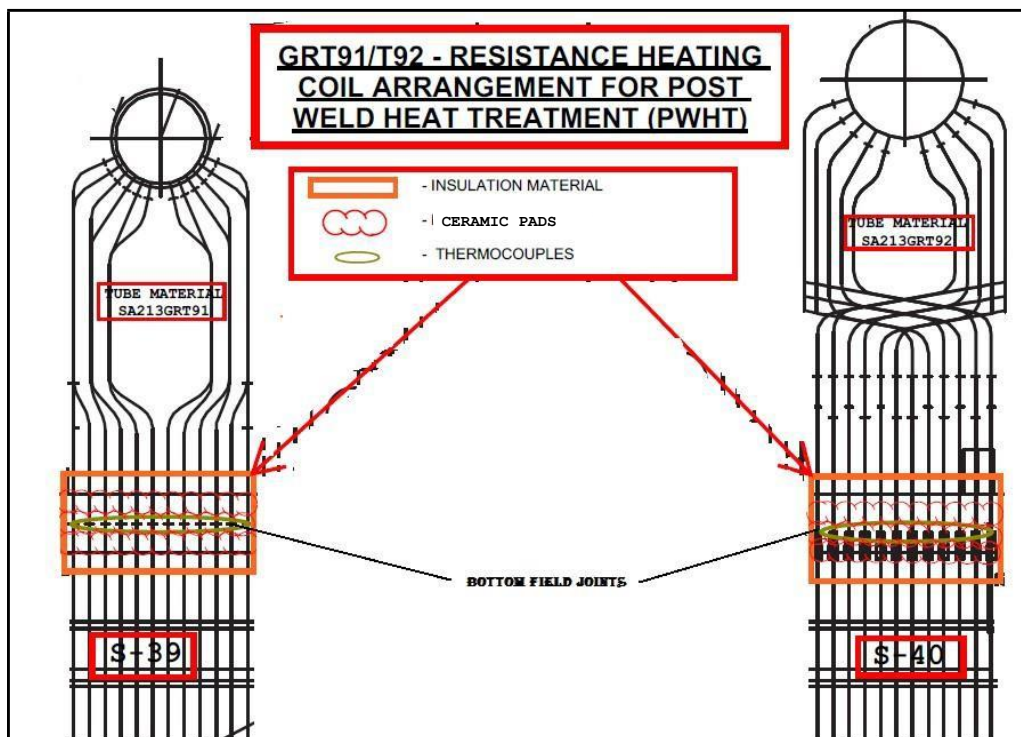


Figure 1.4: Resistance heating Coil arrangement for PWHT of T91/T92 tube assembly

3.5 List of Tables:

- Table-1.1: Weld preheat and PWHT for tubes and pipes outside diameter ≤ 102 mm.
- Table-1.2: Weld preheat and PWHT for Boiler Header welds.
- Table-1.3: Weld preheat and PWHT for pipes outside diameter > 102 mm.
- Table-1.4: Pre-heat and PWHT for Non-Pressure Parts including Structural.

4.0 RECORDS:

Relevant records like Job card and HT Charts shall be maintained by the Site Engineer till the closure of the project. The records may be handed over to the customer at the time of project closure if required by the contract

ANNEXURE I: PWHT JOB CARD

POST WELD HEAT TREATMENT (PWHT) JOB CARD

Project: _____

Card No. : _____ Date : Unit

No. : _____ Package :

Description: Temp. Recorder Details :

Weld Reference : _____ 1. Make : _____

Material Spec. : _____ 2. Type : _____

Size: Dia. mm _____ 3. Sl. No. _____

Thick (t) mm _____ 4. Chart speed: _____ mm / hour

NDE Cleared on : _____ 5. Calibration Due on : _____

Report No. : _____

Thermocouple Locations :

Minimum 2

Distance of TC from the weld centre =

Heating Band =

Insulation Band =

Date of PWHT Chart No. : _____

Start Time : _____ End Time :

	Required	Actual		
Rate of Heating (Max) °C/h				
Soaking Temperature °C				
Soaking Time (Minutes)				
Rate of cooling (Max)° C				

Ambient temperature recorded on the PWHT Chart: _____

TABLE – 1.1
WELD PRE HEAT AND PWHT FOR TUBES & PIPES
OUTSIDE DIAMETER ≤ 102 mm
(Applicable for Butt Welds and Socket Welds)

P. No. of Material	Thickness (mm)	Preheat (°C)	PWHT (°C)
P1 Gr 1	≤ 19	Nil	Nil
P1 Gr 2 (C $\leq 0.25\%$)	≤ 19	Nil	Nil
P1 Gr 2 (C $> 0.25\%$)	≤ 9	Nil	Nil
	> 9	Nil	595-625
P3 Gr 1	≤ 13	Nil	Nil
P3 Gr 2	> 13	100 (Note 1)	620 - 650
P4 Gr 1	≤ 13	150	Nil
	> 13	150	650 - 670
P5 A Gr 1	≤ 8	150	Nil
	> 8	150	680 - 710
P15 E Gr 1 (Gr. 91 & Gr.92)	All	220	730 - 760
SA 213 T23	All	220	730 - 760
P8	All	Nil	Nil

Note 1: Pre-heating is necessary for t >16mm.

TABLE – 1.2
WELD PREHEAT AND PWHT FOR BOILER HEADER WELDS
(Applicable For Welding of Header to Header Joints)

P. No. of Header Material	Thickness (mm)	Preheat °C	Post Heating °C	PWHT °C
P1Gr 1	$t \leq 19$	Nil	Nil	Nil
	$19 < t \leq 25$	Nil	Nil	595 - 625
	$25 < t \leq 75$	100	Nil	595 - 625
	$t > 75$	150	Nil	595 - 625
P1Gr 2	$t \leq 19$	Nil	Nil	620 – 635
	$t > 19$	150	150 for 2 hours	620 – 635
P4 Gr 1	All	150	Nil	650 - 670
P5 A	All	150	250 for 2 hours	680 - 710
P15E Gr1 (Gr 91 & Gr 92)	All	220	Nil	740 - 770
P15 E Gr1 + P5 A	All	220	Nil	730-760
T23	All	220	250 for 1 hour	730 - 760

TABLE – 1.3
WELD PREHEAT AND PWHT FOR PIPES
OUTSIDE DIAMETER >102 MM

P No. of Material	Thickness (mm)	Butt Welds		Stub and Attachment welds				Post heat °C
		Preheat °C	PWHT °C	Throat ≤ 19 mm		Throat > 19 mm		
				Preheat °C	PWHT °C	Preheat °C	PWHT °C	
P1 Gr 1	≤ 19	Nil	Nil	Nil	Nil	Nil	595 - 625	Nil
	>19≤25	Nil	595 - 625	Nil	595 - 625	Nil	595 - 625	Nil
	>25≤75	150	595 - 625	150	595 - 625	150	595 - 625	Nil
	>75	150	595 - 625	150	595-625	150	595 - 625	Nil
P1 Gr 2	≤9	Nil	Nil	Nil	Nil	Nil	595 - 625	Nil
	>9≤19	Nil	595 - 625	Nil	595 - 625	Nil	595 - 625	Nil
	>19	150	595 - 625	150	595 - 625	150	595 - 625	150 for 2 hrs
P4 Gr 1	All	150	640-670	150	640-670	150	640-670	Nil
P5 A	All	150	680 - 710	150	680-710	150	680-710	250 for 2 hrs
P15 E Gr1	All	220	740-770	220	740-770	220	740-770	NA
P15 E Gr1 + P5 A	All	220	730-760	220	730-760	220	730-760	NA

For butt welds of different P group combinations, PWHT temperature may be as follows:

P1 + P3 - 620 to 650°C

P1 + P4 - 640 to 670°C

P4 + P5A- 680 to 710°C

(For other P Group combinations, refer to Manufacturing unit)

TABLE – 1.4
PREHEAT AND PWHT FOR NON PRESSURE PARTS INCLUDING STRUCTURALS

P. No. of Material / Material Specification	Gas Cutting		Welding		
	Thickness (mm)	Preheat °C	Thickness (mm)	Preheat (°C)	PWHT (°C)
P1 / IS 2062 E250 BR, E350 BR,E350C	> 50	Nil 100	> 63	Nil 100 150	595-625 1.0 All butt welds > 50 mm thick 2.0 For Ceiling girders if thickness > 50 mm 3.0 No HT required for web to flange fillet welds.
BS EN 10025 Gr 420 N (Ceiling Girder)	All	220	All	220	620 – 650
P3 Gr 1 and Gr 2	T>25	150	All	150	620-650 a) All butt welds in tension member b) All butt welds of fabricated components > 16mm thick and fillet welds with throat thickness > 13 mm
P4 Gr 1	All	150	All	150	650-680 a) All butt welds in tension member b) All butt welds of fabricated components > 16mm thick and fillet welds with throat thickness > 13 mm
P5A Gr 1	All	150	All	150	680-710 All welds (Note 2)
P15E Gr.1	Not permitted	Not permitted	All	220	740-770

NOTE:

1. All gas cut edges shall be ground for a width of 3mm to remove the HAZ.
2. All welds of P5A material shall be post heated at 250°C for 2 hours immediately after welding.

GENERAL GUIDELINES FOR INSULATION WORKS

This booklet is given as a general guideline to this tenderers about insulation works, However instructions given in the drawings & other schedule issued during execution of the work shall be final and binding of the contractor.



**Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)
Power Sector Southern Region
690, Anna Salai , Nandanam,
Chennai – 600 035**

GENERAL NOTES ON ERECTION OF INSULATION

1. It is important that the sheet metal covering is done, by a experienced and competent tinsmith.
2. Person, who is doing the actual job, can alter the following said methods of fixing the sheet metal, as and when necessary, only after consulting the BHEL Erection Engineer.
3. Fixing pin of corresponding thickness of insulation shall be welded by **STUD WELDING** process.
4. Circumferential and axial overlapping of outer casing should be 50 mm unless specified otherwise.
5. **FOR HORIZONTAL AND INCLINED DUCT AND PIPE:**
 - 1) All overlapping in axial direction should be at the bottom of the duct and pipe. Provision of beading and Sealing compound is not required.
 - 2) For circumferential overlapping of inclined duct and pipe, provision of beading and Sealing compound is not required.
 - 3) For circumferential overlapping of horizontal pipe and duct, provide beading. Apply Sealing compound if necessary.
- 5A. **FOR VERTICAL DUCT AND PIPE:**
 - 1) For overlapping in the axial direction provide beading. Apply Sealing compound if necessary.
 - 2) For circumferential overlapping provision of beading and Sealing compound is not required.
6. The joints of wool mattresses should be staggered in both circumferential and axial direction. The Wire netting at the joints of Wool mattresses are to be sewn together by G.I. sewing wire dia 0.71 mm.
7. In case more than one layer of Wool mattress is to be applied for pipe insulation the inner layer should be tied by two turns of G.I binding wire dia 1.22 mm at a pitch of 240 mm, and the outer layer should be tied by two turns of G.I. binding wire dia 1.22 mm at a pitch of 160 mm. The ends of the wire should be twisted and pressed in to the insulation.

8. All the overlapping of outer casing should be made such that no rain water enters into the insulation through the joints.
9. In case of insulation fixing pin welding to tubes, equal circumferential pitch is to be maintained. Use a minimum number of 4 pins, at 90 degree radial spacing.
10. The inner side of the Aluminum / G.I sheet of outer casing should be painted with two coats of anticorrosive Paint (IS:158). Retainer – Type A must be coated with Aluminum paint to avoid bi-metal corrosion or Neoprene strip must be provided between Retainer – Type A and Casing support.

The above mentioned paints are not in BHEL scope of supply

11. Self tapping screws should be fixed over the circumferential overlapping. The axial joints should be on the Casing supports and outer casing should be fixed to Casing supports with Self tapping screws at a pitch of 150 mm approximately.
12. The outer casing should be wound tightly around the insulation and then fixed with Self tapping screws when there is not any Fixing pin for insulation.
13. Loose wool can be taken from the Wool mattresses wherever required.
14. Clean the surface to be insulated of rust, dust, grease, loose scale, oil, moisture, etc.
15. Care shall be taken that flexible insulation is not unduly compressed.
16. After insulating the equipment with Calcium silicate / Mineral wool mattress, all voids in the joints shall be filled with Moldable insulation / loose mineral wool respectively.
17. Each day application of insulation should be weather proofed overnight by either with the final protective casing or with some temporary weatherproof covering so that it does not get drenched in rain.
18. The indicated thickness of insulation is the minimum requirement which should be provided. Any alteration in the thickness of insulation should be done only after getting the prior approval from the Design Engineer.
19. The layers of Wool mattresses are to be taken as indicated below:

THICKNESS IN mm	LAYER IN mm				
	1 st	2 nd	3 rd	4 th	5 th
250	50	50	50	50	50
230	50	60	60	60	
210	50	50	50	60	
200	50	50	50	50	
190	40	50	50	50	
180	60	60	60		

160	50	50	60
150	50	50	50
140	40	50	50
120	60	60	
100	50	50	
80	40	40	

20. Where junctions between two or three bodies or different dia, occur and different insulation thickness is specified the greater thickness shall be continued for a length equal to one dia of the smaller body then smoothly tapered to the required smaller thickness over a length equal to two dia of the smaller body. When there is a differential thermal expansion between these bodies, they should be insulated individually.

21. The required fixing components and outer casing sheets have been released under PG_32. The insulation materials have been released under PG-33.

22. **STORAGE INSTRUCTIONS:**

22a) Mineral wool mattress:

These materials should be stored under fully covered sheds. Stocking must be done over planks and must be out of contact with ground. Height of stacking should not exceed 3 Meters.

Once drenched in water these materials loose all the desired properties and become unsuitable for use. Drying the material does not restore the desired properties.

22b) Outer casing sheets:

Outer surfaces are meant for improving the appearances also scratch marks, dents, etc, spoil the appearance.

23. Typical insulation arrangement drawings are indicated below.

1)	Tees	4-00-235-08546
2)	Elbows	4-00-235-08547
3)	Flanges	4-00-235-08548
4)	Expansion joint for pipe	4-00-235-08549
5)	Expansion piece for duct	3-00-235-06258 & 3-00-235-06259
6)	Manhole door for duct	3-00-235-06260

INSULATION OF DRUM END

MATERIAL:

- 1) FLAT 50 X 6
- 2) FIXING PIN INSLN DIA – 6
- 3) RETAINER TYPE – A
- 4) G.L. BINDING WIRE DIA – 1.22 / 0.914
- 5) WOOL MATTRESS
- 6) OUTER CASING
- 7) SELF TAPPING SCREW – M4 X 13
- 8) G.L. SEWING WIRE DIA – 0.71 / 0.914

APPLICATION:

Install Flat 50 x 6 circumferential bands to fit snugly around the drum.

Flat 50 x 6 lattice bar 8 numbers should be radially placed over the dished end and contouring the same and it is to be welded over circumferential bands.

Weld the Fixing pins to the lattice bars circumferential bands.

Fix the Wool mattress.

Position the Retainer and tack weld to the Pin.

Tie with Binding wire across the Pins.

Fix the outer casing strips by Self tapping screws.

INSULATION OF PIPES AND BUNCH OF TUBES

MATERIAL:

- 1) WOOL MATTRESS
- 2) G.L. SEWING WIRE DIA-0.71 / 0.914
- 3) G.L. BINDING WIRE DIA – 1.22 / 0.914
- 4) OUTER CASING
- 5) SELF TAPPING SCREW – M4 x 13

APPLICATION:

Fix the insulation over the bunch of tubes / pipes.

Tie the insulation with G.I. binding wire circumferentially.

Fix the outer casing sheet with self-tapping screws.

**INSULATION OF VERTICAL PIPES
(WELDING OF FIXING PINS NOT PERMITTED ON PIPES)**

MATERIALS:

1) FIXING PIN INSLN DIA – 6	9) FLAT 50 x 6
2) RETAINER TYPE – A	10) PACKING CLOTH – 3 MM TK
3) CASING SUPPORT – 850MM	11) HEX HD BOLT M8X40
4) OUTER CASING	12) HEX NUT M8
5) WOOL MATTRESS	13) PNCHD WASHER A9
6) SELF TAPPING SCREW – M4X13	14) GI BINDING WIRE DIA – 1.22 /0.914
7) CLAMP	15) GI SEWING WIRE DIA – 0.71 / 0.914
8) SUPPORTING SHEET	16) SHEET 3.15x30x3000

APPLICATION:

At every three meters provide the Clamps over the pipe with bolt but and washer by using packing cloth in between the pipe and clamp. Fix the sheet 3.15x30x3000 over the pipe and weld to the clamps. Weld the fixing pin over the sheet. Consult the Welding engineer before welding.

Weld the Flat to the Clamps.

Weld the Supporting sheets to the Flats.

Fix the insulation.

Position the Retainer Type – A and tack weld to the Pins.

Tie the insulation to the pipe with GI biding wire circumferentially.

Fix the casing support to the Retainer by using two numbers of Self tapping screws, fixed diagonally for each Retainer.

Fix the outer casing sheet with self tapping screws.

INSULATION OF VALVE

MATERIAL:

- 1) SM CLAMP FOR DETACHABLE INSULATION TYPE – A (To be used up to 200 mm overall dia)
- 1)a SM CLAMP FOR DETACHABLE INSULATION TYPE – B (To be used above 200 mm overall dia)
- 2) WOOL MATTRESS
- 3) OUTER CASING
- 4) SELF TAPPING SCRES – M4 x 13
- 5) G.I SEWING WIRE DIA – 0.71
- 6) SNAP HD RIVET 3 x 8
- 7) CHS SCREW M4 x 20
- 8) HEX NUT M4

APPLICATION:

The sheeting shall be made in two halves and the Sheet metal clamp mounted.

