TENDER SPECIFICATION

BHEL: PSSR: SCT: 1445

FOR

Handling at site stores / storage yard, Transportation to site of work, Application of Refractory & Insulation materials and connected works for Boiler, ESP, Fans, Piping, Vessels etc for Unit – 1&2

at

North Chennai TPS 2x600 MW, STAGE – II ,
M/s TNEB, Athipattu, NCTPS, Chennai.
Tamilnadu state

VOLUME –I BOOK – I

TECHNOCOMMERCIAL BID (Book I & II)

Book-I consists of

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

Book-II consists of

- Volume-IB : Special conditions of Contract,
- Volume-IC : General conditions of Contract
- Volume-ID : Forms & Procedures

BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)
Power Sector – Southern Region
690, Anna Salai, Nandanam, Chennai – 600 035.

BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)
Power Sector, Southern Region
690, Anna Salai, Nandanam, Chennai – 35

Tender Specification No. BHEL: PSSR: SCT: 1445

for

Handling at site stores / storage yard, Transportation to site of work, Application of **Refractory & Insulation** materials and connected works for Boiler, ESP, Fans, Piping, Vessels etc for Unit – 1&2 of **North Chennai** TPS 2x600 MW, STAGE – II, M/s TNEB, Athipattu, NCTPS, Chennai.

One set of Tender documents consisting of

1) TECHNOCOMMERCIAL BID - 2 copies
2) PRICE BID - 2 copies

Book Sl no …….

Issued to
M/s

Refer NIT for Last date of submission

Please note this tender document is not transferable

For and on behalf of
BHARAT HEAVY ELECTRICALS LIMITED

ADDL GENERAL MANAGER / CONTRACTS

Place: Chennai -35
Date:

Rev 00
6th July 2010

NOTICE INVITING TENDER

Bharat Heavy Electricals Limited

Ref: BHEL PSSR SCT 1445 Date: 04/01/2011

NOTICE INVITING TENDER (NIT)

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

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To

Dear Sir / Madam

Sub: NOTICE INVITING TENDER

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

1.0 Salient Features of NIT

Sl. No	ISSUE	DESCRIPTION	
i	Tender Number	**BHEL PSSR SCT 1445**	
ii	Broad Scope of job	Handling at site stores / storage yard, Transportation to site of work, Application of **Refractory & Insulation** materials and connected works for Boiler, ESP, Fans, Piping, Vessels etc for Unit – 1&2 of **North Chennai TPS** 2x600 MW, STAGE – II , M/s TNEB, Athipattu, NCTPS, Chennai.	
iii	DETAILS OF TENDER DOCUMENT		
a	Volume-IA	Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc	Applicable
b	Volume-IB	Special Conditions of Contract (SCC)	Applicable
c	Volume-IC	General Conditions of Contract (GCC)	Applicable
d	Volume-ID	Forms and Procedures	Applicable
e	Volume-II	Price Schedule (Absolute value).	Applicable

iv	Issue of Tender Documents	1.Sale from BHEL PSSR Regional office at :Chennai **Start : 04-01-2011** **Closes: 24-01-2011 , Time :15.00 Hrs** 2.From BHEL website (www.bhel.com) Tender documents can however be downloaded from website till due date of submission	Applicable
v	DUE DATE & TIME OF OFFER SUBMISSION	Date : **25 /01/ 2011 , Time :15.00Hrs** Place : BHEL PSSR :Chennai Tenders can be submitted through representative / in person at SCT Dept, BHEL PSSR, Chennai.	Applicable
vi	OPENING OF TENDER	Date **: 25 /01/ 2011 , Time :15.30Hrs** 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 2,00,000/- (Rupees Two Lakhs Only)**	Applicable
viii	COST OF TENDER	**Rs 2000/-.**	Applicable
ix	LAST DATE FOR SEEKING CLARIFICATION	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 below	Applicable
x	Schedule of Pre Bid Discussion (PBD)	**Date: 19/11/2011. time 10.00AM at** BHEL:PSSR:Chennai-35	Applicable.
xi	INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)	Bidders shall enter into an Integrity Pact (IP) with BHEL as per format given at Volume 1D Formats of this tender. The bidders are required to return this Integrity Pact (IP) along with Techno Commercial Bid duly signed and stamped by the authorized signatory who signs the bid. It may be noted that only those bidders who have entered into such an IP with BHEL would be competent to participate against this tender .i.e. entering into this pact is a preliminary qualifications for the bidders. The Independent External Monitor against this NIT shall be Shri ...	Not Applicable

xii	Latest updates	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage **(www.bhel.com → Tender Notifications →View Corrigendums)** and not in the newspapers. Bidders to keep themselves updated with all such information	

2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly signed & stamped on each page, as part of offer**. Rates / Price including discounts/rebates, if any, mentioned anywhere / in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.**

3.0 Unless specifically stated otherwise, bidder shall remit cost of tender and courier charges if applicable, in the form of Demand Draft drawn in favour of Bharat Heavy Electricals Ltd, payable at Power Sector Regional HQ at Chennai issuing the Tender, along with techno-commercial offer. Bidder may also choose to deposit the Tender document cost by cash at the Cash Office as stated above against sl no iv of 1, on any working day; and in such case copy of Cash receipt is to be enclosed with the Techno Commercial offer. Sale of tender Documents shall not take place on National Holidays, holidays declared by Central or State Governments and BHEL PS HQ at Chennai, Sundays and second/ last Saturdays

4.0 Unless specifically stated otherwise, bidder shall deposit EMD through Demand Draft/Pay Order in favour of Bharat Heavy Electricals Ltd, payable at Chennai. For other details and for 'One Time EMD' please refer General Conditions of Contract.

5.0 **Procedure for Submission of Tenders:** The Tenderers must submit their Tenders to Officer inviting Tender, as detailed below:

- PART-I consisting of 'PART-I A (Techno Commercial Bid)' & 'PART-I B (EMD/COST of TENDER)' in two separate sealed and superscribed envelopes (ENVELOPE-I & ENVELOPE-II)
- PART-II (Price Bid) – in sealed and superscribed envelope (ENVELOPE-III)
- One set of each document shall be retained by the bidder for their reference.

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

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

x.	Volume – I C : General Conditions of Contract (GCC)	
xi.	Volume – I D : Forms & Procedures	
xii.	Volume – II (UNPRICED – without disclosing rates/price, but mentioning only 'QUOTED' or 'UNQUOTED' against each item	
xiii.	Any other details preferred by bidder with proper indexing.	

	PART-I B	
	ENVELOPE – II superscribed as: PART-I (EMD/COST of TENDER) TENDER NO : NAME OF WORK : PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING:-**	
i.	1. Earnest Money Deposit (EMD) in the form as indicated in this Tender **OR** Documentary evidence for 'One Time EMD' with BHEL PSSR Chennai 2. Cost of Tender (Demand Draft or copy of Cash Receipt as the case may be)	

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

	OUTER COVER	
	ENVELOPE-IV (MAIN ENVELOPE / OUTER ENVELOPE) superscribed as: TECHNO-COMMERCIAL BID, PRICE BID & EMD TENDER NO:	

	NAME OF WORK: PROJECT: DUE DATE OF SUBMISSION: **CONTAINING THE FOLLOWING:**	
i	○ Envelopes I ○ Envelopes II ○ Envelopes III	

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

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

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: (Shall be applicable for all Bid Evaluation from 1st April 2011). Bidders capacity for executing the job under tender shall be assessed as per the following:**

I. **Assigning Weightages (A) for Similar Jobs Under-Execution:** Weightages shall be worked out and assigned based on the average number of Similar Works under execution including works yet to be commenced by the agency, in the following manner:

i). Number of Similar Jobs

a) No. of jobs in BHEL, PSER : Say 'J'
b) No. of jobs in BHEL, PSSR : Say 'K'
c) No. of jobs in BHEL, PSWR : Say 'L'
d) No. of jobs in BHEL, PSNR : Say 'M'
e) No. of jobs with other customers* : Say 'N' (* Other than BHEL PSER, PSSR, PSWR & PSNR)
f) Average No. of Jobs is 'P'= (J+K+L+M+N) divided by 5

ii) Weightage "A" assigned to bidders based on Average Number of jobs "P";

a)If 'P' = 0-1, "A" will be equal to '3'
b)If 'P' = 2-3, "A" will be equal to '2'
c)If 'P' = 4-5, "A" will be equal to '1'
d)If 'P' is Above 5, "A" will be equal to '0'

II. **Weightage "B" for Quarterly Performance Reports of Vendors:** This shall be based on the averages of the net weighted score obtained by the bidder for the jobs under execution (excluding works not commenced) for the quarter previous to the last quarter reckoned from the date of latest due date of submission, in all four Regions i.e BHEL PSER, PSSR, PSWR & PSNR, in the following manner.

i). Ratings by Power Sector Region:

a) PS ER's Rating 'Rer' = ($X_1 + X_2 + .. + X_n$)
b) PS WR's Rating 'Rwr' = ($X_1 + X_2 + .. + X_n$)
c) PS SR's Rating 'Rsr' = ($X_1 + X_2 + .. + X_n$)
d) PS NR's Rating 'Rnr' = ($X_1 + X_2 + .. + X_n$)
e) **Over all Power Sector Region Rating 'R_{BHEL}'=** (Rer+ Rwr+ Rsr+ Rnr) divided by (Ner+ Nwr+ Nsr+ Nnr)

(where "$X_1, X_2, X_3, \ldots X_n$" is the net weighted score obtained by the bidder as per the "Evaluation of Contractor Performance (Quarterly)" against the various contracts 'N' under execution in the respective Region).

ii) Weightage "B" assigned to bidders based on Overall Power Sector Rating **(R_{BHEL}):**

a) If **R_{BHEL}** is 80% and above, "B" will be equal to '6'
b) If **R_{BHEL}** is > 70% < 80%, "B" will be equal to '5'
c) If **R_{BHEL}** is > 60% < 70%, "B" will be equal to '4'
d) If **R_{BHEL}** is = < 60%, "B" will be equal to '0'

III. Evaluation of Bidders capacity to execute the job under tender:

shall be based on the sum of scores obtained in 'A' and 'B', as below:

a) 6 or above : Considered 'Qualified' for the job under tender
b) Less than 6: Considered 'NOT Qualified' for the job under tender

IV. Explanatory note:

a) Similar work means Boiler or Turbine or Civil or Electrical or CI, etc as detailed in the scope irrespective of rating of Plant

b) Quarter shall be as per the quarter defined in the "**Evaluation of Contractor performance (Quarterly)**". For contracts where annexed Quarterly Evaluation performance was not part of the contract, 'Quarterly Performance Reports' previous to the last quarter reckoned from the date of latest due date of submission, given by the respective project site against the contract will be the basis for evaluation.

c) Vendors who are not executing any jobs presently in the Region and first timers to the Region, may be considered subject to satisfying all other tender conditions

d) 'Under execution' shall mean works in progress upto Boiler Steam Blowing (for Boiler and Auxilliaries) or Synchronisation (for all other jobs including Civil) shall be considered.

10.0 Since the job shall be executed at site, bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation 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. No additional claim shall be entertained by BHEL in future, on account of non-acquaintance of above.

11.0 For any clarification on the tender document, the bidder may seek the same in writing or through e-mail, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.

12.0 BHEL may decide holding pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.

13.0 In the event of any conflict between requirement of any clause of this specification/ documents/ drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail.

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

15.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), **if applicable,** along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. The names and other details of Independent External Monitor (IEM) for the subject

tender is as given at point (xi) of 1 above.

16.0 The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of pre-qualification evaluation/ techno-commercial bids, approval/ acceptance of customer (as applicable), etc. and date of opening of price bids shall be intimated to only such bidders.

17.0 In case BHEL decides on a `Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful/Disqualified bidders under intimation to the respective bidders.

18.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) or specified otherwise in SCC of tender.

19.0 BHEL reserves the right to decide the successful bidder on the basis of Reverse Auction process. In such case all qualified bidders will be intimated regarding procedure/ modality for Reverse Auction process prior to Reverse Auction and price will be decided as per the rules for Reverse Auction. .

However, if reverse auction process is unsuccessful as defined in the RA rules/procedures, or for whatsoever reason, then the sealed 'PRICE BIDs' will be opened for deciding the successful bidder. BHEL's decision in this regard will be final and binding on bidder.

20.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.

21.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.

22.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.

23.0 In case Consortium Bidding is allowed as per Pre Qualifying Requirement, then Prime Bidder and Consortium Partner shall enter into Consortium Agreement. Validity period of Consortium Agreement shall be 6 months after which the same can be re validated.

'Stand alone' bidder cannot become a '**prime bidder' or a 'consortium bidder' in a consortium bidding**. Prime bidder shall neither be a consortium partner to other prime bidder nor take any other consortium partners. However, consortium

partner may enter into consortium agreement with other prime bidders. In case of non compliance, consortium bids of such Prime bidders will be rejected.

24.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements" duly self certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.

25.0 The bidder may have to produce original document for verification if so decided by BHEL.

26.0 **Mode of Award of work for Unit 1 and Unit 2**

(i) There are two units of 600 MW each at North Chennai Thermal Power Station. Tender SCT1445 is for Unit 1 – 600 MW only. The quantity indicated in the price bid is for Unit 1 only and the quantity for Unit 2 is also same.

(ii) The L1 bidder against this quote will be awarded the contract for one unit of North Chennai Thermal Power Station.

(iii) BHEL reserves the right to award the contract for other Unit of North Chennai Thermal Power Station on the same terms and conditions of SCT 1445 to the next lowest bidder in the order of competitiveness who should match his rates / price with awarded price / rate for the awarded Unit.