Wool mattress thickness according to adjacent pipe lines shall be pressed in to two halves.

The two halves shall be fitted over the valve to be insulated and locked by Sheet metal clamp.

Self tapping screws shall be used for clamping the two edges of the outer sheet casing when the length of the valve is more.

After assembling the Clamp put a bit of GI Binding wire as a pin through 1.6 mm hole provided.

INSULATION OF DUCT / FLAT SURFACE

MATERIALS:

1) FIXING PIN INSLN DIA – 6	5) GI BINDING WIRE DA – 1.22 / 0.914
2) WOOL MATTRESS	6) CASING SUPPORT – 650 MM
3) OUTER CASING	7) SELF TAPPING SCREW M4 x 13
4) RETAINER TYPE – A	8) GI SEWING WIRE DIA – 0.71 / 0.914

APPLICATION:

Weld the Fixing pin over the Duct / Flat surface.

Fix the insulation.

Position the Retainer Type – A and tack weld to the Fixing pins.

The GI Binding wire dia 1.22 shall be wound across the Fixing pins diagonally underneath the Retainer Type – A.

Fix the Casing support – 650 long to the Retainer Type – A by using two numbers of Self tapping screws, fixed diagonally for.

Retainer Type – A.

Fix the outer casing by using Self tapping screws.

DUCT STIFFENERS

When the stiffeners protrudes through the insulation and are exposed to atmosphere, provide an additional 40 mm insulation over the stiffener.

DUCT DAMPER & GATE

Insulation thickness shall be as per the adjacent duct insulation. The stuffing boxes should not be insulated. A clear gap of 50 mm (minimum) should be maintained all around the stuffing boxes.

AIR HEATERS

DO NOT insulate over the axial seal, adjuster seal access covers and basket removal doors insulation should be applied in a manner to permit a free circulation of ambient air around the bearing.

INSULATION OF DUCT (CLEARING STIFFENERS)

MATERIALS:

1) FIXING PIN INSLN DIA – 6	7) OUTER CASING
2) RETAINER TYPE – A	8) SELF TAPPING SCREW M4X13
3) RETAINER TYPE – C	9) WOOL MATTRESS
4) CASING SUPPORT – 650 MM	10) WELD MESH
5) GI BINDING WIRE DIA – 1.22/0.914	11) CORNER SUPPORT
6) GI SEWING WIRE DIA – 0.71 / 0.914	12) ANGLE 40X40X5 – 100

APPLICATION:

Weld the Fixing pin over the Duct.

Position the Retainer Type – C so that it will be in the same plane as that of the top surface of the stiffener.

Tack weld the Retainer – Type – C to the Fixing pin.

For the top plate of the horizontal duct, spread the Weld mesh over the Retainer Type – C.

This serves as the additional support where people walk over the insulation.

Weld the Corner support to the bottom corners of the duct.

Weld the Angle to the corner support.

This arrangement will help to achieve a sharp corner for the insulation and outer casing.

Fix the insulation.

Position the Retainer Type – A and tack weld to the Fixing pin.

The Binding wire shall be wound across the pins diagonally underneath the Retainer Type – A.

Fix the Casing support - 650 mm long to the Retainer by using 2 numbers of Self tapping screws, fixed diagonally for each Retainer.

Fix the outer casing by using Self tapping screws.

PROCEDURE FOR CURING OF CASTABLE REFRECTOR

CURING OF REFRACTORY WORK

Curing of refractory means retaining the moisture for a minimum period in order to ensure the proper hydration of the binder. Curing of exposed castable surfaces should start after the surface has become firm. This can be tested when a finger rubbed across the surface comes away clean or when the surface feels warm to the touch. Moisture loss for the first 24 hours, after the material has been installed shall be retarded. Initial set occurs within one or two hours.

Castables should be cured for 24 hours. Moist conditions can be maintained by protection with damp sacking or plastic sheet which should not come into immediate contact with the refractory or alternatively by dry coating the castable with an impervious organic based sealing compound. In some instances, satisfactory results can be obtained by sparkling water over the surface. It should be watered for a period of 20 to 24 hours after 4 to 5 hours of construction. The rate of water applicable should be carefully controlled to prevent washing of the fines and to prevent collection of pools in low spots. Shield the surface from direct sunlight at least for about 48 hours. 8 hours after casting and pouring, remove the wooden frames which have no load bearing function in order to permit watering of the lateral parts of the structures. In case of steel frames apply water without stripping them. On completion of the curing period the application of moisture should be stopped. The exposed castable should be allowed to air dry for 24 hours. Naturally air drying of castable after curing will actually cause slight increase in strength. The castable can be all dried indefinitely without adverse effect. Optimum results can be obtained with a drying period of 48 hours.

Before lighting the boiler for drying the setting the following shall be attended.

1. All dirt and foreign objects sticking to tube surface are to be removed to ensure a thoroughly clean surface.
2. Expansion joints are to be cleaned and inspected for the proper functioning of expansion during operation.
3. Test sample of castable refractory is to be taken from entry door regions to determine the moisture content in the laboratory.

Sample of castable are to be taken for the determination of moisture content before and after drying. When the moisture content drops below 0.58 the castable is considered to be dry and the boiler is ready for commissioning. All result of measurement should be duly recorded.

CARE OF THE REFRACTORY WORK

The refractory work is subjected to considerable thermal stresses during boiler operation. Sudden application of heat or cooling introduces severe stresses and endangers the refractory work. Even when the boiler is operated in the recommended regime possibilities of damage occurring to the refractories (due to severed reasons such as bad workmanship, poor quality, slag deposition, corrosive atmosphere etc) must be kept in mind. The following simple rules to be observed.

- (i) Avoid sudden cooling of the furnace after a shut down. A cooling rate of 20° to 30° per hour for the refractory lining in the initial period is recommended. This means that FD fans must be stopped after a shut down of the boiler. Ventilation of the furnace by natural draft is permissible only after six hours of shut down. Forced cooling can be started only after 16 hours.
- (ii) Avoid quick heating of the furnace. Boiler starting diagram is usually a reliable guide.
- (iii) Thoroughly examine the refractory work during shot downs for cracks, chipping off spelling etc. During operation also this can be checked periodically by visual examination through observation holes.

Whenever defects are notice arrange for their quick alimentation, by shutting down the boiler at the earliest depending on the scarceness of the defect.

- (iv) Abnormal heating of outside metal sheet covering of the boiler and hot spots are usually a good indication of damaged refractory and insulation in this area. The leakage of flue gas will spoil the property of good mattresses within a short time.
- (v) Deep the access door, observation doors, etc. properly shut. They are entry points for cold air and this cold air can damage the refractory work by localized cooling.
- (vi) Sufficient quantity of water is to be added to the castable refractory for mixing before application as per supplier's recommendations.

METHOD OF APPLICATION AND CURING
OF POURABLE INSULATION

- (i) Typical application are for insulating behind buckstays and areas such as roofs having multiplicity of hangers, rods and other penetrations.
- (ii) The application of pourable insulation can be pumping and gunning.
- (iii) Density of the pourable insulation installed and cured is around 600 to 650 Kgs/M
- (iv) Pourable insulation is a hydraulic setting insulation additive or air entrainment agents shall not be used.
- (v)
 - (a) Empty the entire bag at a time and mix the whole material so that segregated particles get mixed.
 - (b) The pourable insulation should be thoroughly mixed with clean water to develop casing and pump consistencies.
 - © The correct quantity of water shall be placed in the mixer before adding the dry pourable insulation normally about 70 to 100 by weight. However this has to be confirmed from the supplier while purchasing this material.
 - (d) Mixing time shall not be less than five minutes or more than five minutes.
 - (e) Dried out material shall not be remixed.
 - (f) Pourable insulation once mixed must be in place within half an hour.
- (vi)
 - (a) All areas where pourable insulation will be placed must be free of scale, rust, dust or other loose materials.
 - (b) All porous forms used such as wood etc shall be oiled before pouring.
 - © All absorbent surface such as insulation brick, concrete, shall be wet down thoroughly to prevent water absorption.
 - (d) Waiting of wall insulation used as forms at buckstay levels is not required.
- (vii)
 - (a) The surface of pourable insulation once in place will become firm in approximately two hours. The surfaces should be kept damp with an occasional light spray or covering with a cloth that is kept damp for the entire 24 hours curing period.
 - (b) For mixing and spraying the water should be clean and cold.
 - © Application of moisture after 24 hours should be stopped forms etc should be removed and the materials allowed to air dry for 24 hours.
- (viii) The shuttering scaffolding moulds should be removed after about 36 hours of casing.

**APPLICATION OF INSULATION FOR BOILER PIPING,
PIPING AND EQUIPMENTS / VESSELS AND ACCESSORIES.**

Bonded mattress having standard thickness to 25, 40, 50, 60, 75 mm confirming IS 8103 having a density of 150 kg/cubic meter and light bonded mattress having a density of 150 kg/cubic meter and light bounded mattress having standard thickness of 25, 40, 50, 60, 75 mm conforming to IS 9842 having a density of 144 kg/cubic meter and pipe section in the standard thickness of 25, 40, 50, 60, 75 mm confirming IS 9842 having density of 144 kg/cubic meter will be 100 kg/cubic Mtr.

The application of insulation will be done as per general notes/ drawings enclosed. The application commissioning shall be as per latest editions of IS 7413 code of practice for application and finishing of thermal insulation materials between 40° C to 700° C of Bs 5970 code for practice for thermal insulation of pipe work and equipment (in the temperature range – 100° C to + 870° C).

Inspection before application, during the application and after the application of insulation will be carried out by BHEL Field Quality Engineer as per BHEL Field Quality Plan. Every layer of insulation shall be got approved by BHEL Engineer / FQA Engineer.

Prior to applying insulation the surfaces to be insulated shall be made clean and dry and free from dirt and grease. Where cladding is attached to carbons steel or low alloy steels the steel shall be first prime painted with zinc chromate and then painted with Aluminum paintings. Wherever required to provide aluminum foil as protective covering for bolts and other fittings shall be arranged by contactor. The prints wherever required for preservation coating shall be supplied by contractor.

For insulation of piping with performed pipe sections the came shall be applied over pipe and finally be held in position with 15 mm wide aluminum band at greater than 300 mm spacing for mineral wool insulation.

For insulation of piping with mattresses having backing GI wire netting, the required lengths and shapes are to be cut from the blankets and wrapped on the piping and held in position with proper support by fastening the binding to be done circumferential at not greater than 300 mm spacing.

Performed insulation on vertical or near vertical piping must be supported in position by means of metal ring at interval not greater than 960 mm.

The support attachment may be welded or clamped to the pipe, subject to the approval of BHEL Site Engineer Necessary fabrication of support rings to be done as per site requirement.

Piping bends shall be insulated to the same specification as adjacent straight piping and should form a smooth external surface. Where performed material is used it should be cut lobster-back fashion and wired or strapped into position.

Pipe insulation shall be cut to fit nearly around hangers and supports. On horizontal lines which are supported directly on pipe racks the insulation and weather proofing shall be sufficiently cut away at the support to accommodate pipe movement.

Protrusions through insulations which themselves do not required insulations such as pipe clamps supports of small pipings instrument take offs etc shall be covered to the same thickness as the adjacent insulation expect for hanger rods.

At outdoor location the hanger rod protraction shall be shielded with metal flashing to deflect rain and protect the insulation from moisture while permitting the movement of the hanger rod.

Arrangement of securing the metal finish even the insulation shall ensure that direct metal contact between the insulated surface and outer meter cladding is avoided. 4mm thick asbestos board packing shall be used at interface to thermally isolate the metal covering from supporting arrangement. All cladding joints shall be vapours tight and shall be able to accommodate thermal movements. Paste type self setting vapours sealing compound shall be used.

Metal cladding on piping shall be screwed with self tapping screws. These joints should be arranged approximately 30° below horizontal centre line so as to shed water on any horizontal pipe line. The screws shall be flat or round head types of 12mm size and overlapping of 50 mm on both longitudinal and circumferential joints. The screws shall be provided at not greater than 150 mm spacing.

Insulation expansion joints shall be provided in all pipelines to allow movements and expansion of the pipe. The recommended intervals of expansion joints are.

Pipe Temperature	Spacing of Insulation Expansion joints
Below 200°C	5.5 M
201° - 300°C	3.5 M
301°C - 400°C	3.0 M
Above 400°C	2.0 M

All joints in the insulation shall be staggered. For multiple layer of insulation the different layers shall be applied so that the butt joints of one layer do not coincide with those of the other layers. At the joint of each layer of insulation loose insulation shall be packed firmly.

Equipments Insulation Application Procedure

For equipment and shells a matrix of insulation support shall be developed by:-

- (a) Welding the insulation support lugs on a frame work prepared with 20 mm x 3 mm size MS Straps where direct welding of lugs to the sheet is not permitted.
- (b) Welding the directly on shell after written permission by Site Engineer. The material of the support shall be similar to the material of the shell in this case.

The support shall be pitched at 300 mm for vertical and underside surfaces and 500 mm for oppressed surfaces. A support shall be located above each vessel flange at a sufficient distance above the flange bolts to allow for easy removal. The top and bottoms supports shall be slotted suitably for attachments of straps and wires.

The support lugs shall be 6 mm

Insulation with back up GI wire noting, shall be cut to fit the equipments and shall be wrapped on the equipment and held in position with proper support and tie wires. All joints between course shall be staggered and tightly butter and adjacent edges laced together with lacing wire.

Insulation shall be fastened in place with MS Straps of 20 x 3 mm, on approx., 300 mm centers where contour of equipment permits. Straps shall be tightened with a banding machine and champed with seals.

Insulation on top of horizontal heads shall be cut to fit the curvature of the head and shall be secured in place with the help of radial straps fixed in between circumferential rings. Insulation on bottom heads shall be wired to nuts welded to head. Insulation shall also be strapped to bottoms insulation support. For outdoor equipments insulation shall be arranged to be weather proof.

Metal jacketing shall be applied directly over the met insulation and neatly fitted to place. All gaps shall be arranged so as to shed water. Suitable flashing and weather proofing shall be provided at all nozzles, manholes and other projections to prevent the entrance of water.

VALVES & FLANGES INSULATION APPLICATION

The insulation on all valves and flanged joints shall be enclosed in a removable jacketing so that it may be removed without disturbing the concerned equipment or piping. The thickness of insulation shall be same as that of the pipe line in which these valves and fittings are located.

The layout of wool mattresses to be adopted to obtain the specified insulation thickness are as per be on unless otherwise specified:

Thickness of Insulation (mm)	Layer			
	I	II	III	IV
25	25			
40	40	-	-	-
50	50	-	-	-
60	60	-	-	-
65	40	25	-	-
75	75	-	-	-
80	40	40	-	-
100	50	50	-	-
110	60	50	-	-
125	75	50	-	-
135	75	60	-	-
150	75	75	-	-
155	75	40	40	-
160	75	60	25	-
165	75	50	40	-

The material density of boned mineral wool used for pipe having outside diameter more than 355.6 mm is 150 kg/cubic meter 13 8183.

The material density of bonded mineral wool used for pipe having outside diameter less than or equal to 355.6 mm is 144 kg/cubic meter IS 9842.

Cladding material used is galvanised steel sheet as per IS 277 GRADE 375.

Cladding material gauge for pipe outside diameter less than or equal to 300 mm is 24 SWG.

Cladding material gauge for pipe outside diameter greater than 300 is 22 SWG.

For piping up to including 355.6 mm OD, first layer shall be pipe sections and subsequent layer shall be bonded. Wherever pipe sections are not supplied the first layer has to be wrapped using bonded wool material for piping 355.6 mm OD, bonded mattress shall be used or all the layers.

Description of type of insulation and the method of Application for Boiler Feed Pumps

1. Type of insulation

The pumps should be insulated with 125 mm thick flexible wire backed mineral wool mattress of 150 kg/ density.

2. Method of Application

The above insulation is to be applied to 2.0 mm thick flats aluminum sheeting (18 SWG) and secured by 19 mm wide aluminum retaining dips and 1/8 inch diameter aluminum pop rivets, all to be secured by 2 inch long X No.8 spacing to a 40 mm wide x 3 mm thick angle iron frame work of all welded construction bound by 40 mm PVC tape.

<u>SECTION</u>	<u>TITLE</u>	<u>NO. OF SHEETS</u>
A	METHOD OF APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS AND MATERIAL SPECIFICATIONS (ANNEXURE-1)	4
B	THERMAL INSULATION APPLICATION DRAWINGS	13

SECTION - A

THERMAL INSULATION FOR PIPING AND EQUIPMENTS

1.0 INTRODUCTION

In a thermal power station or process plant, thermal insulation or heat lagging of piping and equipment's carrying hot fluids is essential for best economy and protection of operating personnel. Any pipe which is at a temperature higher than its surroundings will lose heat and the amount of heat lost will depend upon the temperature of the fluid and the thermal conductivity of the piping material/covering.

The heat lost through bare pipe increases with

- a) Increase in the temperature of fluid conveyed
- b) Decrease in ambient temperature and
- c) Increase in wind velocity of the surroundings.

The heat so lost has potential for work and rapidly increasing cost of fuel in the recent past has promoted to find all possible means to conserve energy. Providing proper and adequate insulation on to the piping and equipments controls heat transfer and maintains the required service temperature.

2.0 METHOD OF APPLICATION

The method of application is highly skilled job. Badly fitted/laid insulation can lead to greater heat loss, higher cold surface temperature than that estimated and frequent maintenance. Following are the important points to be considered in the application of the insulation.