(iv) Thus the work for Units-1 and 2 will be awarded to two agencies i.e. Unit-1 work for one agency and Unit- 2 work for the other agency.However, of the two units, which unit to be awarded to which agency is subject to BHEL's discretion.

(v) In case the other bidders in their order of competitiveness do not accept to match their rates / Price with awarded price / rate of first awarded Unit, then BHEL reserves the option to consider the L1 bidder, for award of next Unit work also at the same rate / Price and at the same Terms & Conditions of first awarded Unit. This will be solely at the discretion of BHEL and the L1 bidder, who is awarded the work of one Unit, shall not have any claim as a matter of right for award of the other Unit work to him, on conditions whatsoever.

(vi) Incase BHEL, at its discretion opts to go for re-tendering for award of work for second Unit, then the L1 bidder who is awarded with first Unit work shall not be considered for second Unit work.

(vii) Each unit will be treated as a separate contract.

27.0 **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
f. General Conditions of Contract (GCC) —Volume-1C
g. Forms and Procedures —Volume-1D

For BHARAT HEAVY ELECTRICALS LTD

AGM /SCT

Enclosure

01. Annexure-1: Pre Qualifying criteria.
02. Annexure-2: Check List.
03 Other Tender documents as per this NIT.

ANNEXURE - 1

PRE QUALIFYING CRITERIA

JOB	Handling at site stores / storage yard, Transportation to site of work, Application of **Refractory & Insulation** materials and connected works for Boiler, ESP, Fans, Piping, Vessels etc for Unit – 1&2 of **North Chennai TPS** 2x600 MW, STAGE – II , M/s TNEB, Athipattu, NCTPS, Chennai.
TENDER NO	**BHEL PSSR SCT 1445**

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**
A	Submission of Integrity Pact duly signed (if applicable)	Not applicable	
B	Assessment of Capacity of Bidder to execute the work as per sl no 9 of NIT (if applicable)	Shall be applicable for Bid Evaluation from 1st April 2011	
C	Technical The Bidders should have executed insulation works of at least one unit of 190 MW or above capacity Boiler / ESP/ High Pressure piping in any Plant in the last seven year preceding the scheduled date of Bid submission. OR The Bidders should have executed erection and commissioning works of at least one unit of 190 MW or above capacity Boiler / ESP / High Pressure piping in any Plant in the last seven year preceding the scheduled date of Bid submission. The term executed means: Completion of safety valve floating or synchronisation in case of Boiler. Completion of Charging of all fields in case of ESP. Completion of synchronisation in case of high pressure piping.		

D 1	**<u>Financial</u>** **TURNOVER** Bidders must have achieved an average annual financial turnover (audited) of **Rs.88,00,000/= (Rs.Eighty eight lakhs only)** or more over last three financial years i.e., 2007-08, 2008-09 & 2009-10		
D2	**NETWORTH** Net worth of the bidder based on the latest audited accounts as furnished for 'D1' above should be positive.		
D3	**PROFIT** Bidders must have earned profit in any one of the three financial years in the last three years defined in 'D1' above		
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. Price bid of only those bidders shall be opened who are approved by customer.	Applicable	
F	Consortium criteria (if applicable)	Not applicable	
G	Notwithstanding the above, BHEL reserves the right to reject any or all the Tenders for reasons whatsoever beyond its control and the decision of BHEL is final.	Applicable	
	Explanatory Notes for QR 'A' 1.The word 'executed' means the bidder should have achieved the criteria specified in the QR even if the total contract has not been completed or closed 2.Bidder to submit Audited Balance Sheet and Profit and Loss Account for the respective years as given above along with all annexure.		

BIDDER SHALL SUBMIT ABOVE PRE-QUALIFICATION CRITERIA FORMAT, DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT (Copies of Work order / LOI / LOA and work completion certificate) IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

ANNEXURE - 2

CHECK LIST

NOTE: - Tenderers are required to either fill in or submit separately the following details.

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	DD No: Date : Bank : Amount: Please tick (√) whichever applicable:- ONE TIME EMD / ONLY FOR THIS TENDER		
5	Validity of offer	To be valid for six months from due date		
			APPLICABILITY	BIDDER REPLY
6	Whether the format for compliance with PRE QUALIFICATION CRITERIA (ANNEXURE-I) is understood and filled with proper supporting documents referenced in the specified format		Applicable / Not applicable	YES / NO
7	Audited profit and Loss Account for the last three years submitted		Applicable / Not applicable	YES/NO
8	Copy of PAN Card submitted		Applicable / Not applicable	YES/NO

9	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable / Not applicable	YES/NO
10	Integrity Pact	Applicable / Not applicable	YES/NO
11	Declaration by Authorised Signatory	Applicable / Not applicable	YES/NO
12	No Deviation Certificate	Applicable / Not applicable	YES/NO
13	Declaration confirming knowledge about Site Conditions	Applicable / Not applicable	YES/NO
14	Declaration for relation in BHEL	Applicable / Not applicable	YES/NO
15	Non Disclosure Certificate	Applicable / Not applicable	YES/NO
16	Bank Account Details for E-Payment	Applicable / Not applicable	YES/NO
16	Capacity Evaluation of Bidder for current Tender	Applicable / Not applicable	YES/NO
17	Tie Ups / Consortium Agreement are submitted as per format	Applicable / Not applicable	YES/NO
18	Power of Attorney for Submission of Tender / Signing Contract Agreement	Applicable / Not applicable	YES/NO
19	Analysis of Unit rates	Applicable / Not applicable	YES/NO
20	Unquoted price bid submitted or not	Applicable / Not applicable	YES/NO

NOTE: STRIKE OFF 'YES' OR 'NO', AS APPLICABLE

DATE:

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

Rev 00
6th July
2010

VOLUME – IA
Part I & II
TECHNICAL CONDITIONS OF CONTRACT (TCC)

(Document No PS:MSX:TCC)

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

VOLUME IA PART – I CHAPTER – I
PROJECT INFORMATION

1. Project Name : North Chennai Thermal Power Station

2. Project Stage : Stage- II

3. No. of Units x Capacity : 2 X 600 MW

4. Project setting up by : Tamil Nadu Electricity Board (TNEB)

5. LOCATION AND APPROACH : (i) Athipattu Village
From Athipattu Railway Station about 6 Km.
From Chennai City about 20 Km.
From Chennai Airport 35 Km
(ii) District: Thiruvallur
(iii) State : Tamil Nadu

6. Nearest Railway Station : i) Athipattu Pudunagar on Chennai – Howrah route
8 KMs from site
ii) Athipattu 6 Km

7. Nearest Major Town & Distance : Chennai 20 Km.

8. Nearest Airport & Distance : Chennai 35 Km

9. Nearest Highway & Distance : All weather road from Pattamandri on Chennai – Ponneri District Highway / 12 Kms.

10. Temperature: (Dry bulb) : Absolute Max. 45^0 C(Highest mean monthly Max.35^0 C)
: Absolute Min. 15^0 C (Lowest mean monthly Min. 24^0 C)
: Average 35^0 C (Design)

11. Relative Humidity
Maximum : 100 %
Minimum : 36 %
Average : 75 % (Design)

12. Annual Rainfall : Max. 2540.8 mm / Average 1600 mm / Min 1175.7 mm.

13. Wind Load : Basic Wind Speed 50 mm/sec. (Max.) / 11.8 KMPH (Average)

14. Transport:
a) By Rail : Broad Gauge Railway line of Southern Railway
b) Road : District High way

15. Seismic Data : Zone – III as defined in IS: 1893 - 2002

PART – I CHAPTER – II
SCOPE OF WORKS

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

1.2.1 The work to be carried out at quoted/accepted rates by the contractor under the scope of these specifications covers the complete work of handling, loading and transporting of materials from project stores sheds / storage yards and unloading at site of work , cutting bending to the required shape as per drawing, painting of inner sheet wherever required with anti-corrosive paints, welding, application of **Refractory / Insulation** materials on the equipments namely Boiler , ESP , Fans, ducts, Piping, Vessels, 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 at Unit – 1&2 of **North Chennai TPS** 2x600 MW, STAGE – II , M/s TNEB, Athipattu, NCTPS, Chennai.

1.2.1.1 Receipt of materials / component to be erected by the contractor, loading and transportation from the storage yard to the project site, stacking, storage and preservation.

1.2.1.2 Preassembly, Erection, Testing, Commissioning, Trial operation and reliability operation of equipment.

1.2.1.3 Final painting including supply of paints.

Note:

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

VOLUME IA PART – I CHAPTER – III

FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL

(SCOPE MATRIX)

Sl.No	Description	Scope to be taken care by		Remarks
1.3.1	**PART I**	**BHEL**	**Bidder**	
1.3.1.1.	**ESTABLISHMENT**			
1.3.1.1.1	FOR CONSTRUCTION PURPOSE:			
1.3.1.1.1.1	Open space for office	Yes		
1.3.1.1.1.2	Open space for storage	Yes		
1.3.1.1.1.3	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
1.3.1.1.1.4	Bidder's all office equipments, office / store / canteen consumables		Yes	
1.3.1.1.1.5	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
1.3.1.1.1.6	Fire fighting equipments like buckets, extinguishers etc		Yes	
1.3.1.1.1.7	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.3.1.1.2	FOR LIVING PURPOSES OF THE BIDDER			
1.3.1.1.2.1	Open space		Yes	
1.3.1.1.2.2	Living accommodation		Yes	
1.3.1.2	**ELECTRICITY**			
1.3.1.2.1	Electricity For construction purposes (to be specified whether chargeable or free)			
1.3.1.2.1.1	Single point source	Yes		Chargeable basis at the prevailing rate. Refer 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	

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

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

Sl.No	Description	Scope to be taken care by		Remarks
1.3.2	**PART II**	**BHEL**	**Bidder**	
1.3.2.1	**ERECTION FACILITIES**			
1.3.2.1.0	Engineering works for construction			
1.3.2.1.1	Providing the erection drawings for all the equipments covered under this scope	Yes		
1.3.2.1.2	Drawings for construction methods		Yes	In consultation with BHEL
1.3.2.1.3	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes	Yes	Yes	,,
1.3.2.1.4	Shipping lists etc for reference and planning the activities	Yes	Yes	”
1.3.2.1.5	Preparation of site erection schedules and other input requirements		Yes	”
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	
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		Yes	

Sl.No	Description	Scope to be taken care by		Remarks
1.3.2	**PART II**	**BHEL**	**Bidder**	
	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.			
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:**

Open space for building of temporary office shed and contractor's stores shed(s) will be provided free of charges. Contractor has to make his own arrangements for labour colony.

1.3.4 **ELECTRICITY:**

1.3.4.1 Construction power will be provided to the contractor on chargeable basis at the applicable rate of TNEB under LT tariff V from the nearest substation. For construction purpose electricity will be provided at one single point by BHEL. The required energy meter for measuring power consumption will be provided and installed by BHEL. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc. The present LT tariff V rate of TNEB is

a) Consumption charges at Rs.5.80 per unit
b) Fixed charges at Rs. 30 per month
c) Electricity Tax on total amount at the rate of 5%

The TNEB tariff may vary from time to time. Any dispute regarding consumption, the BHEL engineer decision is final

1.3.4.2 The required energy meter for measuring power consumption will be provided and installed by BHEL.

1.3.4.3 Necessary “Capacitor Banks” to improve the Power factor as stipulated by customer shall be provided by the contractor at his cost as per customer requirement. Penalty if any levied by customer on this account will be recovered from contractor’s bills.

1.3.4.4 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards contractor’s office shed also all such expenditure shall be borne by the contractor.

1.3.4.5 Provision for 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.

1.3.4.6 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.

1.3.4.7 As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, contractor shall make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown / failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.

1.3.5 **WATER:**

Water (Raw water) required for construction purposes including testing of Equipments will be provided on chargeable basis at applicable tariff of TNEB/Metro water from the nearest storage tank located inside the plant area. The required water meter for measuring the consumption will be provided by BHEL and the same shall be 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.

The prevailing water charge is Rs 66.00 per 1000 litres which may vary from time to time as per TNEB / Metro water conditions. Any dispute regarding consumption, the BHEL engineer decision will be final. Incase non availability of water, the contractor shall make his own arrangements for 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 Construction purpose and his labour colony at his cost.

VOLUME IA PART – I CHAPTER – IV

T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR

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

VOLUME IA PART – I CHAPTER - V

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

List of T&Ps to be made available by BHEL to contractor free of hire charges on sharable basis.

S.No	Description	Qty
1	Sky climber (For Inside Furnace work)	01

NOTE

1) The above T&P shall be given to contractor on sharable basis and the allotment is made by BHEL/Site in Charge, on need basis.

2) In case of non-availability of these equipments, due to any reason ie., unavoidable breakdown, major overhaul or any other reason etc. the contractor should make arrangement at his own cost to meet the erection targets. No extra claim will be admitted due to non-availability of any of the above equipments. No delay in execution of work shall be accepted on this account.

3) Sky climber is only for erection purpose and shall not be available for material handling and for transportation purpose for which contractor shall make his own arrangement.

4) The day to day and routine maintenance will be carried out by the contractor at his own cost. However, BHEL shall supply spare parts free of charges.

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

6) Apart from the above, any other tools and plants required for satisfactory completion of the work has to be arranged by the contractor.

VOLUME IA PART – I CHAPTER-VI
TIME SCHEDULE

1.6.1 TIME SCHEDULE

1.6.1.1 The complete work of handling, loading and transporting of materials from project stores sheds / storage yards and unloading at site of work , cutting bending to the required shape as per drawing, painting of inner sheet wherever required with anti-corrosive paints, welding, application of Refractory / Insulation materials on the equipments namely Boiler , ESP , Fans, ducts, Piping, Vessels, etc., and binding and cladding with sheets etc., using their own tools plants, tackles, all consumables, supervisor and men as detailed in the Tender Specification shall be completed within **12 (Twelve) 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 phase shift between the two units will be one month.

1.6.2 COMMENCEMENT OF CONTRACT PERIOD

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

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

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

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

S.No	Major milestone for commissioning	Unit 1	Unit 2
1	Tentative start of work of Insulation	Jan' 2011	Jan' 2011
2	Boiler Hydro test	March 2011	Jan 2011
3	Boiler Light up	July 2011	July 2011
4	Synchronisation	Sep 2011	Aug 2011
5	COD	Dec 2011	Nov 2011

1.6.4 In order to meet above 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.

1.6.5 **In case any requirement is there to compress the schedule of activities to achieve project completion, then the additional expenses if any incurred will be discussed mutually and settled. BHEL decision in this regard is final and the issue is not arbitrable.**

1.6.6 **CONTRACT PERIOD**

The contract period for completion of entire work under scope shall be **12 (Twelve) months** from the "COMENCEMENT OF CONTRACT PERIOD" as specified earlier.

1.6.7 GUARANTEE PERIOD FOR EACH UNIT

The guarantee period of twelve months shall commence from the date of handing over of the Unit to Customer or six months from the date of first synchronisation of the set, whichever is earlier (Provided all erection, testing, and commissioning works are completed in all respects).

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

1.7.0 Terms of payment :

The progressive payment for erection, testing and commissioning on accepted price of contract value will be released as mentioned below in Cl 1.7.1 & 1.7.2.

1.7.1 Progressive Payment against monthly running bills will be made upto 85 % of the value of the erected tonnage (Castable & Pourable, Iron Components, Wool mattresses, Aluminium sheeting etc) Pro rata as per Cl no 1.7.1.1 to 1.7.1.3 of the following table.

SL NO	Description	Percentage
I.7.1	**PRO RATA PAYMENTS (85%)**	
1.7.1.1	PLACEMENT IN POSITION	50
1.7.1.2	ALIGNMENT	15
1.7.1.3	WELDING/BOLTING/FIXING	20
	TOTAL FOR PRO RATA PAYMENTS (TOTAL 85%)	85

1.7.2 Further 15 % payment on pro-rata basis common to all PG shall be released on achievement of the following stage / milestones events (as per Cl no 1.7. 2.1 to1.7.2.11 of the following table) for the tonnage erected.

SL NO	Description	Percentage
1.7.2	**STAGE/MILESTONE PAYMENTS (15%)**	
1.7.2.1	Boiler Light Up	1
1.7.2.2	Alkali Boil Out	1
1.7.2.3	Steam Blowing	1
1.7.2.4	Safety Valve Floating	1
1.7.2.5	Coal Firing	1
1.7.2.6	Full Load	1
1.7.2.7	Trial Operation of Unit	2
1.7.2.8	Area cleaning, temporary structures cutting/removal and return of scrap	3
1.7.2.9	Punch List points/pending points liquidation	1
1.7.2.10	Material Reconciliation	2
1.7.2.11	Completion of Contractual Obligation	1

	TOTAL FOR STAGE/MILESTONE PAYMENTS (15%)	15
	TOTAL of 1.7.1 & 1.7.2	100

1.7.3 **In case any requirement is there to compress the schedule of activities to achieve project completion, then the additional expenses if any incurred will be discussed mutually and settled. BHEL decision in this regard is final and the issue is not arbitrable.**

Note:

1. Recovery of Retention amount as per Cl. 2.22 of Volume I C (GCC).
2. RA bill payments as per Chapter-X of Volume I B (SCC)
3. Payment for the first running bill will be released only on production of the following.
    i. PF Regn. No.
    ii. Labour License No.
    iii. Workmen Insurance Policy No.
    iv. Unqualified Acceptance for Detailed L.O.I.
    v. Security Deposit as per GCC
    vi. Rs 100 /- Stamp Paper for Preparation of Contract agreement.

VOLUME IA PART – I CHAPTER VIII
TAXES AND OTHER DUTIES

1.8.0 TAXES

1.8.1 Value Added Tax (VAT) for the works

1.8.1.1 **Price quoted shall be inclusive of VAT except service tax.**

1.8.1.2 Notwithstanding the fact that this is only an erection service contract not involving any transfer of materials whatsoever and not attracting VAT liability, being labour oriented job work, for the purpose of VAT the contractor has to maintain the complete data relating to the expenditure incurred towards wages etc. in respect of the staff/workers employed for this work as also details of purchase of materials like consumables, spares etc., inter alia indicating the name of the supplier, address and VAT Registration No. and VAT paid for the purchases, etc

1.8.1.3 The bidder shall get registered with State VAT authorities and the registration certificate shall be forwarded to BHEL immediately after commencement of work. In case the bidder had already registered under respective State VAT, they must quote their registration Number and forward copy of Registration Certificate while submitting this tender.

1.8.1.4 The monthly/quarterly VAT return, duly incorporating the erection income from BHEL as turnover, should be submitted to BHEL at regular intervals with all annexure and details of payment of VAT (WCT).

1.8.1.5 You have to obtain VAT Clearance Certificate from the on concerned authorities as per the provisions of local VAT act, on completion of the project and submit along with the final bill.

1.8.1.6 The bidder shall quote very competitive price after taking into consideration of above points.

1.8.2.0 Service Tax

1.8.2.1. Price quoted shall be exclusive of Service Tax. The service tax as statutorily leviable and payable by the bidder under the provisions of service tax Law / Act shall be paid by BHEL as per bidder claim through various running bills. The bidder shall furnish proof of service tax registration with Central Excise Department specifying the name of services covered under this contract. Registration Certificate should also bear the endorsement for the premises from where the billing shall be done by the bidder on BHEL for this project. The bidder shall obtain prior consent of BHEL before billing the service tax amount.

1.8.3.0 Other Taxes & Levies

1.8.3.1 Any other taxes and duties (except VAT & Service Tax) if any, as applicable, viz. Entry Tax, Octroi, Licenses, Deposits, Royalty, Stamp Duty, other charges / levies, etc. prevailing / applicable on the date of opening of technical bids and any variation thereof during the tenure of the contract are in the scope of bidder. In case BHEL is forced to pay any such taxes, BHEL shall have the right to recover the same from the bidder either from running bills or otherwise as deemed fit.

1.8.4.0 New Levies / Taxes

1.8.4.1 In case Government imposes any new levy / tax after award of the work 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..

1.8.5.0 Statutory variations

1.8.5.1 Statutory variations are applicable only in the cases of Value Added Tax and Service Tax. The changes implemented by the Central / State Government in the VAT Act / Service Tax 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.

1.8.6.0 Direct Tax

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

VOLUME- IA PART - I CHAPTER - IX
WEIGHT SCHEDULE

1.9.1 WEIGHT SCHEDULE -SUMMARY:-

SL. NO	DESCRIPTION	WEIGHT IN MT / UNIT	Rate schedule Id
1	Pourable, Castable & Refractory	616	1
2	MINERAL WOOL MATTRESSES FOR THERMAL INSULATION AND ACOUSTIC INSULATION	1200	2
3	IRON COMPONENTS FOR FIXING INSULATION INCLUDING STRUCTURAL MATERIALS FOR ENCLOSURES(Fixing components)	329	3
4	Outer casing/ cladding, Al. sheet & GI Sheet	412	4
	TOTAL WEIGHT	**2557**	

TOTAL WEIGHT OF INSULATION MATERIALS PER UNIT - 2557 MT

NOTE: **PGs covered under this scope of work.**

32, 33, 37, 55, 79, 81 and PEM supply

1. The weights mentioned above are approximate and are liable to vary as per design consideration of the manufacturing unit. The tender may note that payments will be made to them at the quoted / accepted rates for the tonnage actually erected.
2. Besides product group indicated above, there is likelihood of addition of any product groups integral to Boiler / ESP and Piping by manufacturing units or any other agencies. Contractor's quoted unit rates shall be applicable for any such product groups also.

1.9.2 WEIGHT SCHEDULE -Detailed:-

Sl.No.	PGMA	Description	Design Wt(Kg)	Rate SCH-Id.
1	33-201	Main Blr Formed Refractory Is8	804	1
2	33-212	Main Blr Castable Refractory Gr C	175000	1
3	33-230	Main Blr Pourable Insulation	360000	1
4	33-975	Misc Eqpts Sealing Compound	200	1

5	81-341	Sealing Compound-External Piping	300	1
6	PEM	Pipe Sections	79500	1
7	33-021	Blr Pr Parts Mineral Wool	222320	2
8	33-121	Blr Mountings Mineral Wool	7560	2
9	33-126	Sb Pipes Mineral Wool	2520	2
10	33-321	Air Ducts Mineral Wool	257280	2
11	33-421	Air Heater And Gas Ducts Mineral Wool	65850	2
12	33-521	Id Ducts Mineral Wool	79250	2
13	33-721	Oil System Mineral Wool	5040	2
14	33-924	Misc. Equip. asbestas	200	2
15	55911	Insulation Wool for FD Fan	10780	2
16	55931	Insulation wool for PA Fan	8624	2
17	79-067	Insulation Wool for ESP	168000	2
18	81-325	Mineral Wool Mattress-External Piping	33000	2
19	PEM	Thermal insulation – LRBs	340000	2
20	32-120	Fixing Comp For Sb Pipes Insul	957	3
21	32-310	Fixing Comp For Air Ducts Insul	68209	3
22	32-410	Fixing Comp For Ah And Gas Ducts Insul	19047	3
23	32-510	Fixing Comp For Id Ducts Insul	104469	3
24	32-710	Fixing Comp For Oil System Insul	2008	3
25	33-970	Misc Eqpts Expanded Metal	3883	3
26	55911	Fixing Comp. for FD Fan	1042	3
27	55931	Fixing Comp. for PA Fan	206	3
28	79-068	Fixing Comp. for ESP	104000	3
29	81-318	Fix Comp For Insuln Of Misc Piping	4000	3
30	PEM	Anciliary	20500	3
31	37-010	Blr Outer Casing Components	37729	4
32	37-810	Blr Outer Casing	39949	4
33	81-350	Aluminium Sheet-External Piping	10000	4
34	PEM	Aluminium Sheet	66000	4
35	79-068	G.I. Plain sheet. for ESP	254000	4
36	55911	Aluminium Sheet	2464	4
37	55931	Aluminium Sheet	1971	4
		Total Weight in Kg.	**2556662**	
		Total Weight in MT.	**2557**	

VOLUME IA PART –I CHAPTER -X
GENERAL

1.10.1 All the works such as cleaning, leveling, aligning, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, weld depositing, grinding, straightening, fitting-up etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate.

1.10.2 The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.

1.10.3 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The applicable erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any rework on this failure to comply with will be to account contractor only. BHEL engineer, depending upon the availability of materials, fronts etc, will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.

1.10.4 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.

1.10.5 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.

1.10.6 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in

excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.

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

1.10.8 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9001 – 2000 Standards.

1.10.9 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like TG / Boiler erection, Cabling, instrumentation etc., to commence their work from / on the equipments coming under this scope. Some time it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.

1.10.10 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.

1.10.11 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.

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

1.10.13 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.

1.10.14 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

1.10.15 SITE INSPECTION

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.

VOLUME IA PART –I CHAPTER -XI
FOUNDATIONS AND GROUTING

VOID

VOLUME-IA PART-I CHAPTER -XII
MATERIAL HANDLING AND SITE STORAGE

1.12.1 Loading at BHEL/Customer stores and storage yard, transport to site, unloading at site/working area of equipment placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailor or trucks/ slings/ tools and tackles / labour including operators Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.

1.12.2 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

1.12.3 Sometimes it may become necessary for the contractor to handle certain unrequired components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

1.12.4 Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.

VOLUME-IA PART-I CHAPTER- XIII
APPLICATION OF INSULATION AND REFRACTORY

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

1.13.1 Application of refractory, wool insulation, sheet metal cladding, welding of hooks / supports to hold insulation and refractory's under this contract including but are not limited to the following. Insulation of main boiler portion, boiler drum, ceiling heat recovery area, air and flue gas ducts, and connected ducts, HP & LP piping, temporary acid cleaning and steam blowing piping connected tubes, oil and coal burners, oil and steam tracing, lines, complete and fuel and draft plants, all drain lines, traps, flanges, fine fittings, sampling lines etc.,

1.13.2 The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.

1.13.3 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision / clarification of BHEL Engineer will have to be followed.

1.13.4 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.

1.13.5 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.

1.13.6 Painting of inner side of sheet metal covering over the insulation walls with two coats of anti-corrosive paint (IS-158) to be applied to the entire satisfaction of BHEL Engineer and application of bituminous sealing compound on cladding/ sheet metal joints shall also be carried out by the contractor. Retainer type 'A' must be coated with Aluminium paint. **For which the required amount of paint, thinner and other accessories for painting, cleaning the surfaces etc., shall be arranged by the contractor within the quoted rate**.

1.13.7 Bituminous sealing compound will be provided by BHEL free of cost which is supplied by the respective Mfg. Units.

1.13.8 It is the responsibility of the contractor to ensure that the insulation and refractory materials and sheet metal covering issued to him for application are well protected against loss or damage or weather conditions tending to affect its quality by the provision of close / semi closed sheds at his cost.

1.13.9 All the insulation and refractory materials and sheet metal covering etc., issued to the contractor shall be properly stored and handled before application due the same. If any damage occur 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.