- 2.1 Before applying insulation, it should be ensured that all instrument tappings, clamps, lugs and other connections on the surface to be insulated have been properly installed as per relevant drawings.
- 2.2 All surfaces to be insulated shall be cleaned of all foreign materials such as dirt, grease, loose scale, moisture etc.
- 2.3 Welding of lugs, attachments, clips etc. on the surface to be insulated for supporting insulation shall not be carried out without the permission of the authorized person.
- 2.4 All flanged joints shall be insulated only after final tightening and testing.
- 2.5 The insulation shall be applied to all surfaces when they are at ambient temperature.
- 2.6 Where more than one layer of insulation is involved, mattresses should have staggered joints (at 60 deg) and they must be held in close contact with face of

pipes/fittings by means of binding wires / Aluminum bands / seals. Circumferential joints of multilayer insulation should also be staggered by at least 150 mm.

(Refer Drg. No. PE-4-999-169-01).

- 2.7 For the first layer of insulation and in case of multi layer of insulation, mattresses with hexagonal wire netting will be facing on outer side.
- 2.8 Insulation mattresses shall be held in place by fastening over with binding wire. Care should be taken to see that the flexible insulation mattresses are not unduly compressed. The ends of binding wire shall be lightly twisted together, bent over and pressed into the insulation. For mattresses, binding wire shall be used at intervals of 300mm.

In the addition Aluminium bands shall also be provided at 300 mm intervals for diameters greater than 500mm. (Refer Drg No. PE-4-99-169-01.)

- 2.9 Where junctions between bodies of different diameters occur and difference in insulation thickness is specified, the greater thickness is to be continued for a length equal to one diameter of the smaller body and then smoothly tapered to the required smaller thickness over a length equal to two diameters of the small body.
- 2.10 The indicated thickness of insulation are minimum requirement which should be maintained. Any change in the thickness of the insulation should be done only after prior approval of the design engineer.
- 2.11 The day-to-day insulation work should be covered with suitable protective materials to prevent the rain water entry, if same is expected.
- 2.12 The insulation shall be cut to fit the piping O.D / equipment and shall be wrapped on the piping / equipments and held in position with proper support and wires. All the joints should be properly staggered and tightly butted and adjacent edges laced (Refer Drg No. PE-4-999/169/01)
- 2.13 The insulation of valves and flange joints shall be enclosed in a removable jacketing so that it may be removed without disturbing the concerned equipment or piping. The thickness of insulating shall be same as that of the pip line in which these valves and fittings are located. (Refer Drg No. PE-4-999-169-07.)
- 2.14 Steam / Air / Gas leakages in and around the pipes to be insulated with be attended before applying insulation.
- 2.15 In order to provide support to Aluminium cladding, support rings made out of 20 x 3 mm M.S. flats shall be fixed at equal intervals of approximately 850 mm spacing and at every circumferential joints. These rings shall be fixed with 'L'

type lugs and shall be fabricated from 20 x 3 mm M.S flats. To reduce that conductivity through these lugs 20 mm x 3 mm size Ceramic mill board shall be used between rings and lugs (Refer Drg No. PE-4-999-169-04 and PE-4-999-169-13).

- 2.16 Spacing between supporting rings for vertical piping shall be 3 mtrs. Support rings are to be provided only when the vertical height exceeds 3 mtrs. (Refer Drg No. PE-4-999-169-03-and PE-4-999-169-05).
- 2.17 For vertical pipes since support rings is provided at every 3 mtrs interval, only two spacer rings shall be provided in between support rings.
- 2.18 Spacer rings shall be provided at both ends of elbows/bends, valves and flanges pipe having dia more than 89mm.
- 2.19 Wherever the end of hanger clamp assembly protrudes out of the insulation at the bottom suitable box structure are to be provided. Pipe hangers and supports should be covered in such a way that the moisture cannot penetrate into the insulation.
- 2.20 It is very important that sheet metal cladding should be done by a well experienced and competent fabricator. Person doing the job can alter the method of fixing of cladding sheet after consulting the concerned design engineer.
- 2.21 The longitudinal joint in the outer cladding sheet should always be at the lower half of the circumference for horizontal piping so that no rain water enters the insulation through the joints. (Refer Drg No. PE-4-999-169-01).
- 2.22 The joints of outer cladding should be staggered axially.
- 2.23 Inside surface of all Aluminium sheet will have two coats of Bituminous paint applied uniformly.
- 2.24 Aluminium sheets covering on outdoor horizontal pipes will be provided with 3 mm drain hole at the bottom center line at 6 mtr intervals.
- 2.25 The cladding sheet shall provide directly over the insulation/finishing cement (1F APPLICABLE). Suitable flashing and weather proofing shall be provided at all nozzles, manholes and other projections to prevent the entrance of water.
- 2.26 Loose wool can be taken from wool mattresses. Wherever gaps and voids have to be filled.
- 2.27 Sealing compound to be applied on Aluminum cladding sheet joints.

- 2.28 Support rings/spacer rings shall be provided if the insulation thickness > 40mm and pipe diameter > 89mm.
- 2.29 Equipment's name plates shall not be insulated.
- 2.30 Clips made out of sheet be riveted inside the box for insulation of valves and flanges to hold the insulation in box. (Refer Drg No. PE-4-999-169-06).
- 2.31 The insulation local to the inspection points of the critical piping shall be removable.
- 3.00 For Thermal Insulation Material Specification related to the project refer Annexure – 1.

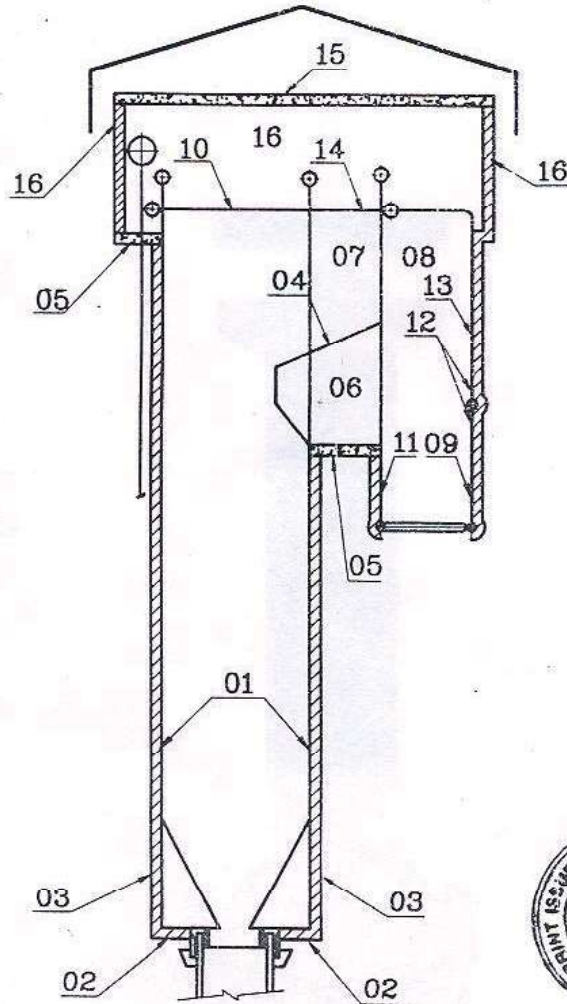
IMPORTANT POINTS TO BE TAKEN CARE DURING APPLICATION

- I) Binding wires for all layers of insulation will be at distance of 300mm.
- ii) In addition Aluminum bands/seals also to be provided at distance of 300 mm for sizes above 500mm.
- iii) Aluminum bands/seals to be provided over aluminum sheets at distance of 500mm.
- iv) Ceramic mill boards to be used between all 'L' type lugs and the support rings.
- v) Inside surface of Aluminum sheets to have 2 coats of bituminous paint applied uniformly.
- vi) Gaps to be properly filled with loose wool taken from mattresses.
- vii) End of hanger clamp assembly protruding out of insulation at the bottom should be suitably boxed with Aluminum sheets.
- viii) Valves to be insulated properly in box structure as given in enclosed drawings.
- ix) Multilayer longitudinal and circumferential joints should be staggered.

ANNEXURE – 1

- 1.0 **Thermal insulating materials shall be per the details given below:-**
- 1.1 **Lightly Bonded Mineral (Rock) wool Mattresses** of density 150 Kg / Cub. Mt with S.S. wire netting will be applied for the first layer of insulation where hot face temperature greater than 400 degree centigrade. For subsequent layers matters of density 150 Kg / Cub. Mtr with G.S. wire netting will be applied.
- 1.2 **Lightly Bonded Mineral (Rock) wool Mattresses** of density 100 Kg/Cub. Mt with G.S. wire netting will be applied for all layers of insulation for host face temperature less than and equal to 400 degree centigrade.
- 2.0 **Binding and lacing wires:** For insulation matters shall be of stainless steel for all insulation interface temperatures.
- 3.0 **Aluminum cladding sheet** shall be provided over the Mattresses ad per details given below.
- | | |
|-----------------------|---|
| 18 SWG (1.22 mm thk.) | For pipes with dia over insulation above 450 MM. |
| 20 SWG (0.91 mm thk.) | For pipes with dia over insulation above 150 MM and less than equal to 450MM. |
| 22 SEG (0.71 mm thk.) | For pipes with dia over insulation less than equal to 150mm. |

SECTION – B

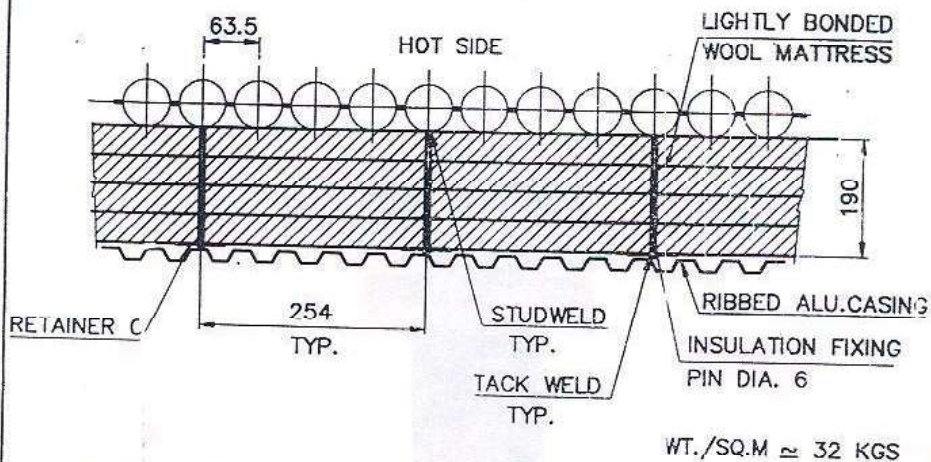


INSULATION	DRN	C.S		DRG.NO. 4-00-215-08551	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

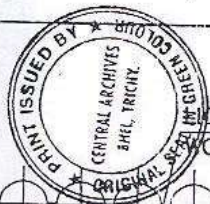
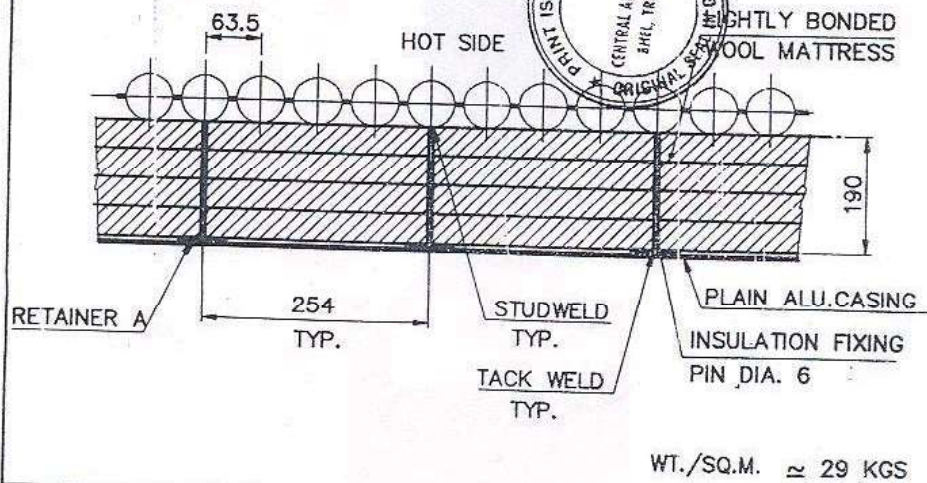
CTS001384-0

DETAIL 01

SHEET 02 OF 09



DETAIL 02

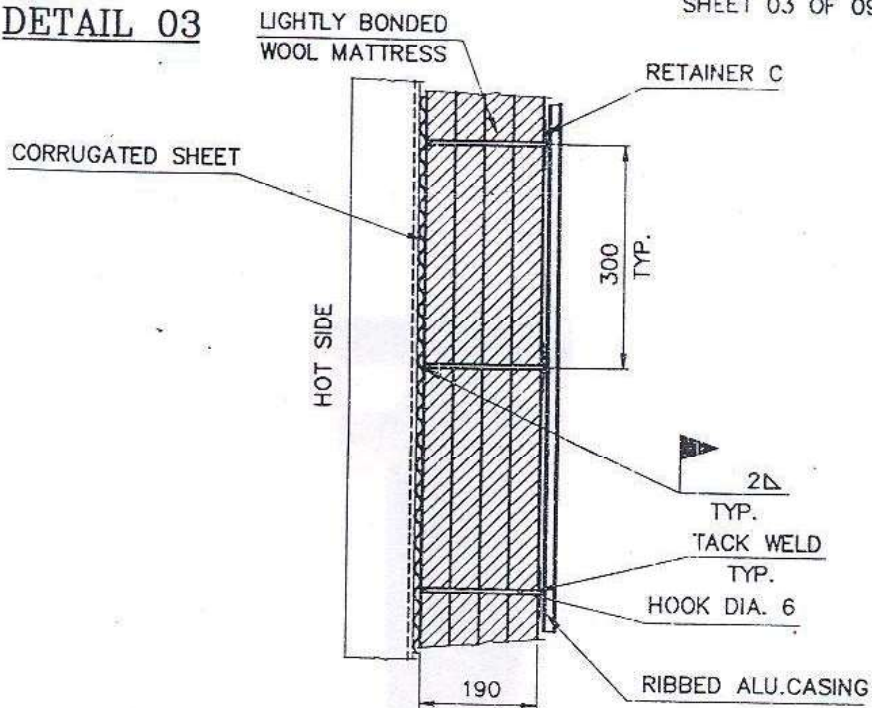


INSULATION	DRN	C.S.		DRG.NO.	REV. & CL
	CHD	C.G.S.			
	APPD	C.G.S.			
				4-00-215-08552	00

CTS001384-0

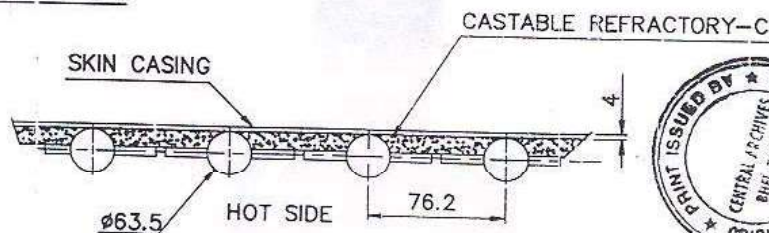
DETAIL 03

SHEET 03 OF 09



WT./SQ.M. $\approx$ 45 KGS

DETAIL 04



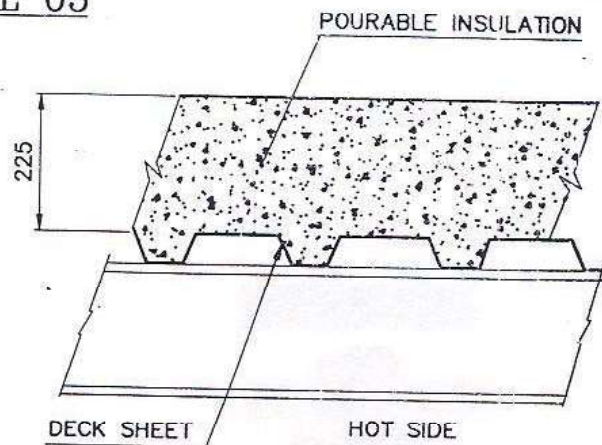
WT./SQ.M. $\approx$ 72 KGS

INSULATION	DRN	C.S.		DRG.NO.	REV.
	CHD	C.G.S.		4-00-215-08553	00
	APPD	C.G.S.			