1.13.10 Contractor is liable for the exact accounting of the materials issued to him and any unaccountable losses shall be made good by him. The necessary accounting of the material issued will have to be furnished by the contractor periodically.

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

1.13.12 Wherever iron components are to be welded on non pressure parts, the contractor shall employ only approved structural welders. It shall also be the responsibility of the contractor to arrange for welding hooks, flats, plates, supports and other fixtures also. All consumables tools and plants etc., required for the work shall be arranged by the contractor at their cost.

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

1.13.14 contractor shall observe all precautions for laying and curing of Castable refractory. Any defective works found shall be re-laid by contractor at his own cost including materials.

1.13.15 Wool insulations are received at site as bonded and unbonded mattresses in standard sizes. These has to be dressed / cut to suit equipment / site work by the contractor.

1.13.16 For the insulation of hot air duct, gas duct, ID duct etc., unfaced bonded wool, mattresses is to be used with wire netting (wire netting is supplied separately) on the outside for rigidity.

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

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

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

1.13.20 Refractory works at complete combustion chambers, ceiling heat recovery area, oil and coal burner areas and application of castable refractory wherever specified in drawing or as directed by BHEL Engineer have to be carried out.

1.13.21 Fabrication of covering sheets may be necessary like preparing the sheets to the sizes and shapes specified in drawings, beading, swaging, beveling of sheets crowning of the sheets if necessary the same to supports over wool insulation with screws as specified in BHEL drawings or as instructed by BHEL engineer.

1.13.22 Fabrication, fixing or welding of hooks / supports to equipment of boiler parts, ESP, piping and other connected equipments to support wool insulation applying of primer paint to welded portion parts welding certain supports on parts other than pressure parts to hold refractory's (by engaging approved welders) as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.

1.13.23 The contractor shall leave certain gap and opening while doing the work as per the instructions of BHEL Engineer to facilitate inspection by Boiler Inspector or doing commissioning to fix gauges, fittings, instruments. Those gaps will have to be finished as per drawings at a later date by the contractor at his cost, as required by BHEL .

1.13.24 Cladding sheets shall be suitably pressed along with diagonals to form diamond shape so as to improve the strength of the sheets, to avoid humpiness and to give aesthetic look.

1.13.25 Plates ,bars, rods and other materials that are to be cut, and re-welded from the fabricated places to suit erection requirements for which no extra payment will be made to the contractor.

1.13.26 A log book shall be maintained by the contractor for the clearance of the area for application of refractory and insulation. If the contractor does the work on his own accord without prior permission the area should be redone at his cost.

1.13.27 The contractor shall draw only one week's requirement of material for their work from BHEL stores and keep them in their semi-closed shed near to the work area. The materials required for a particular space of work only shall be taken to the work spot. At the end of the day's work the leftover or unused materials shall be taken back to their semi-closed shed for keeping the materials safe. Necessary records shall have to be maintained by the contractor in respect of the above drawls / deposits, on daily basis as instructed by BHEL.

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

a) Castable refractory 2%
b) Insulation bricks & mortar 2%
c) Wool mattresses 2%
d) Cladding sheets 5%

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

1.13.30 Upon completion of daily work , the contractor shall remove from the vicinity of work all scrap packing materials rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer. Also, the contractor will demolish all the hutments, sheds, offices, constructed by him and shall clean the debris after the contract is over. In the event of his failure to do so, the same will be arranged / removed by BHEL Engineer and the expenses incurred with overhead will be recovered from the contractors.

1.13.31 Welding of hooks as per pitch, non pressure parts, applying red oxide paint to the welded portion as directed as per drawings before application of mineral wool mattresses will have to be done by the contractor.

1.13.32 Application of Castable refractory between tubes around burners on ceiling and as directed by Engineers and as per detailed drawings and specifications will have to be done by the contractor.

1.13.33 Applying different layers of mineral wool as directed and as per drawings and specifications for boiler and its auxiliaries, pipelines valves and other vessels and after fixing require holdings materials, suitably if necessary, fabrication of rings etc., and fixing as directed and as per drawings and specifications shall also form part of this work.

1.13.34 If necessary the hooks may have to be made from the rods, raw materials supplied in running lengths. The contractor may have to carry out this work also and use the same hooks.

1.13.35 Incase 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.

1.13.36 Wherever additional / clamps, frame works, etc., are required to be fabricated and installed even though not indicated in the drawings shall be fabricated and installed at their cost. Only steel materials shall be given by BHEL free of cost , consumables like electrodes, gases etc., are to arranged by the contractor at his cost.

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

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

1.13.39 In case of any class of work for which there is no such specifications as laid down in the contract, the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.

1.13.40 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. Any damage so to be made good by the contractor at his cost.

1.13.41 Delay in clearance of mechanical equipment and piping for insulations is unlikely to happen. However, if any delay occurs, the contractor shall not claim anything extra, like idle charges.

1.13.42 **Welding of all seal boxes covers** after completion of refractory work shall be done by the contractor. No extra charges will be payable for the same.

1.13.43 **Welding of iron components directly on pressure parts and HP piping is not covered in the scope of this contract since these welding are to be carried out by certified IBR high pressure welders. This is included in the scope of erectors of respective equipment / components.**

1.13.44 **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.

VOLUME IA PART – I CHAPTER - XIV
PROGRESS OF WORK

1.14.1 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.

1.14.2 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.

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

1.14.4 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer.

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

1.14.6 The monthly report ending on 24th of every month shall be submitted as a booklet and shall contain the following details :-

a) Colour Progress photographs to accompany the report should be submitted.

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 24th 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 will be spilt up under the work area of Boiler

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.

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

1.14.8 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.

VOLUME IA PART – I CHAPTER - XV
WELDING

1.15.1 All welders including tack welders and structural 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.

1.15.2 Engineer may stop any welder from the work if his performance is unsatisfactory for any technical reason or if there is a high percentage of rejection in the joints welded by him. The welders having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.

1.15.3 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor’s expense. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the quality engineer.

1.15.4 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.

1.15.5 All weldments shall be subjected to acceptance by BHEL Engineer.

1.15.6 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. All welds shall be painted with primer as specified in the painting schedule,

VOLUME IA PART – I CHAPTER – 16
PAINTING

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

1.16 FINAL PAINTING

1.16.1 Wherever applicable, supply and application of primer / final painting of all the insulation items erected under the scope of this tender. The painting shall be as required and specified in the **painting schedule**, which forms the part of this tender book.

1.16.2 Painting of inner side of sheet metal covering over the insulation walls with two coats of anti-corrosive paint (IS-158) to be applied to the entire satisfaction of BHEL Engineer and application of bituminous sealing compound on cladding/ sheet metal joints shall also be carried out by the contractor. Retainer type 'A' must be coated with Aluminium paint. For which the required amount of paint, thinner and other accessories for painting, cleaning the surfaces etc., shall be arranged by the contractor within the quoted rate.

1.16.3 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.

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

1.16.5 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.,

1.16.6 All surfaces to be painted shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Paint shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots.

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

1.16.8 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.

1.16.9 No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.

1.16.10 **PRESERVATION / TOUCH UP PAINTING**

1.16.10.1 Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipments under this tender specification right from pre- assembly stage to till the equipment is cleared for final painting.

1.16.10.2 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 red oxide primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.

VOLUME IA PART- II CHAPTER -1
REVERSE AUCTION PROCEDURE

GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION

Against this NIT for the subject work, tender shall be processed through "REVERSE AUCTION PROCEDURE" i.e. ON LINE BIDDING on INTERNET.

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
2. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on Internet.
3. BHEL will inform the vendor in writing in case reverse auction, the details of service provider to enable them to contact and get trained.
4. Business rules like event date, time, start price, bid decrement, extensions, etc. also will be communicated through service provider for compliance.
5. Vendors have to fax the compliance form in the prescribed (provided by service provider) before start of Reverse auction. Without this the vendor will not be eligible to participate in the event.
6. BHEL will provide the calculation sheet (e.g.: EXCEL sheet) which will help to arrive at "Total Cost to BHEL".
7. Reverse auction will be conducted on schedule date & time.
8. At the end of reverse auction event, the lowest bidder value will be known on the network.
9. The lowest bidder has to fax the duly signed filled-in prescribed format as provided on case-to-case basis to BHEL through service provider within 24 hours of action without fail.
10. During Reverse Auction, the process of reverse auction is unsuccessful then BHEL at its discretion may decide to call the L1 bidder of reverse auction for further negotiation.
11. Sealed bid reverse auction: The opening bid (in the initial auction) of the bidders shall be same as that quoted in their final sealed price submitted to BHEL. The bidder shall confirm in writing to BHEL that their opening bid in both cases shall be same as that quoted in their final sealed price bids submitted to BHEL against this NIT along with Technical bid.
12. BHEL reserves the right to cancel Reverse Auction (RA) without assigning any reasons and resort to considering the sealed bids submitted by vendor for processing and finalizing the tender.

13. Any variation between the on-line bid value and signed document will be considered as sabotaging the tender process and will invite disqualification of vender to conduct business with BHEL as per prevailing procedure.

14. In case BHEL decides not to go for Reverse auction procedure for this tender enquiry, the price bids and price impacts, if any already submitted and available with BHEL shall be opened as per BHEL standard practice.

15. Bids given by the bidders during the reverse auction process will be taken as an offer to execute the work. Bids once made by the bidder, cannot be cancelled/withdrawn and bidders shall be bound to execute the work as mentioned above at the final bid price. BHEL shall take appropriate action as the lowest bidder do not execute the contract as per the rates quoted by him.

VOLUME IA PART – II CHAPTER 2
PAINTING SCHEDULE

2.2.1 SCOPE

This section covers the painting requirements for the power plant equipment, structures, piping etc. and any other surface required to be painted.

2.2.2 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job:

IS : 5	Colours for ready mixed paints and enamels
IS : 1303	Glossary of terms relating to paints
IS : 2379	Colour code for identification of pipelines
IS :1477	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS : 2524	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS : 2395	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS : 2338	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS : 6278	Code of practice for white washing and colour Washing
IS : 3140	Code of practice for painting asbestos cement building Products
IS : 158	Ready mixed paint, brushing, bituminous, black , lead-free, acid, alkali, water and heat resisting
IS : 2074	Ready mixed paint, air drying, red Oxide Zinc Chrome priming
IS : 104	Ready mixed paint, brushing, Zinc Chrome, priming
IS : 2932	Enamel, synthetic, exterior (a) undercoating (b) finishing

2.2.3 PREPARTION OF SURFACES

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out,

sand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the OWNER / OWNER REPRESENTATIVE. .

2.2.4 PRIMER PAINT

After the surface is prepared, one coat of Zinc Phosphate primer conforming to IS: 2074 shall be applied. After this first coat is dried up completely, second coat of red oxide primer shall be applied. Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be minimum 30 microns.

2.2.5 FINISH PAINT

Synthetic enamel paint conforming to IS:2932 shall be used for finish coats. The colour/shade shall be as approved by the OWNER. After cleaning the dust on the dried up primer, first coat of synthetic enamel shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.

2.2.6 SUGGESTED COLOUR CODES FOR PAINTING

Sl. No.	ITEM/SERVICE	COLOUR	IS-5 Grade	COLOUR (BAND)	IS-5
1.0	Tanks (without insulation and cladding)				
1.1	Outdoor	Aluminium	-	-	-
1.2	Indoor	Light grey	631	-	-
2.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
3.0	Piping (without insulation and cladding)				
3.1	Water System				
	Boiler feed	Sea green	217	-	-
	Condensate	Sea green	217	Light brown	410
	D M Water	Sea green	217	Light orange	557
	Soft water	Sea green	217	French blue	166
	Bearing cooling water	Sea green	217	French blue	166

Sl. No.	ITEM/SERVICE	COLOUR	IS-5 Grade	COLOUR (BAND)	IS-5
	Potable & filtered water	Sea green	217	French blue	166
	Service & clarified water	Sea green	217	French blue	166
	Raw water	Sea green	217	White	-
	Cooling water	Sea green	217	French blue	166
3.2	Air system				
	Station air	Sky blue	101	-	-
	Control air	Sky blue	101	White	-
3.3	Oil system				
	Fuel oil	Light brown	410	French	166
	Light oil	Light brown	410	Brilliant green	221
	Lubricating oil	Light brown	410	Light grey	631
	Transformer oil	Light brown	410	Light orange	557
3.4	Gas system				
	Carbon dioxide	Canary yellow	309	Light grey	631
	Hydrogen	Canary yellow	309	Signal red	537
3.5	Fire services	Fire red	536	-	
3.7	Vaccum pipes	Sky blue	101	Black	
3.9	Drainage	Black	-	-	

Notes:

1. This colour code basically refers to IS 2379 for piping with necessary modifications.

2. wherever band colour is specified ,the same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

VOLUME-IA PART-II
CHAPTER 3

In the next 52 pages

General guide lines for insulation works	51 pages

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. Incase 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:

	LAYER IN mm				
THICKNESS IN mm	1st	2nd	3rd	4th	5th
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
2) RETAINER TYPE – A
3) CASING SUPPORT – 850MM
4) OUTER CASING
5) WOOL MATTRESS
6) SELF TAPPING SCREW – M4X13
7) CLAMP
8) SUPPORTING SHEET
9) FLAT 50 x 6
10) PACKING CLOTH – 3 MM TK
11) HEX HD BOLT M8X40
12) HEX NUT M8
13) PNCHD WASHER A9
14) GI BINDING WIRE DIA – 1.22 /0.914
15) GI SEWING WIRE DIA – 0.71 / 0.914
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
2) WOOL MATTRESS
3) OUTER CASING
4) RETAINER TYPE – A
5) GI BINDING WIRE DA – 1.22 / 0.914
6) CASING SUPPORT – 650 MM
7) SELF TAPPING SCREW M4 x 13
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 s 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
2) RETAINER TYPE – A
3) RETAINER TYPE – C
4) CASING SUPPORT – 650 MM
5) GI BINDING WIRE DIA – 1.22/0.914
6) GI SEWING WIRE DIA – 0.71 / 0.914
7) OUTER CASING
8) SELF TAPPING SCREW M4X13
9) WOOL MATTRESS
10) WELD MESH
11) CORNER SUPPORT
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 outr casing.

Fix the insulation.

Position the Retainer Type – A and tack weld to the Fixing pin.

The Biding 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 REFRECTORY

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 cane 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 20º to 30º 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 cab 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 mi the while material so that segregated particles get mixed.

(b) The pourable insulation should be thoroughly mixed with coal 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 to be less than the 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 fee 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, 10, 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 40º C to 700º C of Bs 5970 code for practice for thermal insulation of pipe work and equipment (in the temperature range – 100º C to + 870º 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 loster-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 30º 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 he 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 shell 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 shell 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 shell 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 mater 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 vide 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.

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 hest economy and protection of operating personnel. Any pip which is at a temperature higher than it s surroundings will loose 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 hast 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 services temperature.

2.0 METHOD OF APPLICATION

The method of application is highly skilled job. Badly fitted/laid insulation can lead to greater hear 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 insulate d 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 ate 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 provides 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.

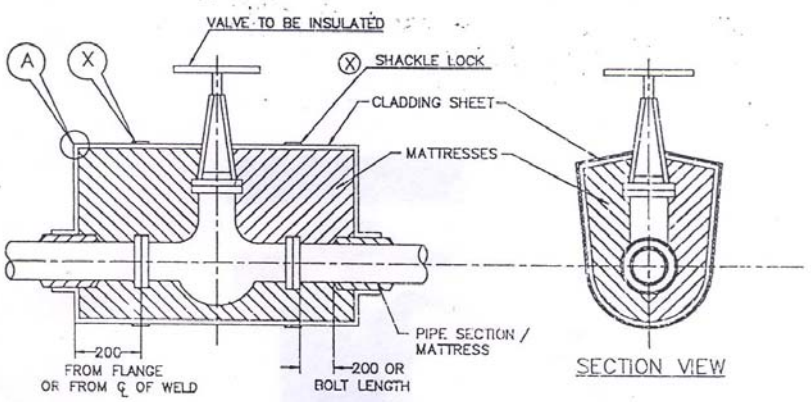
18 SWG (1.22 mm thk.)	For pipes with dia over insulation above 450 MM.
20 SWG (0.91 mm thk.)	For pipes with dia over insulation above 150 MM and less than equal to 450MM.
22 SEG (0.71 mm thk.)	For pipes with dia over insulation less than equal to 150mm.

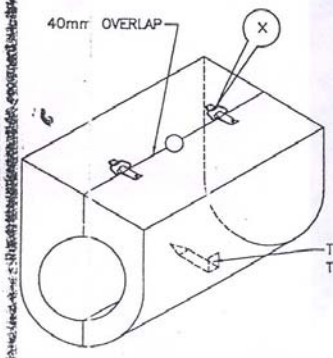
SECTION – B

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD





ASSEMBLED VALVE BOX

MATERIALS REQUIRED:–

1. MATTRESSES
2. CLIPS 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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:–
INSULATION APPLICATION
(VALVES)

	NAME	SIGN	DATE
DRN	S.C.S.		5.6.97
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

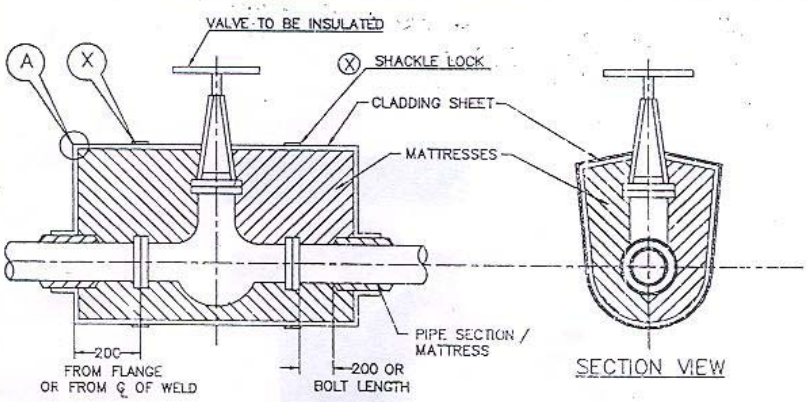
DS

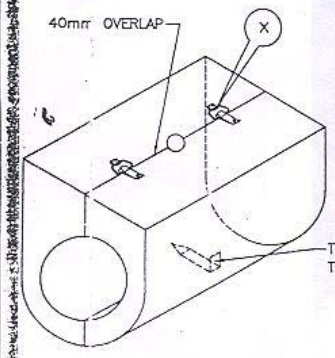
A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD





ASSEMBLED VALVE BOX

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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:–
INSULATION APPLICATION
(VALVES)

	NAME	SIGN	DATE
DRN	S.C.S.		5.6.97
DESN	S.C.S.		5.6.97
CHD	D.B.S.		6.6.97
APPD	S.K.J.		11.6.97

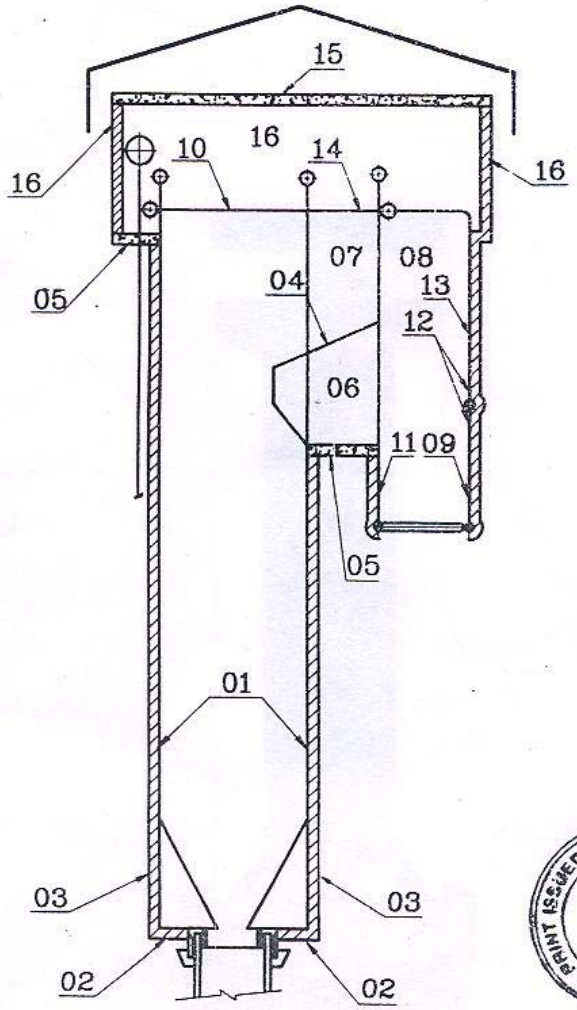
CARD CODE —

DRAWING NO. PE-4-999-169-06

SHEET 1 OF 1 REV. 00

DG

A4

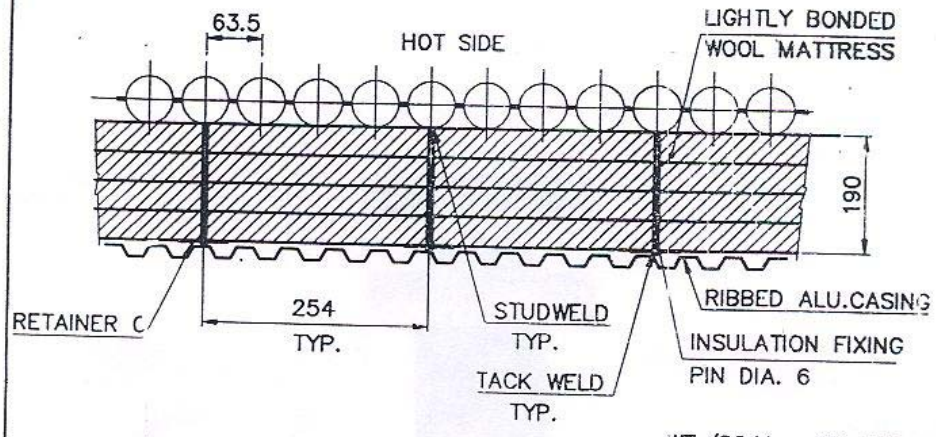


INSULATION	DRN	C.S		DRG.NO. 4-00-215-08551	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

CTS001384-0

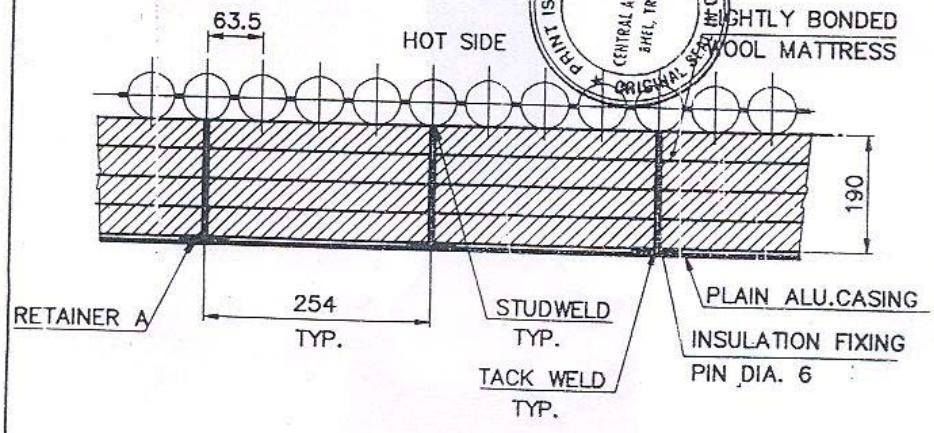
DETAIL 01

SHEET 02 OF 09



WT./SQ.M ≃ 32 KGS

DETAIL 02

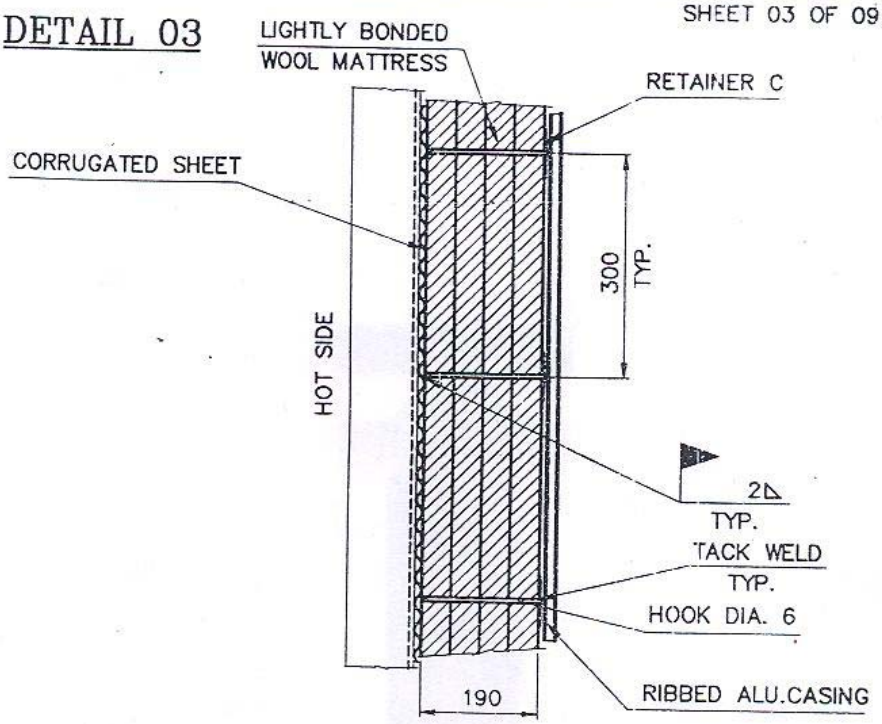


WT./SQ.M. ≃ 29 KGS

INSULATION	DRN	C.S		DRG.NO. 4-00-215-08552	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

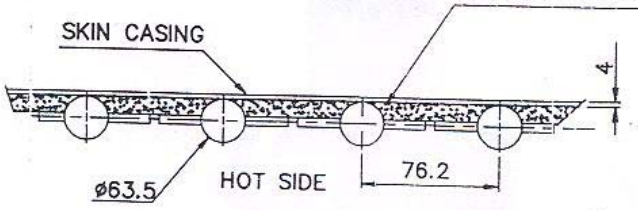
CTS001384-0

DETAIL 03



WT./SQ.M. ≃ 45 KGS

DETAIL 04

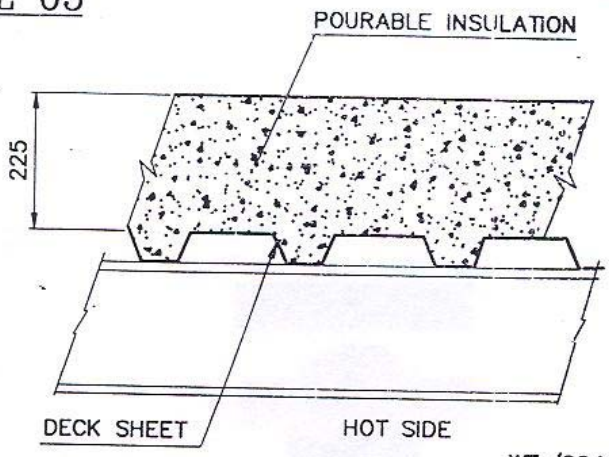


WT./SQ.M. ≃ 72 KGS

INSULATION	DRN	C.S ,		DRG.NO. 4–00–215–08553	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