CTS001384-0

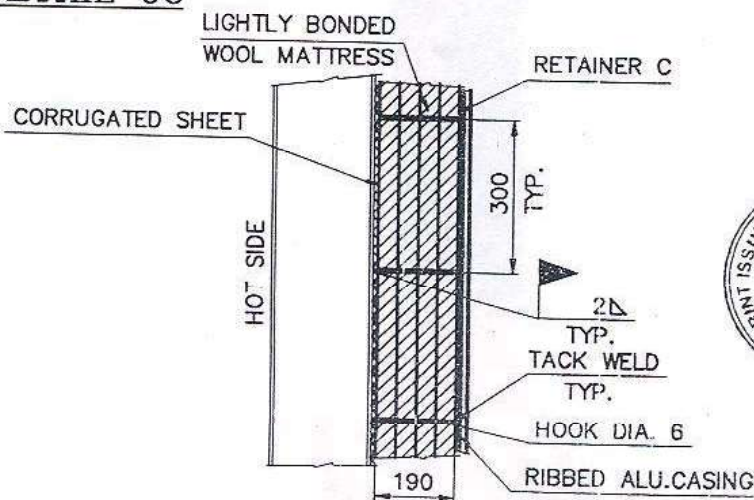
DETAIL 05

SHEET 04 OF 09

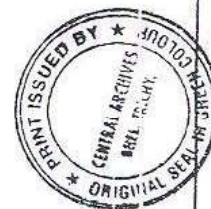


WT./SQ.M $\approx$ 193 KGS

DETAIL 06



WT./SQ.M $\approx$ 45 KGS

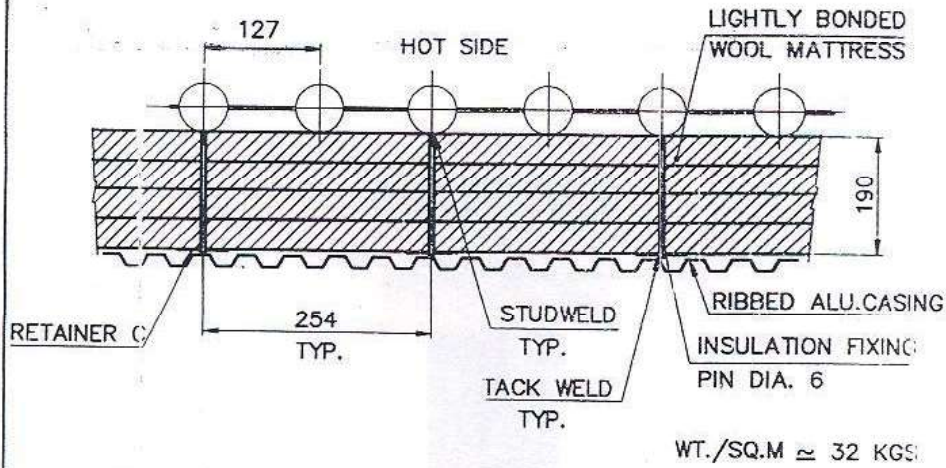


INSULATION	DRN	C.S		DRG.NO.	REV/MIL
	CHD	C.G.S			
	APPD	C.G.S			
4-00-215-08554				00	

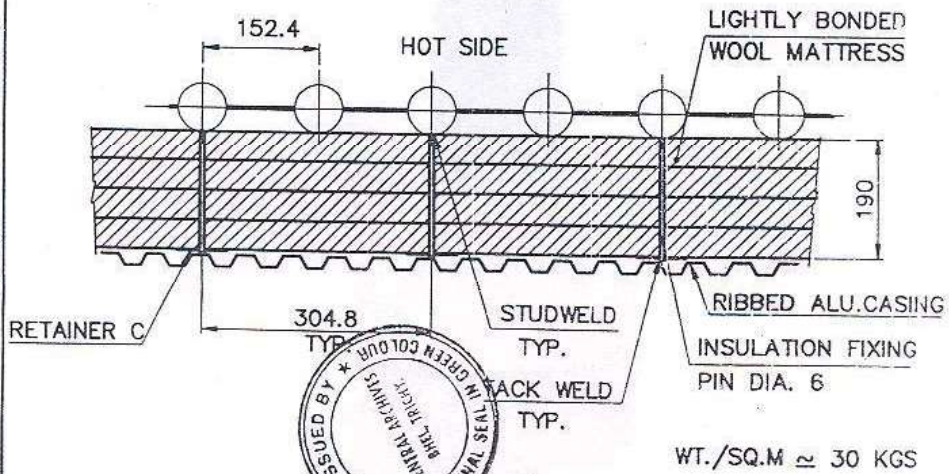
CTS001384-0

DETAIL 07

SHEET 05 OF 09



DETAIL 08

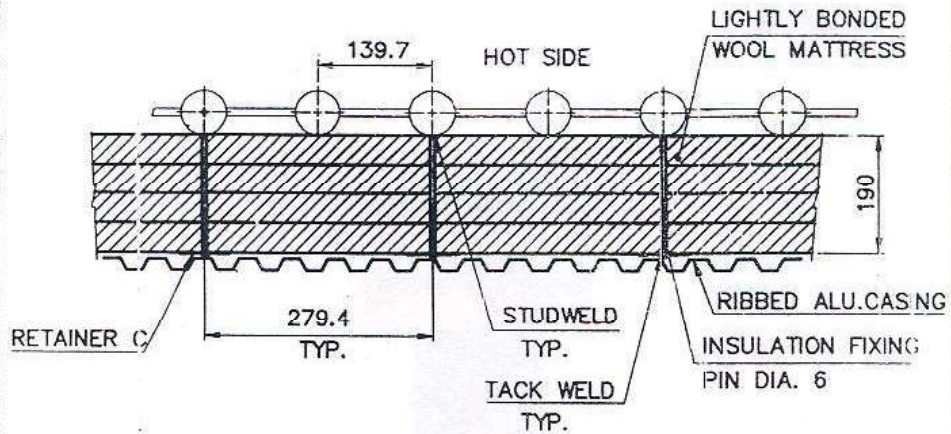


INSULATION	DRN	C.S.	DRG.NO.	REV.HEL
	CHD	C.G.S.		
	APPD	C.G.S.		
			4-00-215-08555	00

CTS001384-0

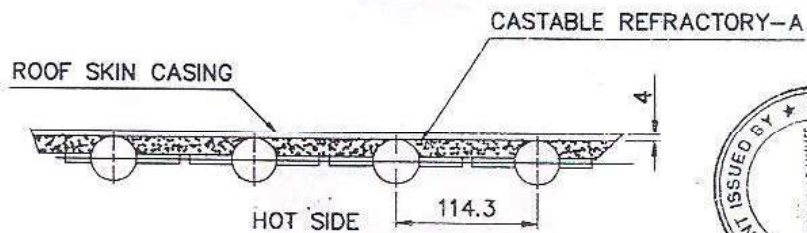
DETAIL 09

SHEET 06 OF 09

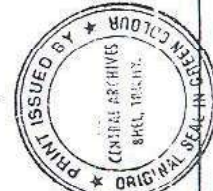


WT./SQ.M $\approx$ 30 KGS

DETAIL 10



WT./SQ.M $\approx$ 75 KGS

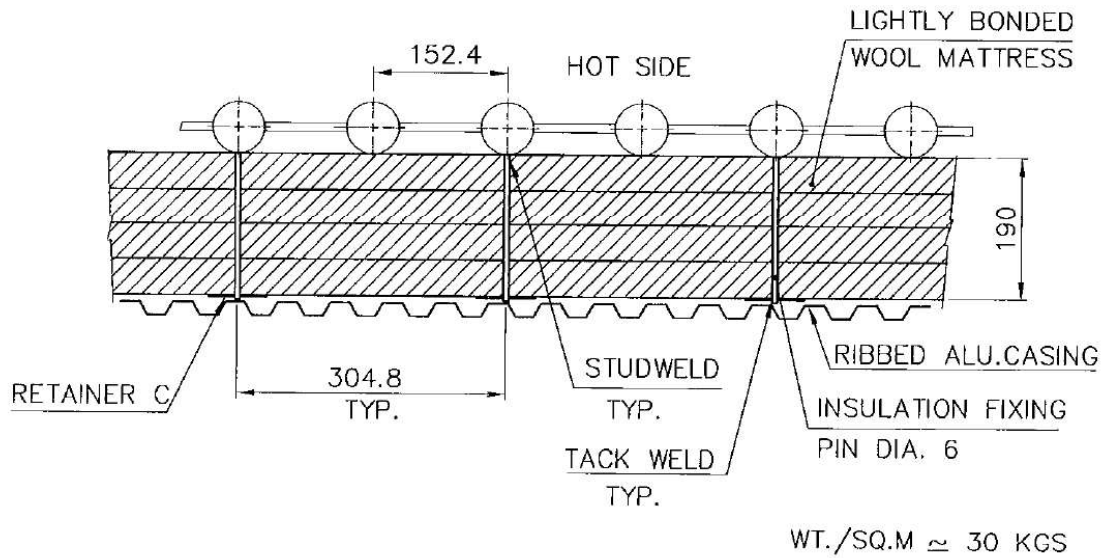


INSULATION	DRN	C.S	DRG.NO.	REV. NO.
	CHD	C.G.S		
	APPD	C.G.S		
			4-00-215-08556	00

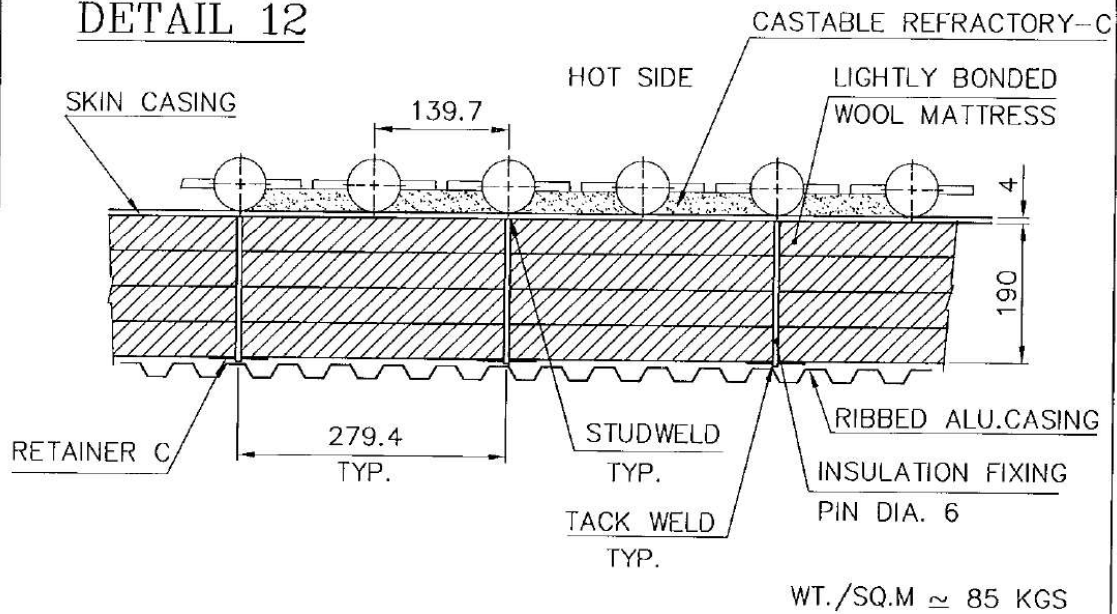
CTS001384-0

DETAIL 11

SHEET 07 OF 09



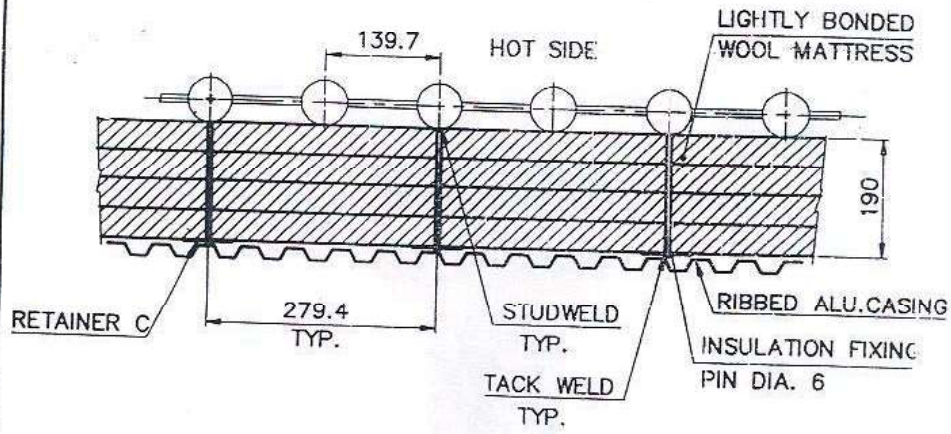
DETAIL 12



INSULATION	DRN	C.S	DRG.NO.	REV.NO.
	CHD	C.G.S		
	APPD	C.G.S		
			4-00-215-08557	00

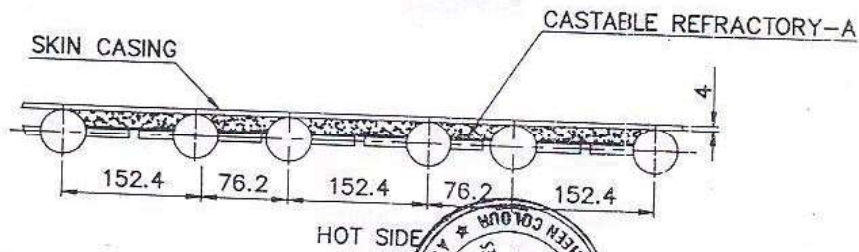
DETAIL 13

SHEET 08 OF 09



WT./SQ.M $\approx$ 30 KGS

DETAIL 14



WT./SQ.M. $\approx$ 75 KGS

INSULATION

DRN	C.S
CHD	C.G.S
APPD	C.G.S

4-00-215-08558

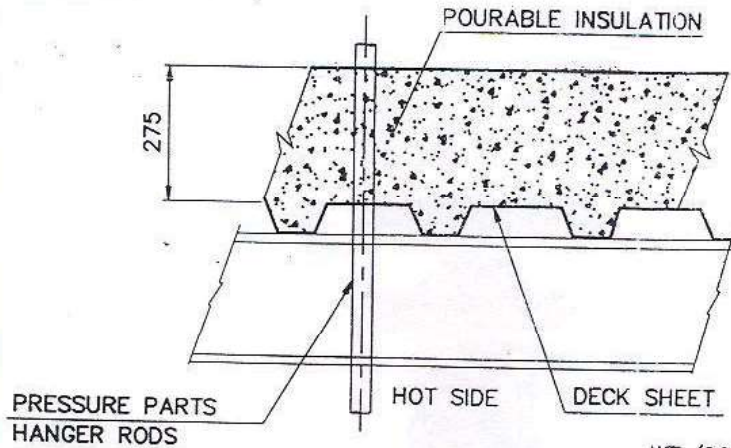
REV/KEL

00

CTS001384-0

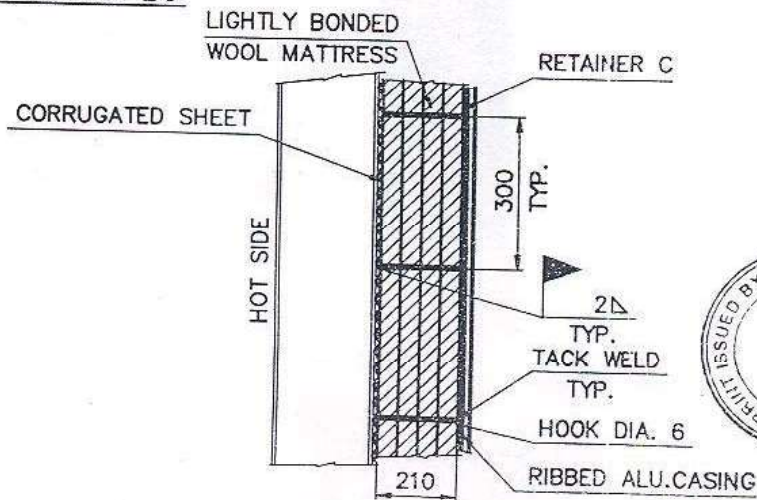
DETAIL 15

SHEET 09 OF 09

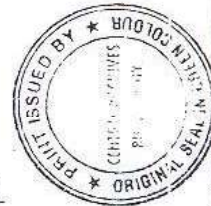


WT./SQ.M $\approx$ 233 KGS

DETAIL 16



WT./SQ.M $\approx$ 46 KGS

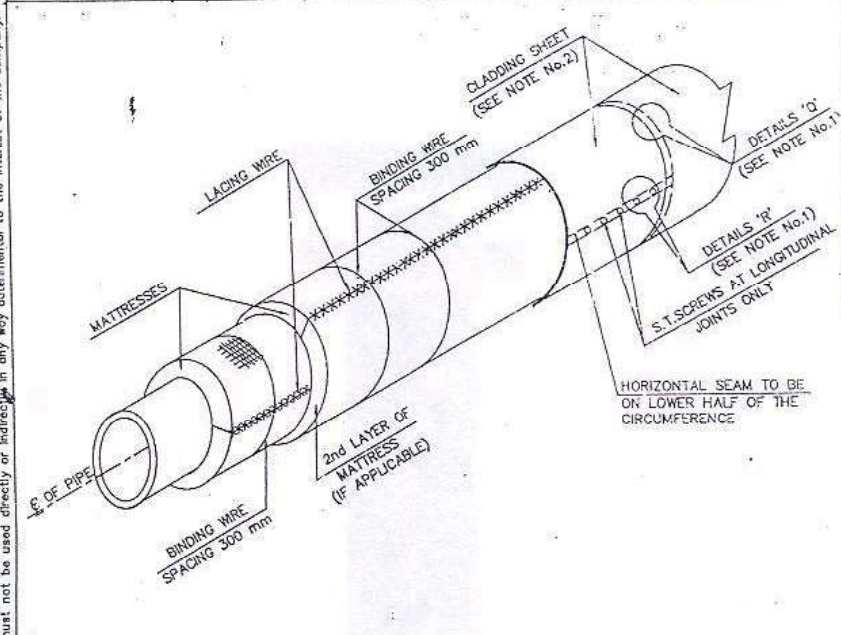


INSULATION	DRN	C.S	DRG.NO.	REV.NO.
	CHD	C.G.S		
	APPD	C.G.S		
			4-00-215-08559	00

CTS001284.0

COPY RIGHT AND CONFIDENTIAL
This document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)			
REV.	DATE	ALTERED	CHECKED
JOB NO.		STANDARD	



NOTES: -

1. FOR DETAILS 'Q' AND 'R' REFER DRG No. PE-4-999-169-12
2. FOR SHEET SUPPORT REFER DRG No. PE-4-999-169-04
3. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS".
4. IN ADDITION TO BINDING WIRE ALUMINIUM BANDS TO BE PROVIDED FOR DIAMETERS > 500 MM.