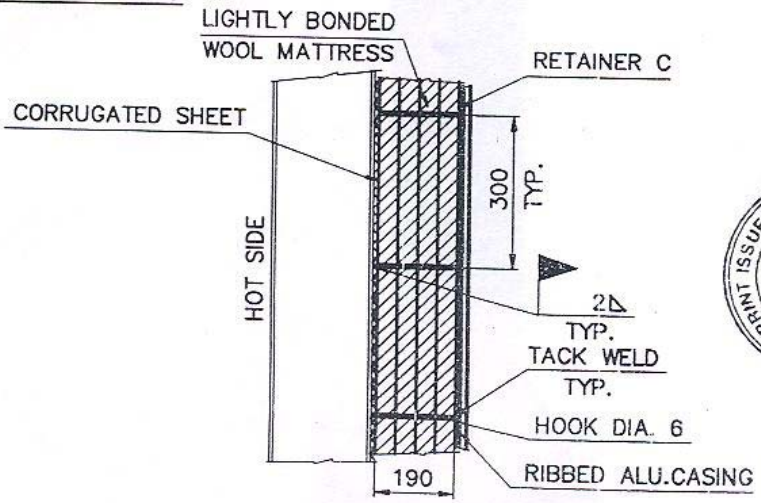
CTS001384-0

DETAIL 05



WT./SQ.M ≃ 193 KGS

DETAIL 06

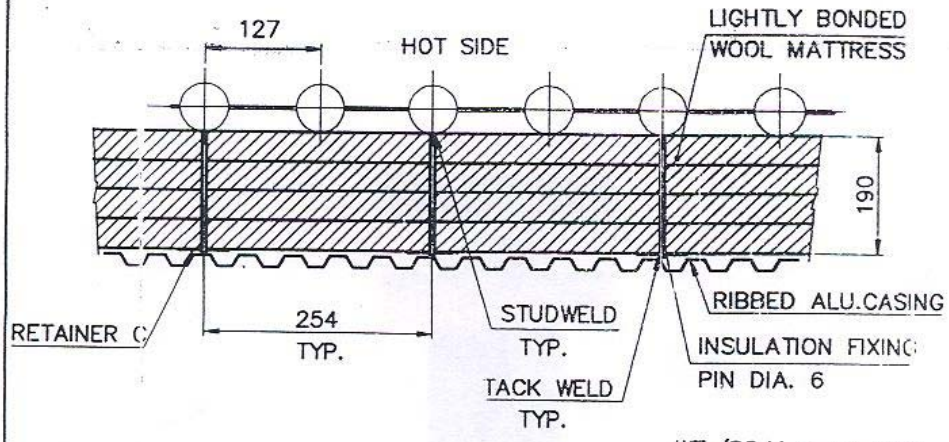


WT./SQ.M ≃ 45 KGS

INSULATION	DRN	C.S		DRG.NO. 4-00-215-08554	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

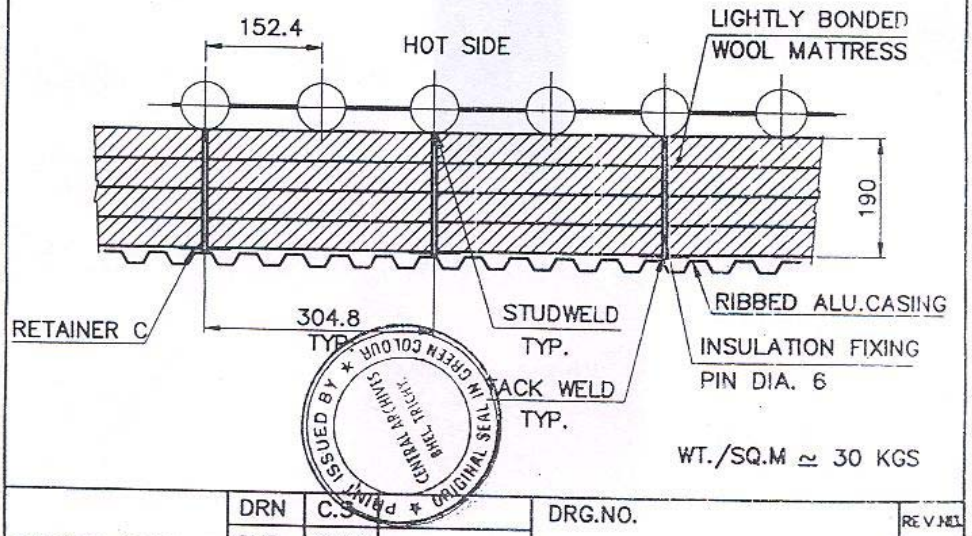
SHEET 05 OF 09

DETAIL 07



WT./SQ.M ≃ 32 KGS

DETAIL 08

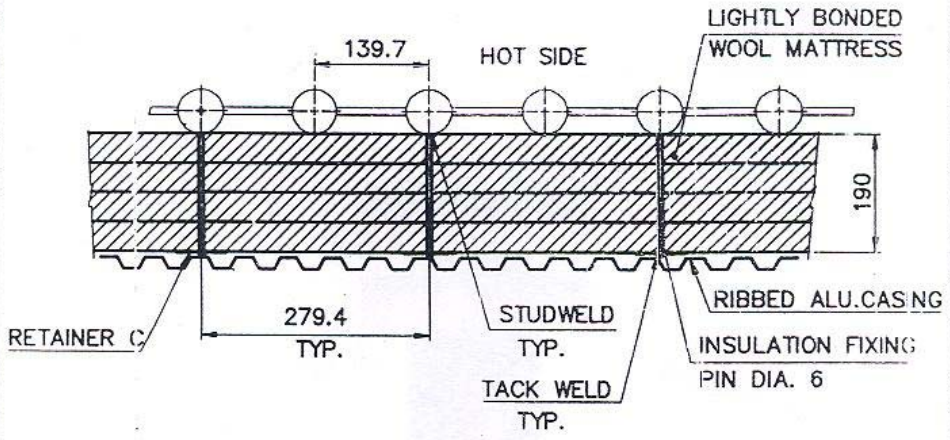


WT./SQ.M ≃ 30 KGS

INSULATION	DRN	C.S		DRG.NO. 4-00-215-08555	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

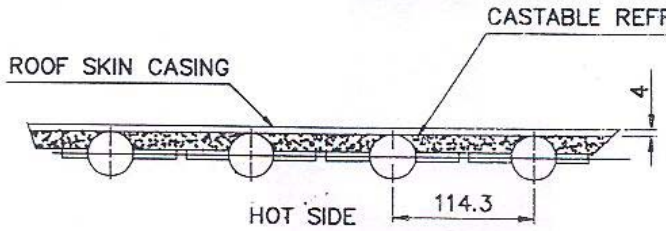
CTS001384-0

DETAIL 09



WT./SQ.M ≃ 30 KGS

DETAIL 10

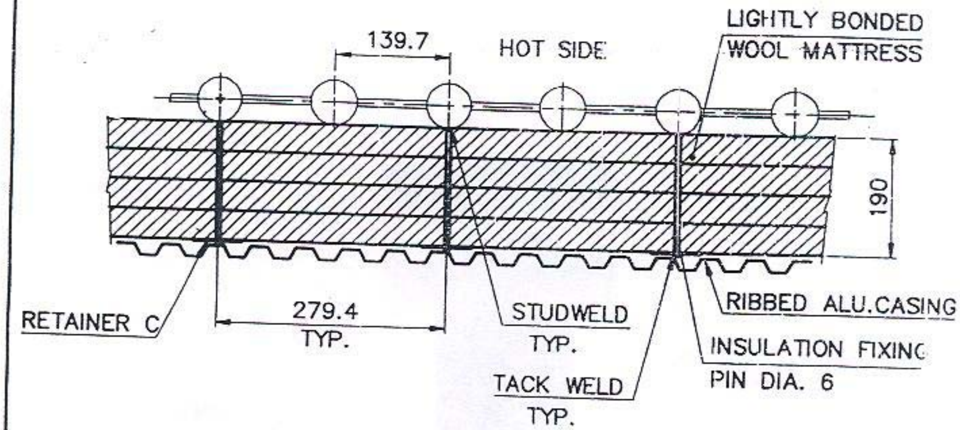


WT./SQ.M. ≃ 75 KGS

INSULATION	DRN	C.S		DRG.NO. 4–00–215–08556	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

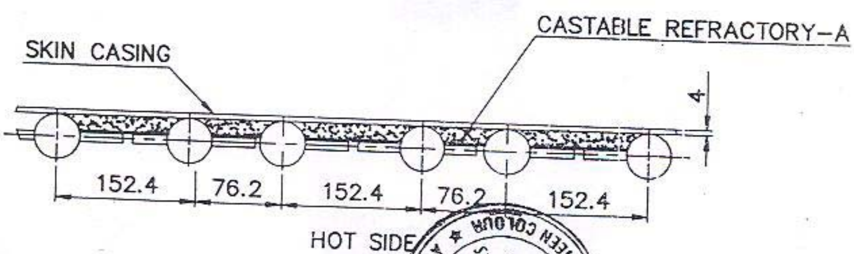
CTS001384-0

DETAIL 13



WT./SQ.M ≃ 30 KGS

DETAIL 14

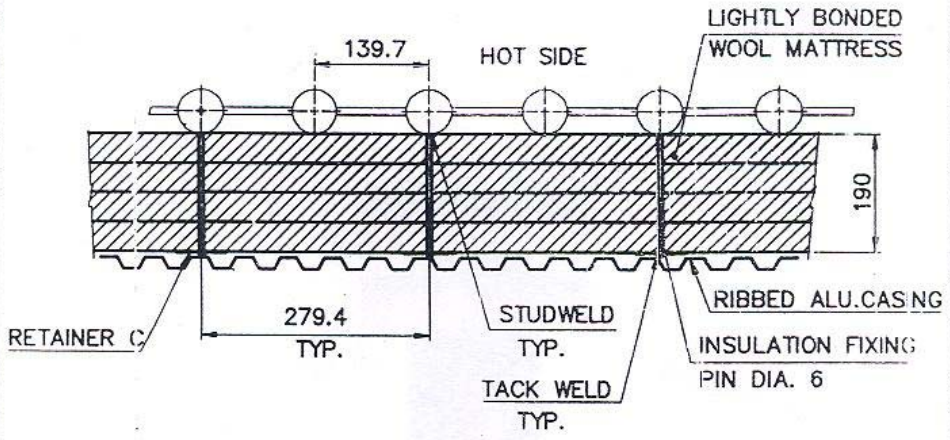


WT./SQ.M. ≃ 75 KGS

INSULATION	DRN	C.S		DRG. NO.	REV.NO.
	CHD	C.G.S			
	APPD	C.G.S		4–00–215–08558	00

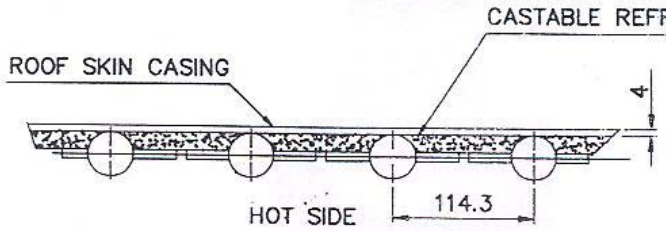
CTS001384-0

DETAIL 09



WT./SQ.M ≃ 30 KGS

DETAIL 10

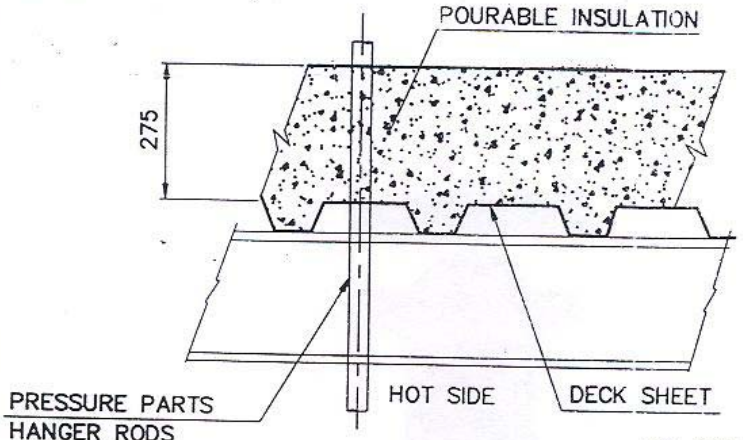


WT./SQ.M. ≃ 75 KGS

INSULATION	DRN	C.S		DRG.NO. 4–00–215–08556	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

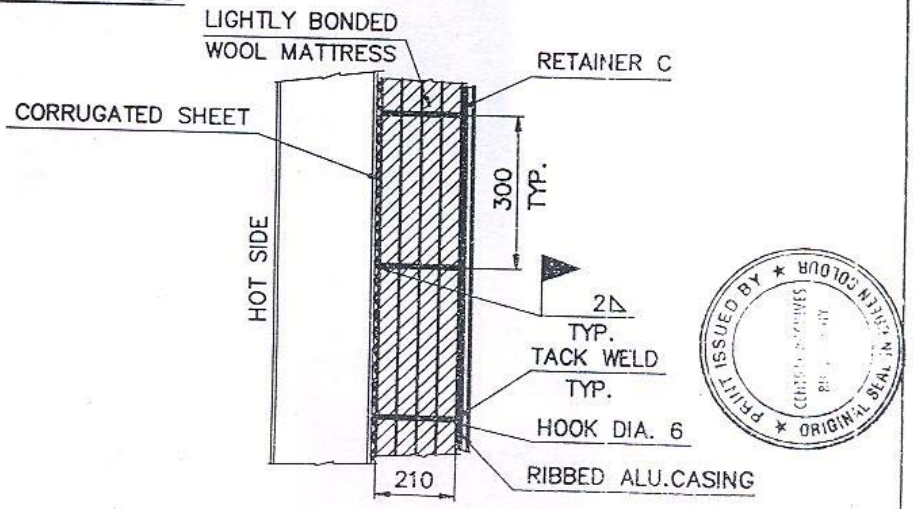
CTS001384-0

DETAIL 15



WT./SQ.M ≃ 233 KGS

DETAIL 16



WT./SQ.M ≃ 46 KGS

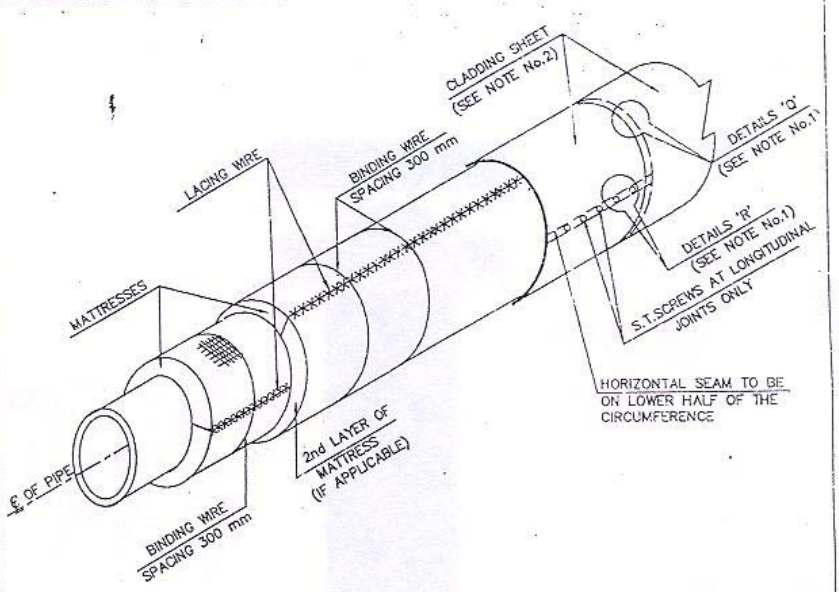
INSULATION	DRN	C.S		DRG.NO. 4-00-215-08559	REV.NO. 00
	CHD	C.G.S			
	APPD	C.G.S			

CTS001284-0

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MP	M	N.T.S.	—	—	—

TITLE:

INSULATION APPLICATION
(HORIZONTAL PIPES WITH MATTRESSES)

	NAME	SIGN	DATE
DRN	S.C.S.		
DESN	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APPD	S.K.J.		11.6.97

CARD CODE: —

DRAWING NO. PE–4–999–169–01

SHEET 1 OF 1 REV. 00

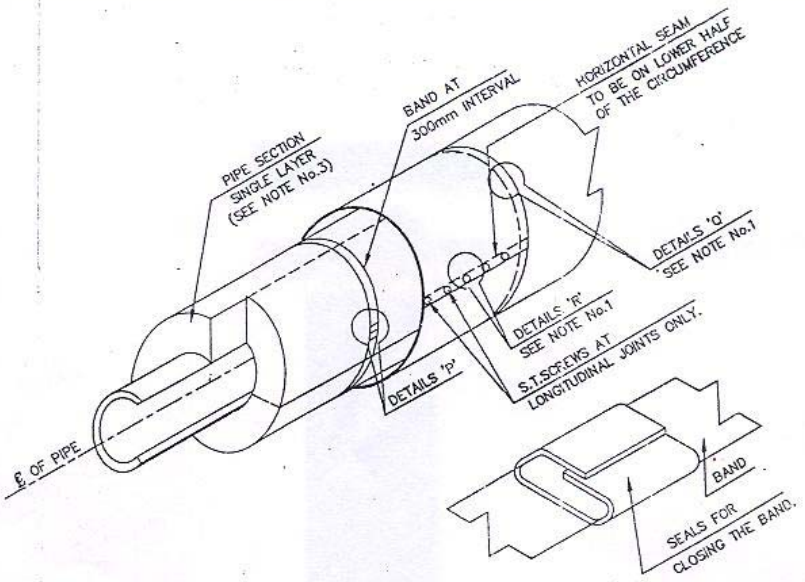
DL

A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD



DETAILS 'P'

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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:–
INSULATION APPLICATION
(HORIZONTAL PIPES WITH PIPE SECTION)

	NAME	SIGN	DATE
DRN	S.C.S.		
DESN	S.C.S.		6.6.94
CHD	D.B.S.		9.6.94
APPD	S.K.J.		11.6.94

CARD CODE —

DRAWING NO. PE–4–999–169–02

SHEET 1 OF 1 REV. 00

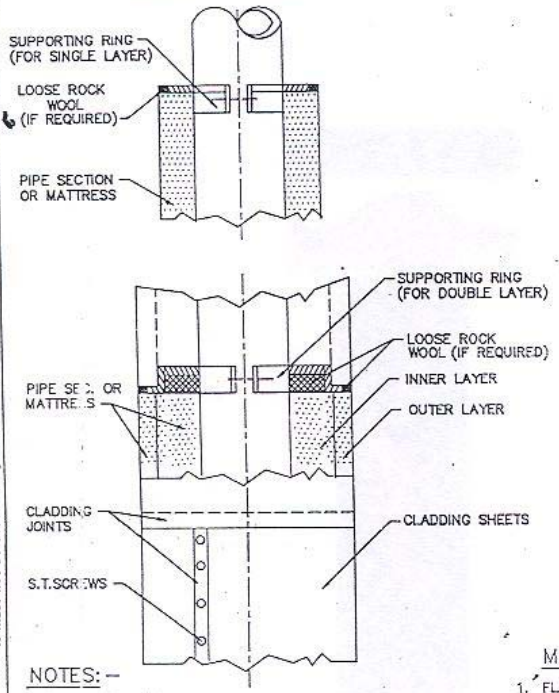
D2

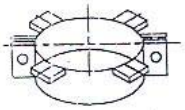
A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

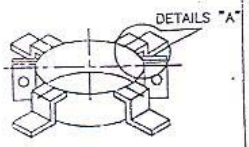
REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD

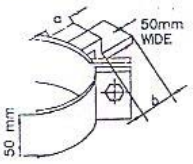




SUPPORT RING
(FOR SINGLE LAYER)



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 80 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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:–
INSULATION APPLICATION
(VERTICAL PIPING)

	NAME	SIGN	DATE
DRN	S.C.S.		9.6.97
DESN	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APPD	S.K.J.		9.6.97

CARD CODE —

DRAWING NO. PE-4-999-169-03

SHEET 1 OF 1 REV. 00

1-4

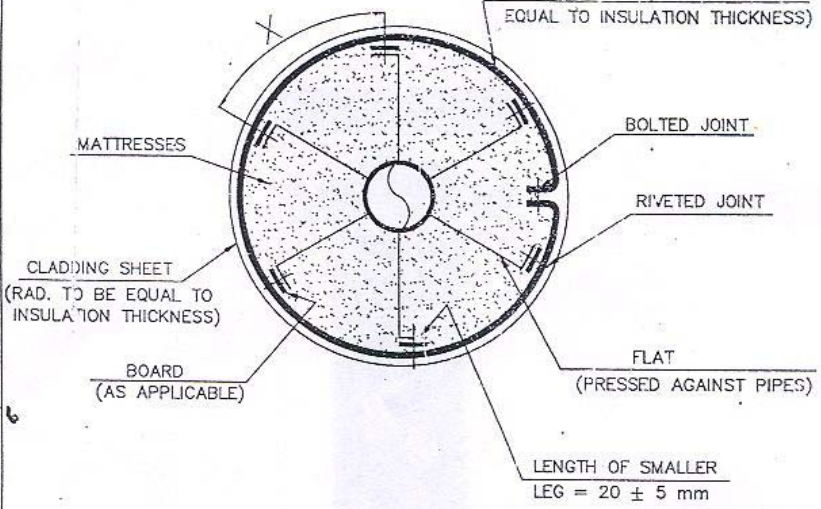
D3

A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN mm)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / 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.	CODE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:– INSULATION APPLICATION (CLADDING SHEET, SUPPORT RING FOR HOR. PIPE O.D>114.3mm & HOR. EQUIPMENTS)

	NAME	SIGN	DATE
DRN	S.C.S.		
DES'N	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APP'D	S.K.J.		11.6.97

CARD CODE —

DRAWING NO. PE-4-999-169-04

SHEET 1 OF 1 REV. 00

AL-11

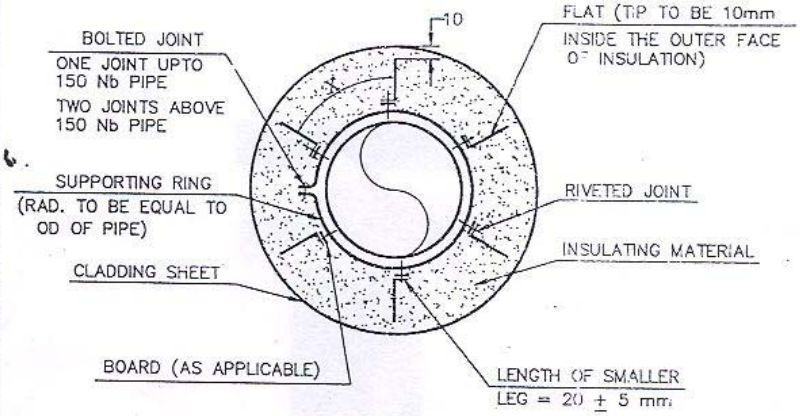
D4

A4

FIRST ANGLE PROJECTION ALL DIMENSIONS ARE IN MM

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / 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

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–4–999–169–09.
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	WEIGHT (KG)	REF. TO ASSY. DRG	ITEM
M-L	M	N.T.S.			

TITLE:– INSULATION APPLICATION (INSULATION SUPPORT RING FOR VERTICAL PIPING & VERTICAL EQUIPMENTS)

	NAME	SIGN	DATE
DRN	S.C.S.		9.6.92
DESN	S.C.S.		9.6.92
CHD	D.B.S.		9.6.92
APPD	S.K.J.		11.6.92

CARD CODE

DRAWING NO. PE–4–999–169–05

SHEET 1 OF 1 REV. 00

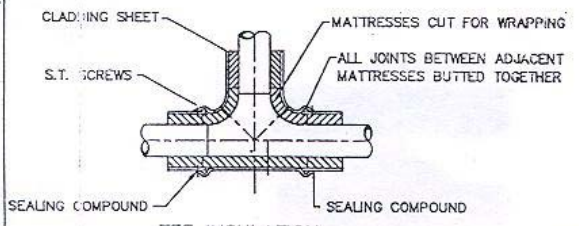
AL–222

A4

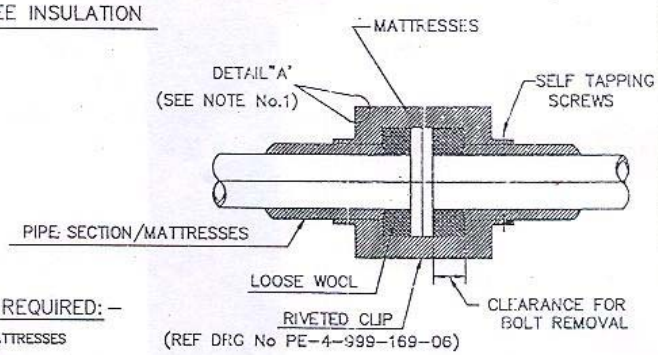
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED
6					

JOB NO. STANDARD



TEE INSULATION



(REF DRG No PE-4-999-169-06)

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

NOTE:-

1. FOR DETAIL "A" 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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:-
INSULATION APPLICATION
(TEES AND FLANGE JOINTS)

	NAME	SIGN	DATE
DRN	S.C.S.		9.6.97
DESN	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APPD	S.K.J.		9.6.97

CARD CODE	DRAWING NO.	REV.
—	PE-4-999-169-07	00

SHEET 1 OF 1

L-6

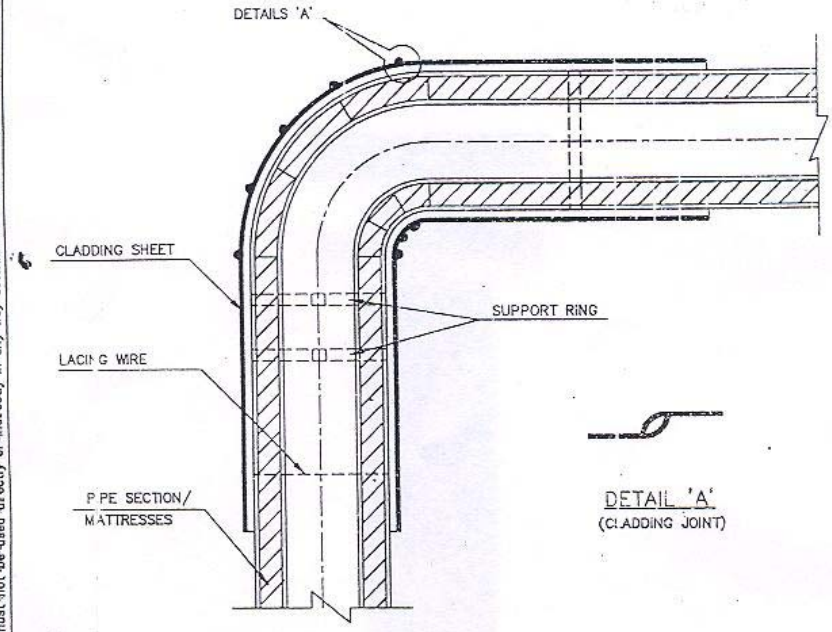
DF

A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD



DETAIL 'A'
(CLADDING JOINT)