MATERIALS REQUIRED: -

1. MATTRESSES
2. BANDS AND SEALS
3. CLADDING SHEET
4. S.T.SCREWS
5. SEALING COMPOUND
6. LACING WIRE
7. BINDING WIRE

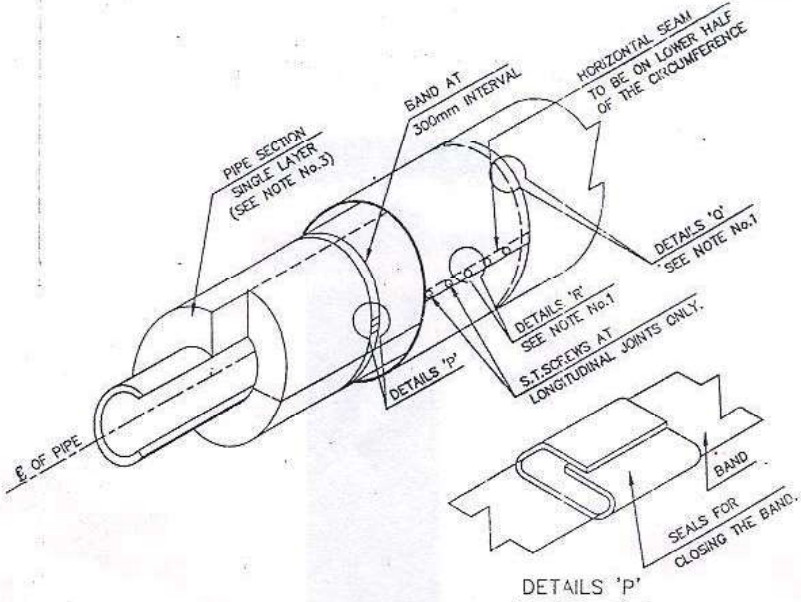
		BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI	
DEPT. MP	CODE M	SCALE N.T.S.	WEIGHT (KG.)
TITLE: INSULATION APPLICATION (HORIZONTAL PIPES WITH MATTRESSES)		REF. TO ASSY. DRG	ITEM
DRN S.C.S. NAME SIGN DATE DESN S.C.S. 9.6.97 CHD D.B.S. 9.8.97 APPD S.K.J. 11.6.97		CARD CODE DRAWING NO. PE-4-999-169-01	
SHEET 1 OF 1		REV. 00	

COPY RIGHT AND CONFIDENTIAL
This drawing is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED

JOB NO. STANDARD



NOTES: -

1. FOR DETAILS 'Q' AND 'R' REFER DRG. No. PE-4-999-169-12
2. FOR CLADDING SHEET SUPPORT REFER DRG. No. PE-4-999-169-04
3. 2nd & 3rd LAYER IF ANY SHALL BE OF MATTRESSES.
4. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS"

MATERIALS REQUIRED: -

1. PIPE SECTIONS
2. BANDS AND SEAL
3. CLADDING SHEET
4. S.T. SCREWS
5. SEALING COMPOUND



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

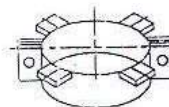
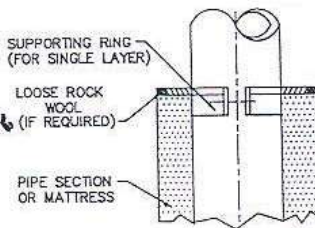
DEPT. MPL	CODE M	SCALE N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG.	ITEM																
TITLE: - INSULATION APPLICATION (HORIZONTAL PIPES WITH PIPE SECTION)				<table border="1"> <tr> <th>DRN</th> <th>NAME</th> <th>SIGN</th> <th>DATE</th> </tr> <tr> <td>DESN</td> <td>S.C.S.</td> <td>[Signature]</td> <td>6.6.97</td> </tr> <tr> <td>CHD</td> <td>D.B.S.</td> <td>[Signature]</td> <td>7.6.97</td> </tr> <tr> <td>APPR</td> <td>S.K.J.</td> <td>[Signature]</td> <td>11.6.97</td> </tr> </table>	DRN	NAME	SIGN	DATE	DESN	S.C.S.	[Signature]	6.6.97	CHD	D.B.S.	[Signature]	7.6.97	APPR	S.K.J.	[Signature]	11.6.97	
DRN	NAME	SIGN	DATE																		
DESN	S.C.S.	[Signature]	6.6.97																		
CHD	D.B.S.	[Signature]	7.6.97																		
APPR	S.K.J.	[Signature]	11.6.97																		
CARD CODE		DRAWING NO. PE-4-999-169-02																			
SHEET 1 OF 1		REV. 00																			

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.

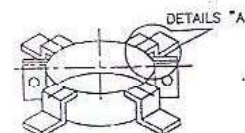
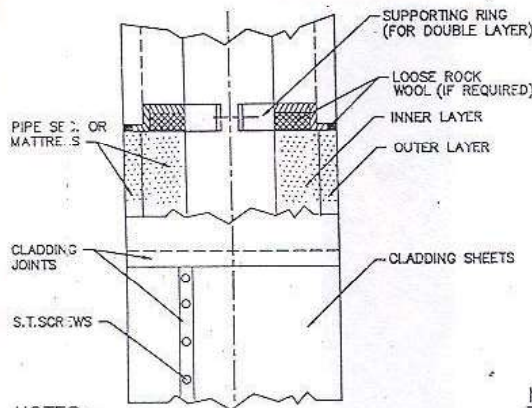
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED

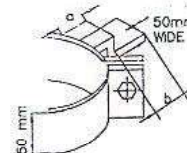
JOB NO. STANDARD



SUPPORT RING
(FOR SINGLE LAYER)



SUPPORT RING
(FOR DOUBLE LAYER)



DETAIL 'A'

NOTES:—

1. LENGTH 'a' & 'b' TO BE 12 TO 50mm LESS THAN SPECIFIED INSULATION THICKNESS.
2. SUPPORT RING TO BE FABRICATED OUT OF MS FLATS/STRAPS.
3. SUPPORT RING REQUIRED FOR PIPE 60 Nb & LARGER IF INSULATION THICKNESS LARGER THAN 30mm.
4. SUPPORT RINGS REQUIRED FOR MATTRESS ONLY.
5. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS"

MATERIALS REQUIRED:—

1. FLATS/STRAPS
2. MATTRESSES/PIPE SECTIONS
3. CLADDING SHEET
4. NUTS AND BOLTS
5. SELF TAPPING SCREWS
6. SEALING COMPOUND
7. SUPPORT RINGS (FOR MATTRESSES ONLY)



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

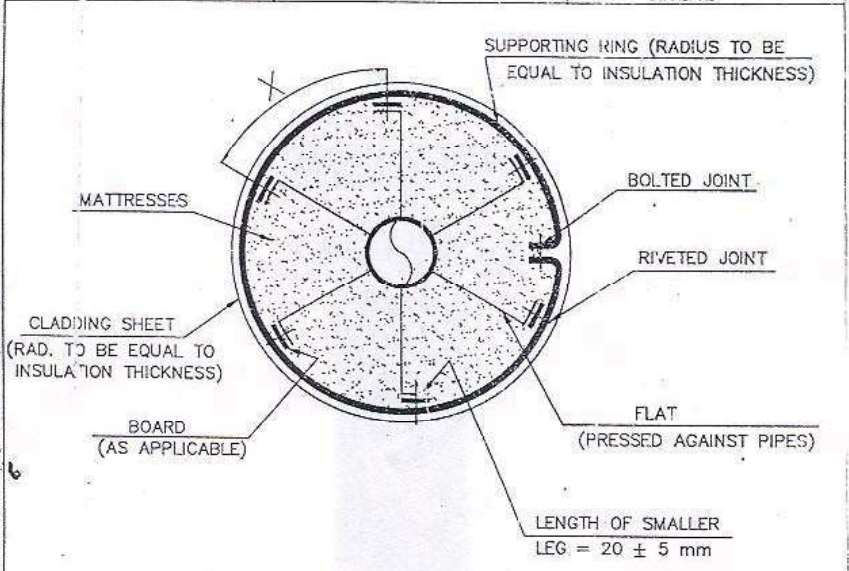
DEPT. MPL	CODE M	SCALE N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
TITLE:—			INSULATION APPLICATION (VERTICAL PIPING)		
			CARD CODE	DRAWING NO.	
			—	PE-4-999-169-03	
			SHEET 1 OF 1	REV. 00	

23

A4

COPY RIGHT AND CONFIDENTIAL
Bharat Heavy Electricals Limited, New Delhi.
The information on this document is the property of Bharat Heavy Electricals Limited.
It must not be used directly or indirectly in any way detrimental to the interest of the company.

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED
JOB NO.			STANDARD		



X = 150 mm TO 200 mm SO THAT NUMBER OF WEBS IS EVEN NUMBER

MATERIAL REQUIRED:-

1. FLATS
2. RIVETS
3. BOLTS AND NUTS
4. BOARD

NOTE:-

1. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS".

BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI							
DEPT. MPL	CODE M		SCALE N.T.S.	WEIGHT (KG)	REF. TO ASSY. DRG	ITEM	
TITLE:- INSULATION APPLICATION (CLADDING SHEET, SUPPORT RING FOR HOR. PIPE O.D > 114.3mm & HOR. EQUIPMENTS)				DRN	NAME	SIGN	DATE
				DESN	S.C.S.		9.6.92
				CHK	D.B.S.		9.6.92
				APPD	S.K.J.		11.6.92
CARD CODE				DRAWING NO.			
				PE-4-999-169-01			
SHEET 1 OF 1				REV. 00			

24

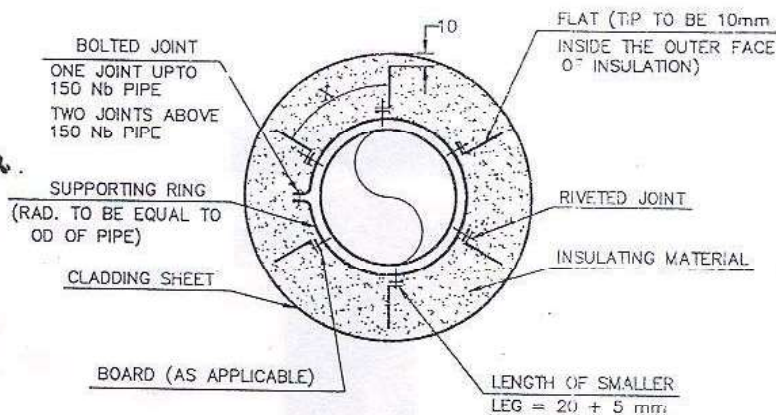
A4

FIRST WHOLE PROJECTION OF ALL DIMENSIONS ARE IN MM

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED

JCS NO. STANDARD

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in any way detrimental to the interest of the company.



X = 150 mm TO 200 mm SO THAT NUMBER OF WEBS IS EVEN NUMBER
MATERIAL REQUIRED:-

1. FLATS
2. RIVETS
3. BOLTS AND NUTS
4. BOARD

NOTES:-

1. INSULATION DETAILS ON VERTICAL PIPING SHALL BE SAME AS PER FOR HORIZONTAL PIPES.
2. SPACING BETWEEN SUPPORTING RINGS SHALL BE 3 Mtrs.
3. FOR INSULATION OF END OF VERTICAL EQUIPMENTS REFER DRG. No. PE-4-989-169-09.
4. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS."
5. FLATS/RINGS OF REQUIRED LENGTH/DIA SHALL BE MADE BY ERECTING AGENCY AT SITE FROM MS FLATS/STRAPS.

		BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI				
DEPT.	CODE	SCALE	N.T.S.	WEIGHT (KGS)	REF. TO ASSY. DRG	ITEM
TITLE:-			INSULATION APPLICATION (INSULATION SUPPORT RING FOR VERTICAL PIPING & VERTICAL EQUIPMENTS)			
			DRN NAME SIGN DATE DESN S.C.S. 9.6.77 CHD D.B.S. 9.6.77 APPD S.X.J. 11.6.77			
CARD CODE			DRAWING NO.			
			PE-4-989-169-05			
SHEET 1 OF 1			REV. 00			

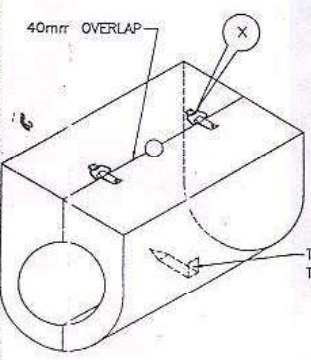
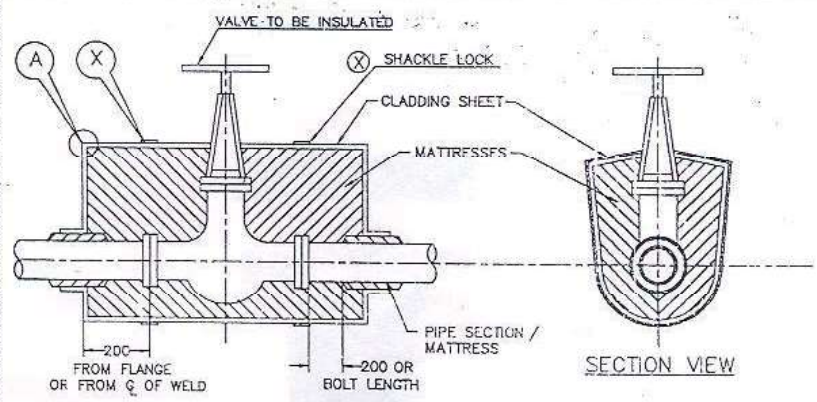
AL-222

26

AV

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED
 IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

REV.		DATE	ALTERED	REV.		DATE	ALTERED
			CHECKED				CHECKED
				JOB NO. STANDARD			



MATERIALS REQUIRED: -

1. MATTRESSES
2. CUPS OF SHACKLE LOCKS FABRICATED OUT OF CLADDING SHEET
3. CLADDING SHEET
4. RIVETS
5. SHACKLE LOCKS CONNECTING BUCKLES.
(REF. DRG. PE-4-999-169-10)
6. SELF TAPPING SCREWS
7. SEALING COMPOUND.

NOTE:-

1. FOR DETAIL A & X REFER DRG No. PE-4-999-169-10
2. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS".

		BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI						
DEPT. MPL	CODE M		SCALE N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM		
TITLE: -			INSULATION APPLICATION (VALVES)		DRN	NAME	SIGN	DATE
					DESN	S.C.S.		5.6.97
					CHD	D.B.S.		6.6.97
					APPD	S.K.J.		11.6.97
CARD CODE			DRAWING NO.					
			PE-4-999-169-06					
			SHEET 1 OF 1		REV. 00			

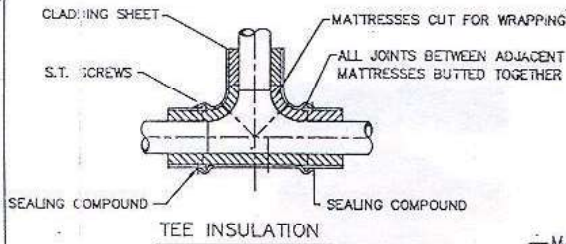
DB

A1

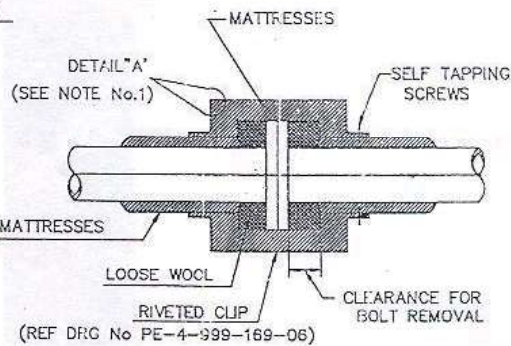
COPY RIGHT AND CONFIDENTIAL
The information in this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
6		CHECKED			CHECKED
			JOB NO. STANDARD		



TEE INSULATION



FLANGE JOINT INSULATION

MATERIALS REQUIRED:-

1. PIPE SECTION/MATTRESSES
2. STITCHING WIRE
3. CLADDING SHEET
4. BINDING WIRE
5. SELF TAPPING SCREWS
6. SEALING COMPOUND

(REF DRG No PE-4-999-169-06)

NOTE:-

1. FOR DETAIL "A" REFER DRG No. PE 4 099-169-10
2. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS."



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT.	CODE	SCALE	WEIGHT	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	(KG)		
TITLE:-					
INSULATION APPLICATION (TEES AND FLANGE JOINTS)				DRN	NAME
				DESIGN	S.C.S.
				CHD	D.B.S.
				APPD	S.K.J.
				SIGN	DATE
					9.6.97
					7.6.97
					4.6.97
CARD CODE		DRAWING NO.			
		PE-4-999-169-07			
		SHEET 1 OF 1	REV. 00		

27

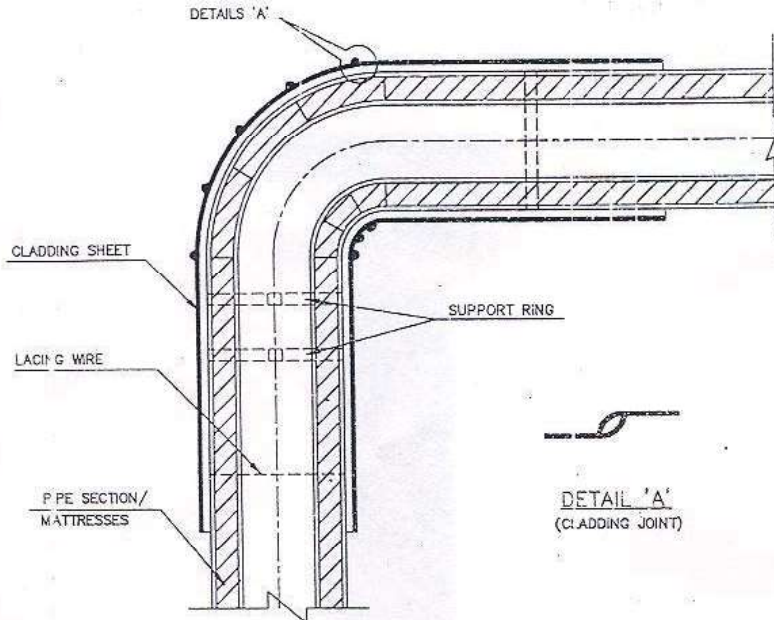
A4

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED

JOB NO. STANDARD



MATERIALS REQUIRED:-

1. MATTRESSES
2. PIPE SECTION (IF APPLICABLE)
3. LACING WIRE
4. CLADDING SHEET
5. BINDING WIRE
6. SELF TAPPING SCREWS
7. SEALING COMPOUND

NOTES:-

1. TWO SELF TAPPING SCREWS TO BE USED FOR EACH SHEET SEGMENT AT INNER SIDE OF BEND.
2. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS."



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT. MPL	CODE M	SCALE N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG.	ITEM
TITLE:- INSULATION APPLICATION (ELBOWS & BENDS SIZE EXCEEDING 150mm)				DRN NAME S.C.S.	SIGN DATE
				DESIGN S.C.S.	9.6.97
				CHKD D.B.S.	9.6.97
				APPD S.K.J.	11.6.97
CARD CODE		DRAWING NO. PE-4-999-169-08			
—		SHEET 1 OF 1		REV. 00	

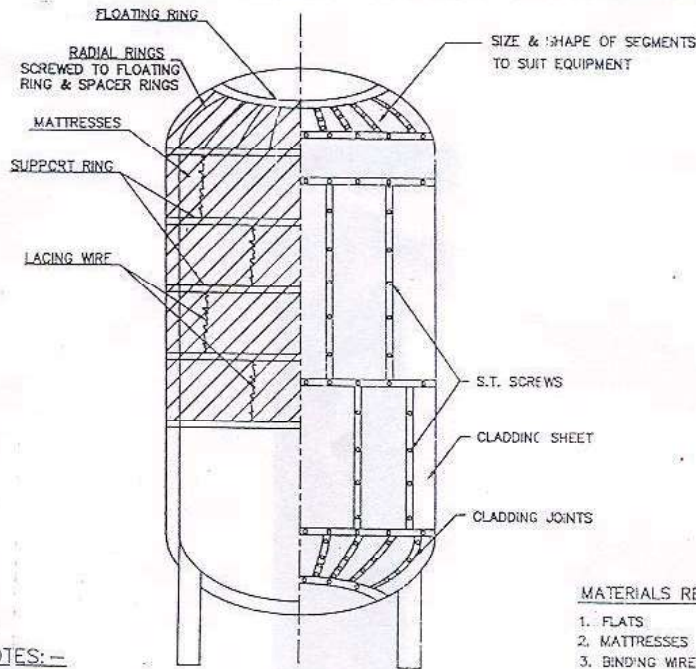
D8

A4

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED
JOB NO. STANDARD					



NOTES:-

1. STRAPS/BANDS CUT FROM SHEET, WITH SEAL SHALL BE USED OVER FINAL LAYER AT 300mm INTERVALS.
2. INSULATION OF HOR. EQPTS. SHALL BE AS FOR HOR. PIPES. REFER DRG No. PE-4-999-169-01 & PE-4-999-169-02
3. FOR CLADDING SHEET SUPPORT REF. DRG. No. PE-4-999-169-04.
4. FOR INSULATION SUPPORT REF. DRG. No. PE-4-999-169-05.
5. INSULATION OF ENDS OF HOR. EQPTS. SHALL BE SIMILAR TO THIS DRG.
6. WELDING TO EQUIPMENT NOT PERMITTED.
7. FOR GEN. INF. ON APPLICATION OF INSULATION REF. DOC. "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING & EQPTS".

MATERIALS REQUIRED:-

1. FLATS
2. MATTRESSES
3. BINDING WIRE
4. LACING WIRE
5. CLADDING SHEET
6. GLASS FABRIC/BOARDS (AS APPLICABLE)
7. RIVETS
8. SELF TAPPING SCREWS
9. SEALING COMPOUND
10. STRAPS/BANDS

		BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI																				
DEPT. MPL	CODE M		SCALE N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM																
TITLE:-			INSULATION APPLICATION (EQUIPMENT)																			
			<table border="1"> <tr> <td>DRN</td> <td>NAME</td> <td>SIGN</td> <td>DATE</td> </tr> <tr> <td>DESN</td> <td>S.C.S.</td> <td><i>[Signature]</i></td> <td>9.6.77</td> </tr> <tr> <td>CHD</td> <td>D.B.S.</td> <td><i>[Signature]</i></td> <td>9.6.77</td> </tr> <tr> <td>APPD</td> <td>S.K.V.</td> <td><i>[Signature]</i></td> <td>11.6.77</td> </tr> </table>				DRN	NAME	SIGN	DATE	DESN	S.C.S.	<i>[Signature]</i>	9.6.77	CHD	D.B.S.	<i>[Signature]</i>	9.6.77	APPD	S.K.V.	<i>[Signature]</i>	11.6.77
DRN	NAME	SIGN	DATE																			
DESN	S.C.S.	<i>[Signature]</i>	9.6.77																			
CHD	D.B.S.	<i>[Signature]</i>	9.6.77																			
APPD	S.K.V.	<i>[Signature]</i>	11.6.77																			
			CARD CODE DRAWING NO. PE-4-999-169-09																			
			SHEET 1 OF 1 REV. 00																			

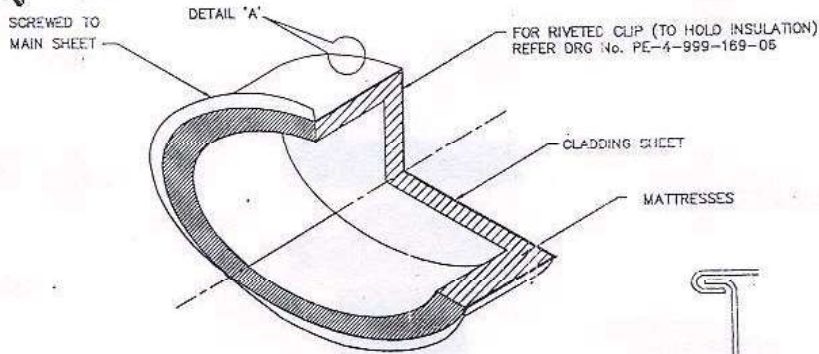
D9

14

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company.

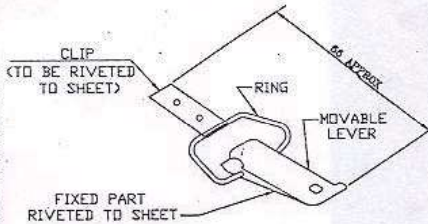
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED
JOB NO. STANDARD					



INSULATING COVER FOR MAN HOLE

DETAILS 'A'
(LOCKING OF SHEETS)



G.I. SHACKLE LOCK CONNECTING BUCKLE
DETAILS 'X'

MATERIAL REQUIRED:-
(MAN HOLE)

1. MATTRESSES
2. CLADDING SHEET
3. SELF TAPPING SCREWS
4. RIVETS
5. CLIPS (TO BE MADE AT SITE)
6. SEALING COMPOUND

MATERIAL REQUIRED:-
(FOR SHACKLE LOCK)

1. CLIP (MADE FROM CLADDING SHT.)
2. RIVETS

NOTES:-

1. FOR GENERAL INFORMATION ON APPLICATION INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS".



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT.	MPL	CODE	M		SCALE	N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM			
TITLE:-								DRN	NAME	SIGN	DATE	
(INSULATION APPLICATION (FABRICATED HEAT INSULATING COVER FOR MAN-HOLE))								DESN	S.C.S.		9.6.97	
								CHD	D.B.S.		9.8.97	
								APPD	S.K.J.		11.6.97	
								CARD CODE				DRAWING NO.
—				PE-4-999-169-10		SHEET		1	OF	1	REV.	00

DLO

A4

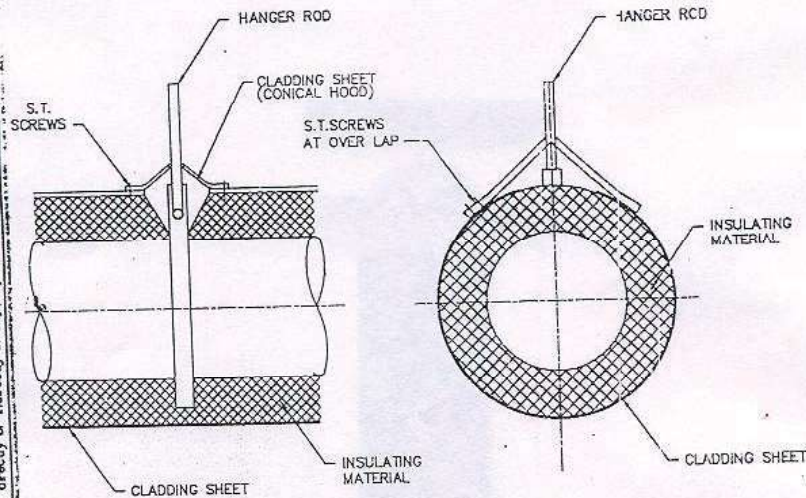
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
01	10.5.82	CHECKED			

NOTE 2 ADDED.

JOB NO. STANDARD

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED
It must not be used directly or indirectly in any way detrimental to the interest of the company.



MATERIALS REQUIRED:-

1. MATTRESSES/PIPE SECTIONS
2. CLADDING SHEET
3. SELF TAPPING SCREWS
4. SEALING COMPOUND

NOTES:-

1. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS".
2. WHEREVER THE END OF CLAMP PROTRUDES OUT OF INSULATION AT THE BOTTOM, SUITABLE BOX STRUCTURE TO BE PROVIDED MADE OF ALUMINIUM.



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT.	CODE	SCALE	N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M					
TITLE:- INSULATION APPLICATION (METAL FLASHING ON HANGER ROD PROTRUSION)						
				DRN	NAME	SGN
				DES	S.C.S.	DATE
				CHO	D.B.S.	
				APPD	S.K.J.	
				CARD CODE	DRAWING NO. PF-4-999-169-11	
					SHEET 1 OF 1	REV. 00

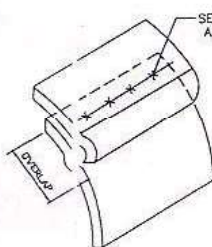
DLI

1/4

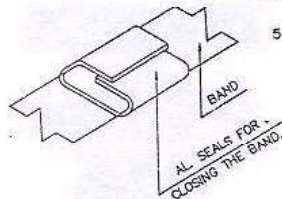
COPY RIGHT AND CONFIDENTIAL
This information is the property of BHARAT HEAVY ELECTRICALS LIMITED.
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

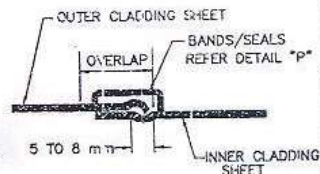
REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED
JOB NO. STANDARD					



****DETAIL 'R'**
(LONGITUDINAL JOINT)



DETAIL 'P'



***DETAIL 'Q'**
(CIRCUMFERENTIAL JOINT)

1. JOINTS TO BE MADE AT 45° FROM BOTTOM
2. JOINTS TO BE ON LOWER HALF OF THE CIRCUMFERENCE FOR HORIZONTAL PIPES AND EQUIPMENTS.
3. SEALING COMPOUND WILL BE USED ON ALL LONGITUDINAL JOINTS.

1. TELESCOPIC SLIDING JOINTS SHALL HAVE 5 TO 8mm SPACING.
2. THE OVERLAPPING OF TELESCOPIC JOINTS SHALL BE AS BELOW:--

CIRCUMFERENCE OF SHEET (mm)	LONGITUDINAL OVERLAP (mm)
< 400	30
401 ~ 500	40
> 500	50
3. TELESCOPIC JOINT SHALL BE PLAIN.

NOTE: -

1. ALL JOINTS NEAR OIL PIPING TO HAVE SEALING COMPOUND.
2. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING AND EQUIPMENTS".



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT.	CODE	SCALE	N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M					
TITLE: -					DRN	NAME
INSULATION APPLICATION (DETAILS OF "P", "Q" AND "R")					DESN	S.C.S.
					CHD	D.H.S.
					APPD	S.K.J.
CARD CODE					DRAWING NO.	
—					PE-4-999-169-12	
SHEET 1 OF 1					REV. 00	

D/2

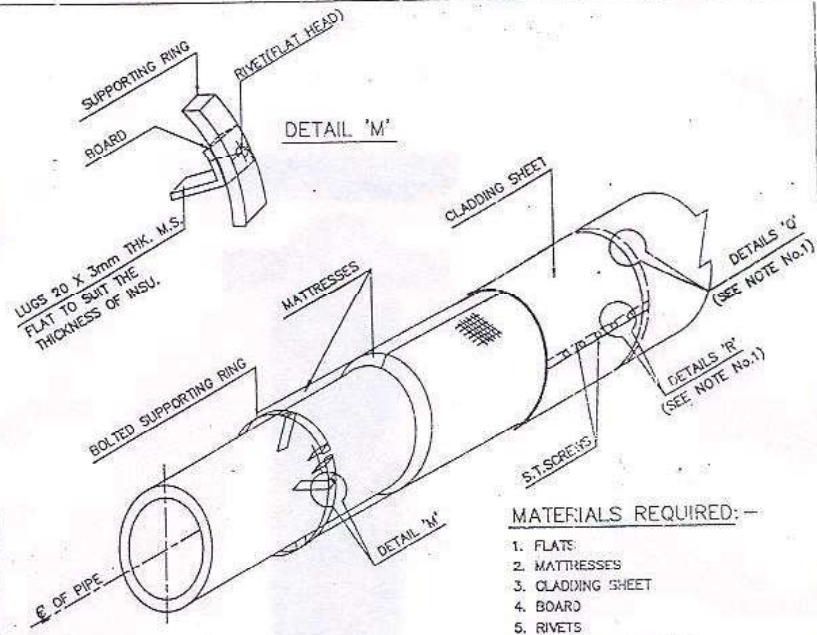
A4

BHARAT HEAVY ELECTRICALS LIMITED
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.
 It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED

JOB NO. STANDARD



MATERIALS REQUIRED:-

1. FLATS
2. MATTRESSES
3. CLADDING SHEET
4. BOARD
5. RIVETS
6. SELF TAPPING SCREWS
7. SEALING COMPOUND
8. BOLTS & NUTS.

DETAILS OF LUGS:

PIPE	Nb(mm)	No. OF LUGS
1.	33 - 150	4
2.	200 - 300	6
3.	350 - 450	8
4.	500 - 600	10

NOTES:-

1. FOR DETAILS 'Q' AND 'R' REFER DRG No. PE-4-999-169-12
2. FOR GENERAL INFORMATION ON APPLICATION OF INSULATION REFER DOCUMENT "INSTRUCTIONS FOR APPLICATION OF THERMAL INSULATION FOR PIPING & EQUIPMENTS".



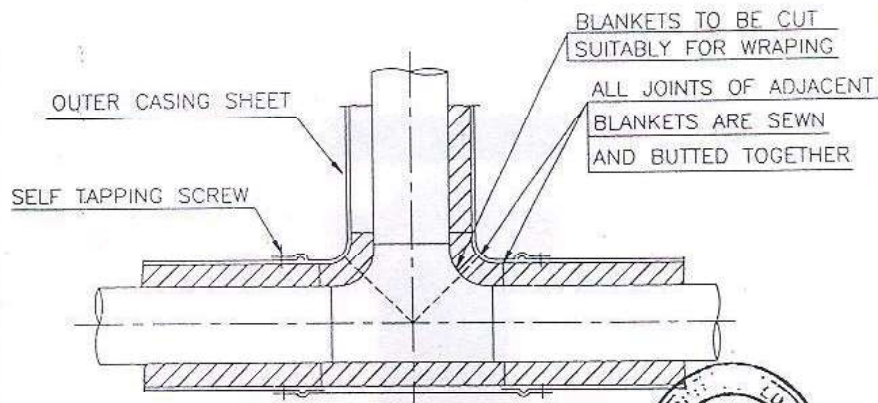
BHARAT HEAVY ELECTRICALS LIMITED
 POWER SECTOR
 PROJECTS ENGINEERING MANAGEMENT
 NEW DELHI

DEPT. MPL	CODE M	SCALE N.T.S.	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
TITLE:- INSULATION APPLICATION (SUPPORT RING FOR PIPE O.D. > 168.3mm)			DRN DESIGN	NAME S.C.S.	SIGN DATE
			CHD APPD	D.B.S. S.K.J.	7.6.77
CARD CODE		DRAWING NO. PE-4-999-169-13			
—		SHEET 1 OF 1		REV. 00	

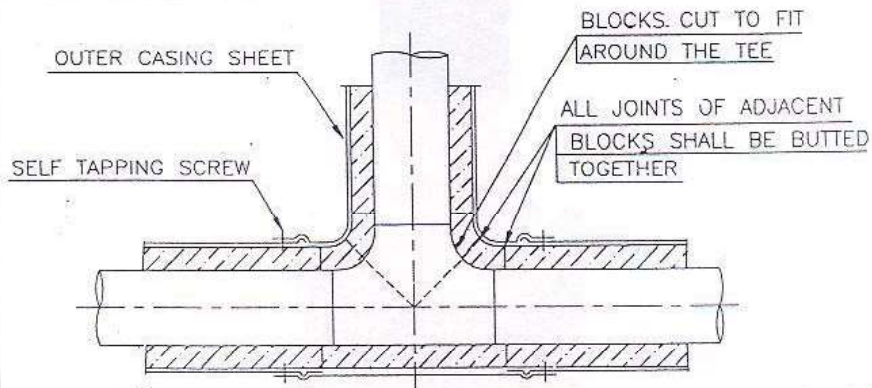
DI3



TEE INSULATION



TEE INSULATION
(WITH WOOL MATTRESS)



TEE INSULATION
(WITH CALCIUM SILICATE)

INSULATION	PREPARED	A.R. JOTHIRUNATHAN	SIGNATURE	DATE	DRAWING NO.	REV.
	CHECKED	K. KALIRAJAN		04.12.03	4-00-235-08546	
	APPROVED	C. GUNASEKARAN				



ELBOW INSULATION

ALL JOINTS BETWEEN ADJACENT
BLANKETS SHALL BE SEWN
AND BUTTED TOGETHER

SELF TAPPING SCREW

BLANKETS CUT FOR
WRAPPING AROUND
THE ELBOW

ALL SHEETS AT
JOINTS TO OVERLAP
BY 40 MM

OUTER CASING SHEET

WITH WOOL MATTRESS

ALL JOINTS BETWEEN
ADJACENT BLOCKS SHALL
BE BUTTED TOGETHER

SELF TAPPING SCREW

BLOCKS CUT TO FIT
AROUND THE ELBOW

ALL SHEETS AT
JOINTS TO OVERLAP
BY 40 MM

OUTER CASING SHEET

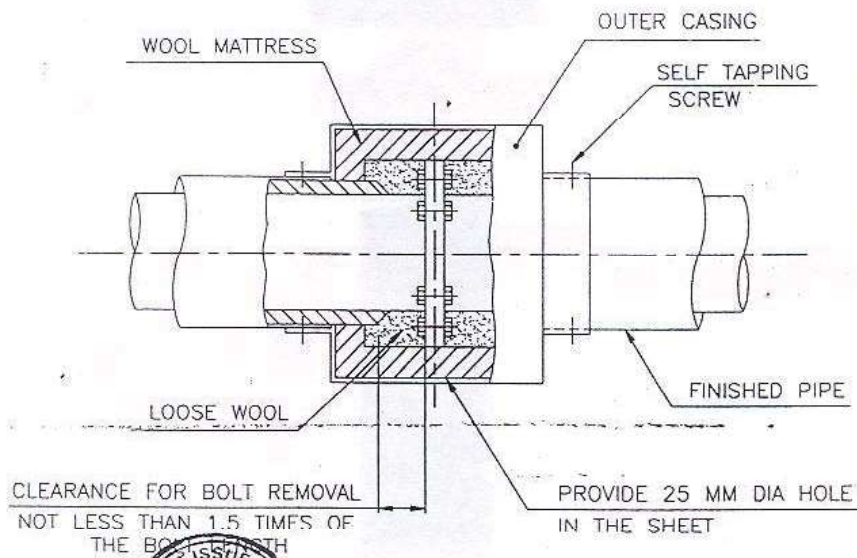


WITH CALCIUM SILICATE

INSULATION	PREPARED	AJ. JOTHIBOURNATHAN	DATE	04.12.03	DRAWING NO : 4-00-235-08547	REV
	CHECKED	K. KALIRAJAN				
	APPROVED	C. GUNASEKARAN				



FLANGE INSULATION



NOTE:—

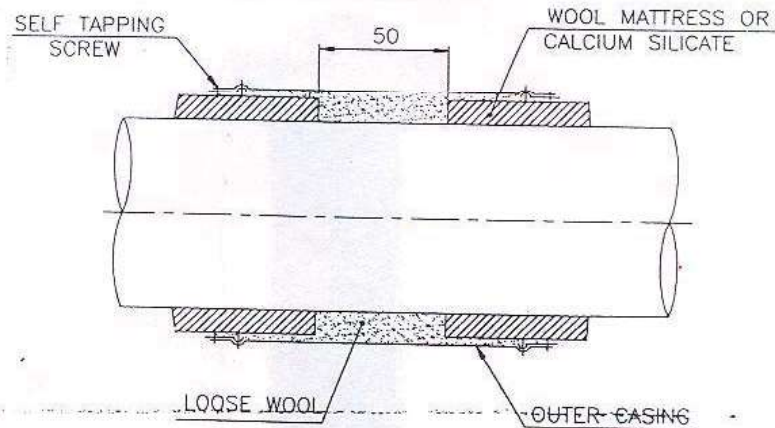
1. WHEREEVER THE FLANGES ARE ENVISAGED FOR DISMANTLING, THIS TYPICAL ARRANGEMENT IS TO BE FOLLOWED.

INSULATION

PREPARED	ARJITHI GURUNATHAN	SIGNATURE	DATE	DRAWING NO :	REV
CHECKED	K.KALIRAJAN		04.12.03	4-00-235-08548	
APPROVED	C.GUNASEKARAN				



EXPANSION JOINT FOR PIPES



NOTE:—

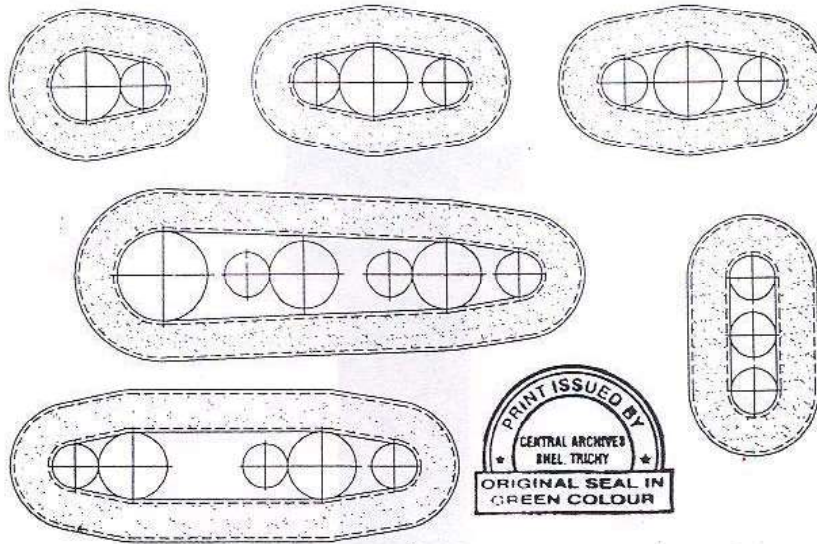
1. THIS ARRANGEMENT IS APPLICABLE FOR BOTH HORIZONTAL AND VERTICAL PIPE LINES, AT EVERY 5 METRES.
2. WHEN THE OPERATING TEMPERATURE IS BELOW 230°C, EXPANSION JOINTS ARE NOT REQUIRED.
3. FOR PIPES, WHERE THE FLOW IS ONLY INTERMITTENT, EXPANSION JOINTS ARE NOT REQUIRED.



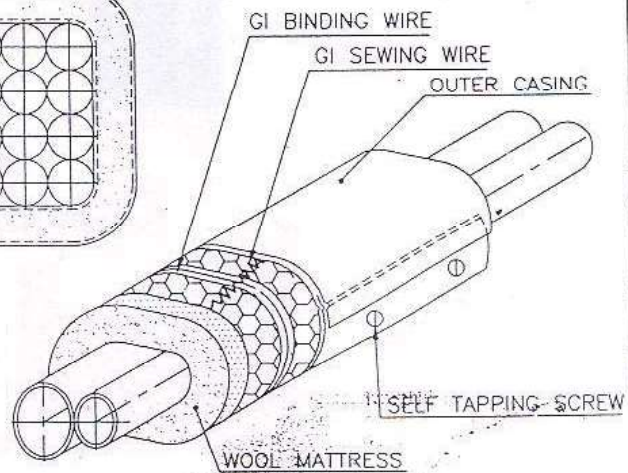
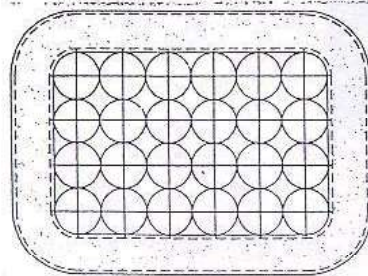
INSULATION	PREPARED	A. JOSEPH GURUNATHAN	SIGNATURE	DATE	DRAWING NO :	REV
	CHECKED	K. KALIRAJAN				
	APPROVED	C. GUNASEKARAN				
4-00-235-08549						



BUNCH INSULATION



FOR NOTES REFER DRG.4-00-235-08541.

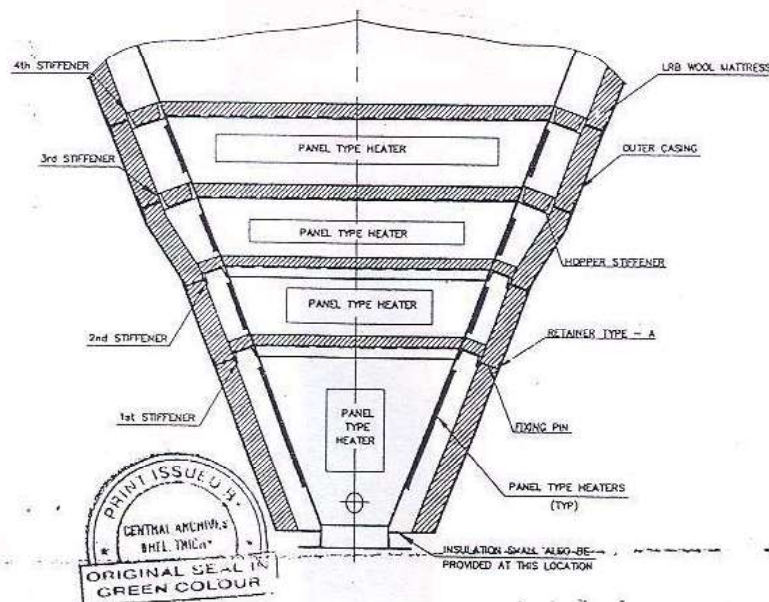


INSULATION	PREPARED	A.C.JOTHIRUNATHAN	SIGNATURE	DATE	DRAWING NO.	REV
	CHECKED	K.KALIRAJAN				
	APPROVED	C.GUNASEKARAN				
4-00-235-08550						

THE INFO ON THIS DOCUMENT IS THE PROPERTY OF BHEL.
CAUTION: IT MUST NOT BE USED DIRECTLY OR INDIRECTLY
IN ANY WAY DETRIMENTAL TO THE INTEREST OF BHEL.

REV	DATE	ALTERED : A.R.J.
01	01.10.05	CHD & APPD : C.G.S.
DRAWING ALTERED		

FOR TOLERANCES OF UNTOLERANCED
DIMENSIONS DURING MANUFACTURE
REFER PLANT STD. NO TP 023 0299



NOTE:

01. THE INSULATION SHOWN IS FOR TYPICAL PANEL HEATER HOPPERS. THIS IS TO BE FOLLOWED WHERE EVER PANEL TYPE HEATERS ARE ENVISAGED.
02. INSULATION FIXING PINS AND RETAINERS SHOULD NOT FOUL WITH THE PANEL HEATERS.
03. FOR OTHER INSULATION DETAILS, REFER DRG. 1-00-235-06854.

		Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014		DRW NAME A.R.J.	SIGNATURE	DATE 20.09.05
355-056				CHD C.G.S.		22.09.05
				APPD C.G.S.		22.09.05
DEPT L&I	ALL DIMENSIONS ARE IN MM	PROJECTION 	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG	
CODE 123	TITLE HOPPER INSULATION DETAIL FOR PANEL TYPE HEATERS			DRAWING NO 4-00-235-08702	REV 01	



MONTHLY PLAN REVIEW WITH CONTRACTOR

Form No: F-14 (Rev 01)

PS-

Page 1 of 5

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART- A: PLAN/ REVIEW OF WORK FOR THE MONTH OF

Date of Plan/ Review

SN.	Description of work	Unit of Measur- ement	Unit Rate	Planned		Cumulative Shortfall attributable to contractor upto last month (Refer Note 1)		Achieved		Shortfall attributable to BHEL w.r.t Plan (as per Col. 3 of Part- D)		Cumulative Shortfall attributable to Contractor upto & including this month		REMARKS (Reasons for Shortfall attributable to Contractor. Supporting documents to be kept as record.)	
				(QTY Planned for the month as per Part –C of last month)											
(a)	(b)	(c)	(d)	A		B		C		D		E=A+B-C-D			
				Phy.	Financial	Phy.	Financial	Phy.	Financial	Phy.	Financial	Phy.	Financial		
	Value of Other Items not mentioned above but planned to be executed in this month														
Total					ΣA		ΣB		ΣC		ΣD		ΣE		

Note 1: In addition to the work planned as per Col. 'A', Contractor shall also make full efforts to minimize the 'Cumulative shortfall attributable to contractor upto the month' as mentioned in Col. 'B' by enhancing its resources, so as to achieve the completion of activities as per agreed schedule. In case contractor is not able to execute the entire shortfall, then BHEL 'Engineer in-charge', shall decide the priority of work to be executed and it shall be binding on the contractor.

Note 2: Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month = $[(\Sigma E - \Sigma B) / (\Sigma A - \Sigma D)] \times 100$
In case, $(\Sigma E - \Sigma B)$ is negative, then it shall be treated as zero percent."

Note 3: Form 14 should include all items being planned in the current month, and all items against which shortfall was attributable to contractor till previous month. However, for practical reason, if it is not possible to mention some of the items in Form-14 being planned to be executed in this month, then also value of such items shall necessarily be included in calculation of Total Value.

Note 4: In case reason for shortfall attributable to contractor is w.r.t. T&P and Manpower, it should be in conformity with Part B1 and B2.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)



MONTHLY PLAN REVIEW WITH CONTRACTOR

Form No: F-14 (Rev 01)

PS-

Page 2 of 5

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – B-1: PLAN/REVIEW OF DEPLOYMENT OF MAJOR T&Ps FOR THE MONTH OF Date of Plan/ Review

CONTRACTOR'S SCOPE:-

SN.	PLAN				DEPLOYMENT STATUS			
	Major T&P to be deployed as per work planned for the month	QTY.	Deployment Period (in days)	Weightage assigned to planned T&P (in fraction such that $\Sigma C = 1$)	Actual Deployed Quantity	Actual Deployment Period (in days)	Weighted T&P Deployed	REMARKS (Works affected due to non-deployment of T&Ps)
		A	B	C	D	E	$F = (C \times D \times E) / (A \times B)$	

Note: In case, $E > B$, it shall be considered as $E = B$. Similarly, in case $D > A$, it shall be considered as $D = A$.

Percentage of T&P Deployed = $\Sigma F \times 100$

BHEL SCOPE:-

SN.	PLAN			DEPLOYMENT STATUS		
	Major T&P to be deployed as per work planned for the month	QTY.	Deployment Period (in days)	Actual Deployed Quantity	Actual Deployment Period (in days)	REMARKS (Works affected due to non-deployment of T&Ps)

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)



MONTHLY PLAN REVIEW WITH CONTRACTOR

Form No: F-14 (Rev 01)

PS-

Page 3 of 5

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – B-2: PLAN/ REVIEW OF DEPLOYMENT OF MANPOWER FOR THE MONTH OF Date of Plan/ Review

CONTRACTOR'S SCOPE:-

SN.	Area of Work	Category of Labour	No. of Labour required as per category	Deployment Period (in days)	No. of Labour actually deployed	Actual Deployment Period (in days)	REMARKS (Works affected due to non-availability of labour)
			A	B	C	D	

Percentage of Manpower Deployed= $100 \times \Sigma(C \times D) / \Sigma(A \times B)$

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)



MONTHLY PLAN REVIEW WITH CONTRACTOR

Form No: F-14 (Rev 01)

PS-

Page 4 of 5

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – C: PLAN(PHYSICAL) FOR THE NEXT MONTH i.e.

Date of Plan

SN.	Description of work	Original Planned Quantity	Planned Quantity (excluding shortfalls attributable to contractor till date)	Unit of Measu- rement	T&Ps Required				Manpower Required		REMARKS (Reasons for difference in Original Planned Quantity w.r.t. Planned quantity to be given)
					Contractor Scope		BHEL Scope		Category of Labour	No. of Labour required as per Category	
					Major T&P to be deployed as per work planned for the month	Quantity	Major T&P to be deployed as per work planned for the month	Quantity			

Note 1: Planned quantity should be based on available/ expected fronts/ inputs in the next month

Note 2: “Original Planned Quantity” shall be as per latest jointly agreed programme between BHEL and Contractor before commencement of work or at the time of latest Time Extension, as the case may be.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)



MONTHLY PLAN REVIEW WITH CONTRACTOR

Form No: F-14 (Rev 01)

PS-

Page 5 of 5

Name of Project		Contract No.	
Name of Work		Name of Contractor	

PART – D: REASONS FOR SHORTFALL ATTRIBUTABLE TO BHEL IN RESPECT OF PLAN FOR THE MONTH

SN.	Description of Work (from Part-A)	Quantities Affected		Reasons for Shortfall attributable to BHEL	Agency responsible for reasons for shortfall	Remarks (Supporting Documents in respect of agency responsible)
		Physical Quantity	Unit of Measu- rement			
1	2	3		4	5	6

Note1: Reasons for shortfall shall include non-availability of fronts/ drawings/ materials/ T&P (BHEL Scope)/ clearances etc. and other hindrances for which contractor is not responsible.

Note2: Agency responsible may be BHEL Site/ MUs/ Design Centre/ BHEL Customer etc.

BHEL
(Sign with name, designation and date)

CONTRACTOR
(Sign with name, designation and date)

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 1 of 6

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#1.01	Cumulative number of days in the month, the nominated Quality Officer or his authorised nominee was not available	QUALITY	1.5		Quality Officer or his authorised nominee should be available for all the days of working at site	Daily Log Book entry/Incident Registers/letter references
#1.02	Number of instances of non- compliance wrt FQP, Standard Drawings, Specifications, E&C Manuals etc.	QUALITY	1.5		No deviation from FQP, Standard Drawings, Specifications, E&C Manuals etc. is allowed without BHEL Engineer's approval.	Daily Log Book entry/Incident Registers/letter references
#1.03	Percentage submission of test certificates for batches of welding electrodes, cement, sand, aggregate, consumable, Paints etc. as applicable for this month OR In case of MM & MH package, monthly checks for Storage/Preservation of material.	QUALITY	1		Submission of 100% Test certificates for materials as per FQP is mandatory. MM & MH package: Storage/Preservation as per manual/procedure.	Daily Log Book entry/Incident Registers/letter references
#1.04	Number of incidences of improper storage & preservation (not in accordance to the guidelines of BHEL MUs or approved FQP) of materials, consumables (viz. gases, welding electrodes & fluxes, fuel etc.) & bought-out items (paints, fasteners etc.) under the custody of the contractor	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#1.05	Rework/ Rejection instances in a month necessitated due to deviation from Standard Drawings /Specifications /Manuals /E&C procedures /FQPs or due to Poor Workmanship by contractor	QUALITY	2		Reworks/ Rejection should be as minimum as possible. Total number of reworks/ rejections due to reasons attributable to contractor.	Daily Log Book entry/Incident Registers/letter references
#1.06	Delay in preparation & submission of signed protocols / log sheets / site register / NDT test reports as per approved FQP/ Qualified Welder List along with photocopies of Welder ID cards / Welder Performance Evaluation records etc. in the month OR in case of MM / MH package reconciliation statement / verification report.	QUALITY	1		Within 2 days of measurements taken or within first 3 working days of next month, as advised by BHEL Engineer	Daily Log Book entry/Incident Registers/letter references
#1.07	Number of instances for Major equipment/product failure due to negligence/improper work/poor workmanship by contractor	QUALITY	1		No such event should happen	Daily Log Book entry/Incident Registers/letter references
#1.08	Total number of complaints received in the month on the quality of finish / aesthetics	QUALITY	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 2 of 6

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#2.01	Cumulative number of days of delay in submission of Plan FOR THE MONTH supported by deployment plan of Major T&Ps and Manpower (as per Form F-14) and relevant construction/layout drawings - like A4 plan / elevation views of plan status for structures / pressure parts/Civil Works, Piping isometrics for piping, Layout / PID / System reference sketch, Unloading / storage plans etc.as applicable.	PERFORMANCE	5		Number of days delayed from second working day of the month	Daily Log Book entry/Incident Registers/letter references
#2.02	Percentage of timely submission of Daily Reports for Progress of work, Resources, Consumables etc.	PERFORMANCE	1.5		Percentage of timely submission of daily reports/ Scheduled date is successive next day for each day	Daily Log Book entry/Incident Registers/letter references
#2.03	Number of days delayed for submission of FQP log sheets / protocols / Monthly Progress Reports for the work executed during the month under measurement	PERFORMANCE	1.5		Number of days delayed/Scheduled date is first 2 working days of next month	Daily Log Book entry/Incident Registers/letter references
#2.04	Percentage Shortfall attributable to contractor w.r.t. "Plan - Shortfall attributable to BHEL" for the month as per Form-14	PERFORMANCE	35		As per Part-A of Form-14	Progress review formats
#2.05	Number of days delayed in submission of Running bills with complete supporting documents (including updated reconciliation statement of BHEL issued material) for the month	PERFORMANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#2.06	Number of times the Top Management of contractor did not respond to critical issues of site, for the month	PERFORMANCE	1		Total number of instances	Daily Log Book entry/Incident Registers/letter references
#2.07	Cumulative number of days in the month the works were stopped / refused on interpretation of contract clauses/scope due to tendency of taking undue advantage by interpreting contract clauses in their favour	PERFORMANCE	2		Cumulative number of days lost	Daily Log Book entry/Incident Registers/letter references
#2.08	Number of times rework was refused by contractor	PERFORMANCE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 3 of 6

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#2.09	Cumulative number of days in the month recording / logging was not done in daily log / history register / hindrance register / soft form in a PC maintained at BHEL Site Office	PERFORMANCE	1		Cumulative number of days recording or logging was not done / all days of the month	Daily Log Book entry/Incident Registers/letter references
#3.01	Percentage of Manpower Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7		As per Part-B2 of Form-14	Daily Log Book entry/Incident Registers/letter references
#3.02	Percentage of T&P Deployed w.r.t. Plan for the month as per Form-14.	RESOURCES	7		As per Part-B1 of Form-14	Daily Log Book entry/Incident Registers/letter references
#3.03	Cumulative number of major instances in the month hampering / affecting progress of work due to breakdown or non-availability of major T&P and MME for the work, under the scope of Contractor	RESOURCES	3		Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references
#3.04	Cumulative number of major instances in the month hampering / affecting progress of work due to non-availability of Consumables/ use of improper consumables under the scope of contractor	RESOURCES	3		Cumulative number of instances	Daily Log Book entry/Incident Registers/letter references
#4.01	Number of non-compliances during the month for Statutory requirements like validity of Labour Licence, Insurance Policy, Labour Insurance, PF, BOCW Compliance etc. and any other applicable laws/ Regulation, Electrical Licence, T&P fitness certificate, Contractors' All Risk Policy etc. as applicable	SITE INFRASTRUCTURE & SERVICE	1		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#4.02	Cumulative number of days in a month poor illumination is reported at storage area, erection area, pre-assembly area and other designated areas by BHEL site.	SITE INFRASTRUCTURE & SERVICE	0.5		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.03	Cumulative number of days of non-availability of well-maintained toilets facilities for workers (separate for men and women) and non-availability of potable drinking water stations for workers in specified areas.	SITE INFRASTRUCTURE & SERVICE	1		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 4 of 6

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#4.04	Total number of instances in the month, Housekeeping NOT attended to in spite of instructions by BHEL -i.e. removal / disposal of surplus earth / debris / scrap / unused / surplus cable drums / other electrical items / surplus steel items / packing materials, thrown out scrap like weld butts, cotton waste etc. from the working area to identified locations	SITE INFRASTRUCTURE & SERVICE	2		Total number of non-compliances/random checks	Daily Log Book entry/Incident Registers/letter references
#4.05	Total number of instances in a month, Site Office with reasonably good facilities including enough nos. of computers and printers etc. for use by office and supporting staff was not made available/maintained.	SITE INFRASTRUCTURE & SERVICE	0.5		No discrepancy during regular or surprise visits	Photograph and report of the Engineer
#5.01	Number of days delayed in making labour payments for the last month	SITE FINANCE	2		Number of days delayed / Scheduled date is 7th day of next month	Daily Log Book entry/Incident Registers/letter references
#5.02	Number of complaints from labour/ sub supplier/ sub-contractor for non-receipt of payments from contractor	SITE FINANCE	1.5		Total number of complaints or reporting	Daily Log Book entry/Incident Registers/letter references
#5.03	Number of times the site operations were hampered for want of funds at the disposal of site-in-charge.	SITE FINANCE	1.5		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.01	Cumulative number of days in a month the nominated Safety Officer was not available	HSE & SA	1		Safety Officer should be available for all the days	Daily Log Book entry/Incident Registers/letter references
#6.02	Shortfall in number of weekly safety meetings in the month conducted or attended by the Safety Officer	HSE & SA	0.5		Safety meetings to be held every week	Copy of Minutes of meeting
#6.03	Level of compliance w.r.t decisions taken in previous Safety meetings	HSE & SA	0.5		Number of consolidated issues discussed in Safety meetings	Copy of Minutes of meeting, Non-compliance intimation documents from BHEL site
#6.04	Delay in submission of monthly report on safety (including electrical safety for equipment & personnel etc.) in the prescribed form	HSE & SA	1		Number of days delayed/Scheduled date is third working day of next month	Daily Log Book entry/Incident Registers/letter references
#6.05	Number of days taken for lodging FIRs from date of occurrence/notice of incident of theft / accident etc.	HSE & SA	0.5		Number of days delayed/Scheduled date is within 24 Hrs of occurrence/notice of incidence	Copy of FIR lodged by Contractor

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 5 of 6

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
#6.06	Number of times written(email, letters etc.) warning issued for non-availability/ use of improper Fall protection and rescue arrangement as lifeline, fall arrestors, safety net, hand-railings, covered floors, man-basket, rescue basket & kit etc. by the contractor	HSE & SA	2		Total number of non-compliances	Daily Log Book entry/Incident Registers/letter references
#6.07	Number of times punitive fines imposed for unsafe practices as per contract like non-availability/use of PPEs as safety shoes, helmets, goggles, gloves, lifeline, safety belts etc.	HSE & SA	1		Total number of non-compliances	Non-compliance intimation documents from BHEL site
#6.08	Percentage compliance to Emergency preparedness and response plan: Portable Fire-extinguishers, Buckets, Fire-wardens, display of emergency numbers, mock-drills, Hazard Identification and Risk Assessment(HIRA) etc.	HSE & SA	1		Compliance should be 100% as per HSE Plan or as finalized in Safety Meetings	Non-compliance intimation documents from BHEL site
#6.09	Number of times the agency has defaulted on display of safety posters / safety slogans / safety barriers/emergency numbers etc. in identified areas	HSE & SA	0.5		Total number of instances	Non-compliance intimation documents from BHEL site
#6.10	Non compliances observed during HSE and Safety Audit	HSE & SA	0.5		Total number of non-compliances	Non-compliance intimation documents from BHEL site, Audit Reports
#6.11	Cumulative number of days in the month, non-availability of First Aid Kit, First Aider & Emergency Vehicles/Ambulance.	HSE & SA	0.5		Cumulative number of days	Non-compliance intimation documents from BHEL site
#6.12	Number of days taken for submission of Root Cause analysis (RCA) for the accident from the cut-off date intimated by BHEL for submission of RCA	HSE & SA	0.5		Number of days delayed/Scheduled date is cut-off date intimated by BHEL	Daily Log Book entry/Incident Registers/letter references
#6.13	Non conductance of training (induction, job specific, height work etc.), tool box meeting and health check-up as per Contract requirements	HSE & SA	0.5		Number of incidences of non-conductance during the month	Daily Log Book entry/Incident Registers/letter references
Total			100			

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

MONTHLY PERFORMANCE EVALUATION OF CONTRACTOR

Form No.: F-15 (Rev 02)

Page 6 of 6

Project		Vendor			Package/Unit	
Sl. No.	Parameter for Measurement	Classification	Max Score	Score Obtained	Measurement Key/Scheduled date	Supporting Documents
Less Deduction in Score Due to Major Accidents (Fatal, Permanent Disability or bodily injury by which person injured is prevented to resume to work within 48 hours or more after accident,, Major Damage to Equipment etc.) attributable to the contractor @ 3 points/ accident						
Less Deduction in Score Due to Minor Accidents attributable to the contractor @ 1 point/ accident						
Less Deduction in Score Due to not Maintaining of Labour Colony (if applicable) as per BHEL HSE policy @2 points in a month on verification any day						
Final Score						

Performance Score Summary for the Month	Total Score	Score Obtained
QUALITY	10	
PERFORMANCE	50	
RESOURCES	20	
SITE INFRASTRUCTURE & SERVICE	5	
SITE FINANCE	5	
HSE & SA	10	
OTHERS (deductions if any)	0	
TOTAL	100	

Note:

- 1) It is only indicative and shall be as per the online format issued by BHEL time to time.
- 2) No request will be entertained after specified date of current month w.r.t. changes requested in the scores of immediate previous month.

Name and Signature of BHEL Package In-charge

Name and Signature of Contractor

PROFORMA OF BANK GUARANTEE (in lieu of EARNEST MONEY if permissible under Works Policy)

(On non-Judicial paper of appropriate value)
(Para 4.7.6 of Works Accounts Manual)

Bank Guarantee No.....

Date.....

To
(Employer's Name and Address)

.....

Dear Sirs,

In accordance with the terms and conditions of Invitation for Bids/Notice Inviting Tender No.....¹ (Tender Conditions), M/s. ² having its registered office at ³ (hereinafter referred to as the 'Tenderer'), is submitting its bid for the work of.....⁴ invited by Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at *BHEL House, Siri Fort, Asiad, New Delhi – 110049* through its unit at *Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600035*

The Tender Conditions provide that the Tenderer shall pay a sum of Rs ⁵ as Earnest Money Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of ⁶ is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,

we, the(Name & address of the Bank)
..... having our Head Office at
.....(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs.....⁶ (in words Rupees.....) without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. ⁶

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Tenderer in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

We Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to extend the time of submission of from time to time or to postpone

for any time or from time to time any of the powers exercisable by the Employer against the said Tenderer and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Tenderer or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Tenderer and notwithstanding any security or other guarantee that the Employer may have in relation to the Tenderer's liabilities.

This Guarantee shall be irrevocable and shall remain in force upto and including.....⁷ and shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the ⁸ we shall be discharged from all liabilities under this Guarantee.

We, ... Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁶
- b) This Guarantee shall be valid up to ⁷
- c) Unless the Bank is served a written claim or demand on or before ⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

We, ... Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

(Signature of Authorised signatory)

Date.....

Place of Issue.....

¹ Details of the Invitation to Bid/Notice Inviting Tender (Tender Ref. No. Eg. - BHEL PSSR SCT XXXX)

² Name of Tenderer

³ REGISTERED Office Address of the Tenderer

⁴ Details of the Work i.e Tender Description

⁵ EMD Amount as mentioned in Notice Inviting Tender

⁶ BG Amount in words and Figures (BG Amount shall be Minimum of EMD amount less Rs. 2 Lakhs)

⁷ Validity Date

⁸ Date of Expiry of Claim Period (Claim Period shall be minimum of 3 Months after the validity date of Bank Guarantee)

Note:

- 1. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.

2. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

(On non-Judicial paper of appropriate value)

(Para 4.7.6 of Works Accounts Manual)

Bank Guarantee No.....

Date.....

To

(Employer's Name and Address)

.....

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at *BHEL House, Siri Fort, Asiad, New Delhi – 110049* through its unit at *Bharat Heavy Electricals Limited, Power Sector Southern Region, 690, Anna Salai, Nandanam, Chennai 600035* having agreed to exempt

_____ ¹ (Name of the Vendor / Contractor / Supplier) with its registered office at _____ ² (hereinafter called the said "Contractor" which term includes supplier), from demand under the terms and conditions of the Contract arising vide Letter of Intent (LOI) reference No. _____ dated _____ ³ valued at Rs. _____ ⁴ (Rupees _____ only) ⁴ (hereinafter called the said Contract), of Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs. _____ ⁵ (Rupees _____ only),

We, the (Name & address of the Bank) having our Head Office at (hereinafter referred to as the Bank), at the request of _____ [Contractor(s)], being the Guarantor under this Guarantee, do hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer, an amount not exceeding Rs. _____ without any demur, immediately on demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand

Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ ⁵.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied & the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) or acceptance of the final bill or discharge of this guarantee by the Employer, whichever is earlier. This guarantee shall initially remain in force upto and including _____ ⁶ and shall be extended from time to time for such period as may

be desired by the Employer. Unless a demand or claim under this guarantee is made on us in writing on or before the _____⁷, we shall be discharged from all the liability under this guarantee thereafter.

We, _____(indicate the name of the Bank) further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We, ... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....⁵
- b) This Guarantee shall be valid up to ⁶
- c) Unless the Bank is served a written claim or demand on or before _____⁷ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Date _____ Day of _____
for _____ (indicate the name of the Bank)

(Signature of Authorised signatory)

¹ NAME OF VENDOR /CONTRACTOR / SUPPLIER

² REGISTERED OFFICE ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ LETTER OF INTENT(LOI) REFERENCE NO. WITH DATE

⁴ CONTRACT VALUE (AS MENTIONED IN LOI)

⁵ BG AMOUNT IN FIGURES AND WORDS

⁶ VALIDITY DATE

⁷ DATE OF EXPIRY OF CLAIM PERIOD (CLAIM PERIOD SHALL BE MINIMUM OF 3 MONTHS AFTER VALIDITY DATE)

Note:

1. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.
2. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a. From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
 - b. From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor Country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by any of the Consortium Banks only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time).

INTEGRITY PACT

Between

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

and

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

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for BHEL: PSSR: SCT: 1848- Erection, Testing and Commissioning of Power Cycle Piping and all associated Piping & Insulation works including handling at site stores / storage yard, transporting to site, inspection, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, chemical cleaning/ pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints and application of refractory & insulation works as per requirement / as given in the drawings including labeling & flow direction on the piping / over insulation & hangers and supports, pre-commissioning, commissioning, trial operation & handing over to customer etc. for Unit-1 (Package-A) & Unit-2 (Package-B) at 2X660MW Ennore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPS, Tamilnadu

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

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

Section 1 - Commitments of the Principal

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

- 1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
- 1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.



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

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

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

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

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



Section 4 - Compensation for Damages

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

Section 5 - Previous Transgression

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

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

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

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

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

Section 8 - Independent External Monitor(s)

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/



Contractor(s) / Sub-contractor(s) with confidentiality in line with Non- disclosure agreement.

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

Section 9 - Pact Duration

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



Section 10 - Other Provisions

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


V. JASEJA
 For & On behalf of the Principal
 Deputy General Manager (SCT)
 (Office Seal)
 690, Anna Salai, Nandanam, Chennai - 600 095.

Place CHENNAI

Date 22/08/2019

 For & On behalf of the Bidder/ Contractor
 (Office Seal)

Place _____

Date _____

Witness: 

(Name & Address) SREENATH. N-G
SUB CONTRACTS DEPT.
BHEL PSSR, CHENNAI-35

Witness: _____

(Name & Address) _____