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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:-
INSULATION APPLICATION
(ELBOWS & BENDS SIZE EXCEEDING 150mm)

	NAME	SIGN	DATE
DRN	S.C.S.		9.6.97
DESN	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APPD	S.K.J.		11.6.97

CARD CODE	DRAWING NO.	REV.
—	PE-4-999-169-08	00

SHEET 1 OF 1

L-7

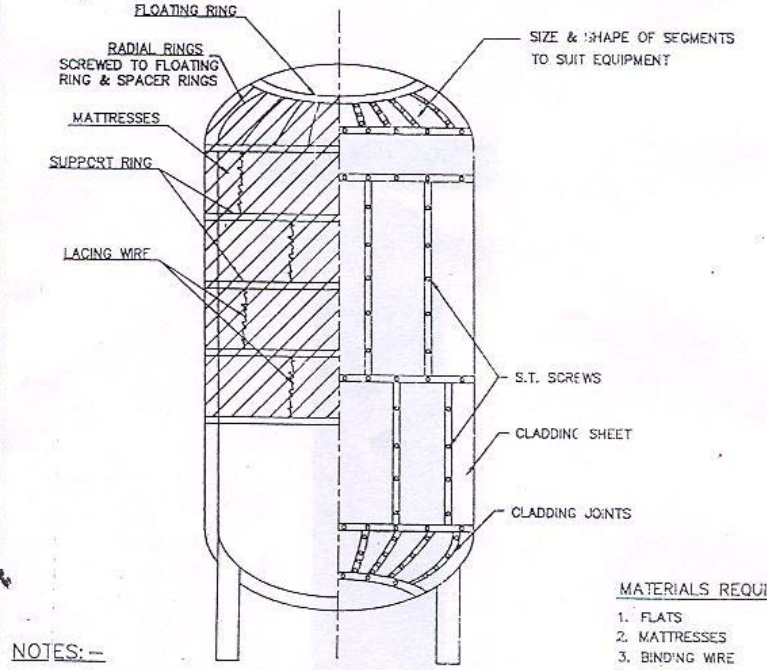
D8

A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD



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

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".

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DEPT.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:- INSULATION APPLICATION (EQUIPMENT)

	NAME	SIGN	DATE
DRN	S.C.S.		
DESN	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APPD	S.K.J.		11.6.97

CARD CODE —

DRAWING NO. PE-4-999-169-09

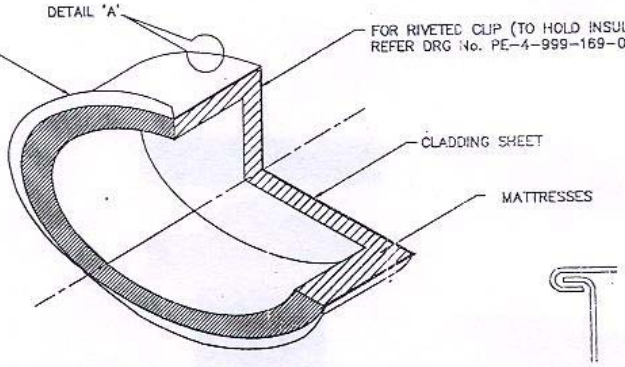
SHEET 1 OF 1 REV. 00

D9

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

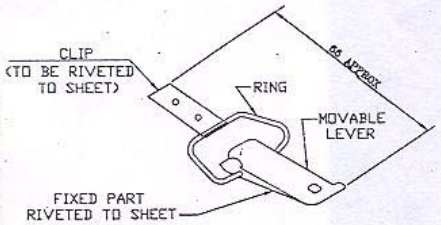
REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD



INSULATING COVER FOR MAN HOLE

DETAILS 'A'
(LOCKING OF SHEETS)



G.I. SHACKLE LOCK CONNECTING BUCKLE
DETAILS 'X'

MATERIAL REQUIRED:-
(FOR SHACKLE LOCK)

1. CLIP (MADE FROM CLADDING SHT.)
2. RIVETS

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

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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:-
INSULATION APPLICATION
(FABRICATED HEAT INSULATING COVER FOR MAN-HOLE)

	NAME	SIGN	DATE
DRN	S.C.S.		9.6.97
DESN	S.C.S.		9.6.97
CHD	D.B.S.		11.6.97
APPD	S.K.J.		

CARD CODE	DRAWING NO.	REV.
—	PE-4-999-169-10	00

SHEET 1 OF 1

DLO

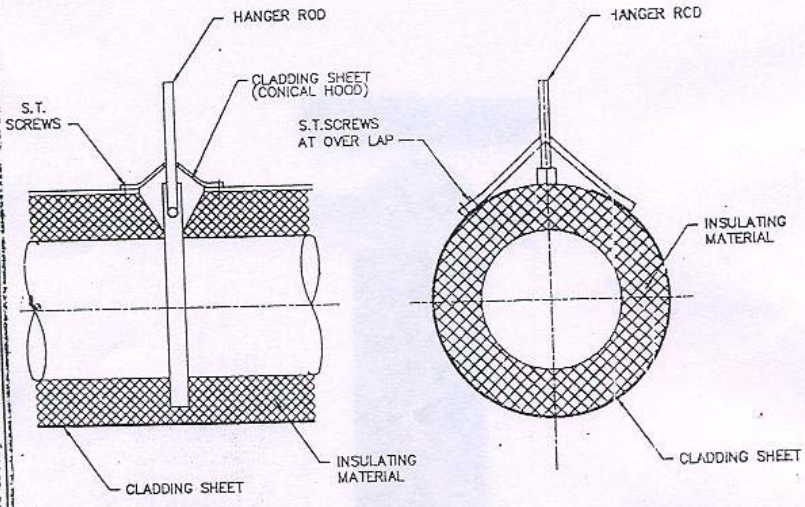
A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED	REV.	DATE	ALTERED
01	10.5.02	CHECKED			CHECKED

NOTE 2 ADDED.

JOB NO. STANDARD



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	WEIGHT (KG.)	REF. TC ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:- INSULATION APPLICATION (METAL FLASHING ON HANGER ROD PROTRUSION)

	NAME	SIGN	DATE
DRN	S.C.S.		5.6.97
DESN	S.C.S.		6.6.97
CHD	D.B.S.		10.6.97
APPD	S.K.J.		11.6.97

CARD CODE —

DRAWING NO. PE-4-999-169-11

SHEET 1 OF 1 REV. 00

L-10

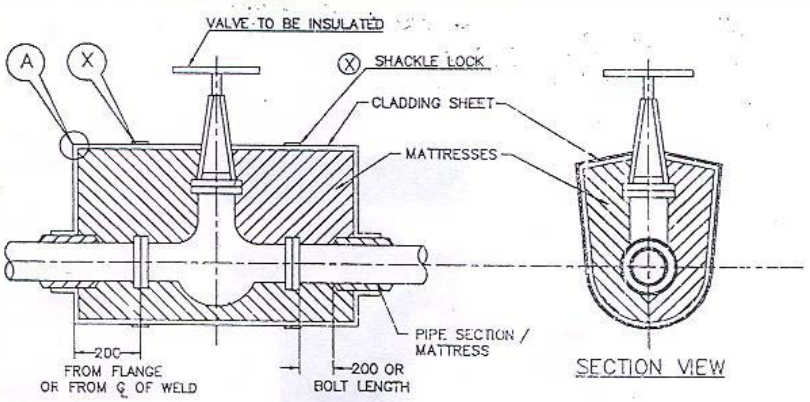
D11

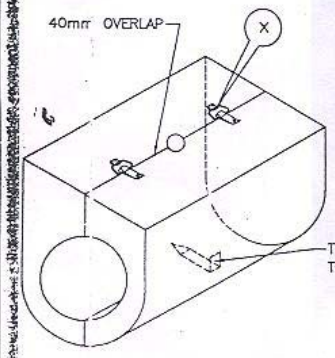
14

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

JOB NO. STANDARD





ASSEMBLED VALVE BOX

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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:–
INSULATION APPLICATION
(VALVES)

	NAME	SIGN	DATE
DRN	S.C.S.		5.6.97
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

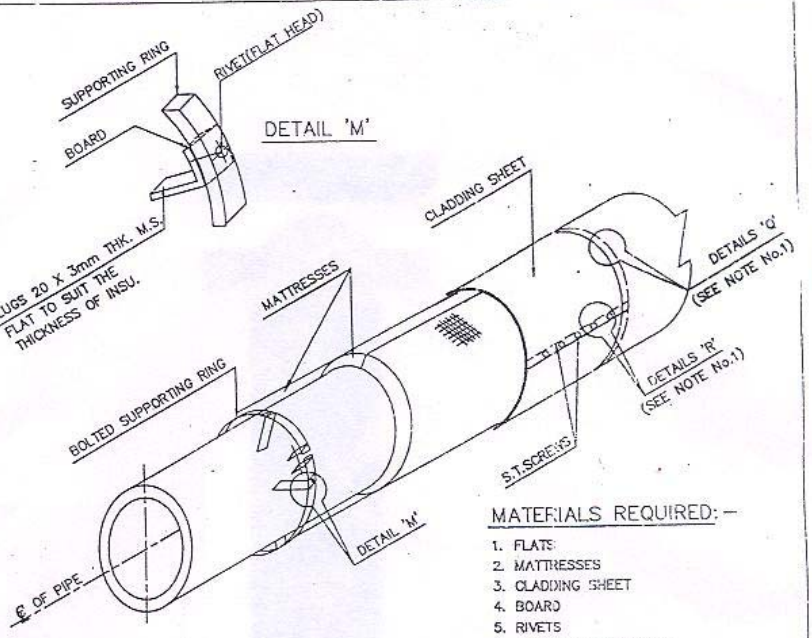
DG

A4

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / 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.	CODE	SCALE	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S	—	—	—

TITLE:–
INSULATION APPLICATION
(SUPPORT RING FOR PIPE O.D.>168.3mm)

	NAME	SIGN	DATE
DRN	S.C.S.		7.6.12
DES'N	S.C.S.		7.6.12
CHD	D.B.S.		9.6.12
APP'D	S.K.J.		

CARD CODE —

DRAWING NO. PE–4–999–169–13

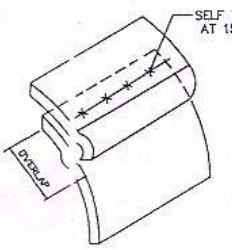
SHEET 1 OF 1 REV. 00

D13

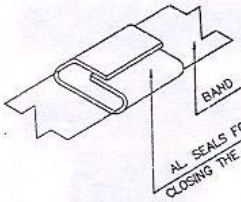
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED

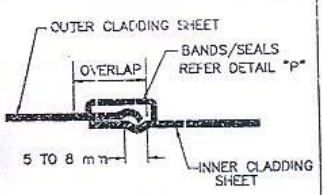
JOB NO. STANDARD



**DETAIL 'R'
(LONGITUDINAL JOINT)



DETAIL 'P'



*DETAIL 'Q'
(CIRCUMFERENCIAL JOINT)

**

1. JOINTS TO BE MADE AT 45° FROM BOTTOM
2. JOINTS TO BE ON LOWER HALF OF THE CURCUMFERENCE 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 OVERLAPING 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	WEIGHT (KG.)	REF. TO ASSY. DRG	ITEM
MPL	M	N.T.S.	—	—	—

TITLE:- INSULATION APPLICATION (DETAILS OF "P", "Q" AND "R")

	NAME	SIGN	DATE
DRN	S.C.S.		9.6.97
DESN	S.C.S.		9.6.97
CHD	D.B.S.		9.6.97
APPD	S.K.J.		11.6.97

CARD CODE —

DRAWING NO. PE-4-999-169-12

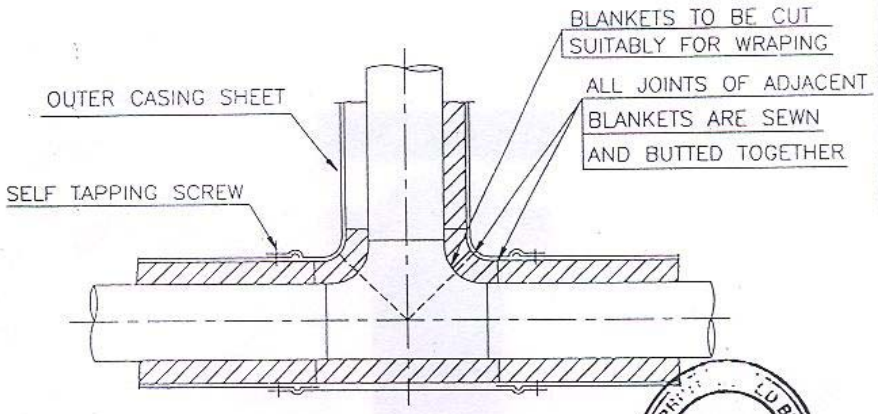
SHEET 1 OF 1 REV. 00

L-11

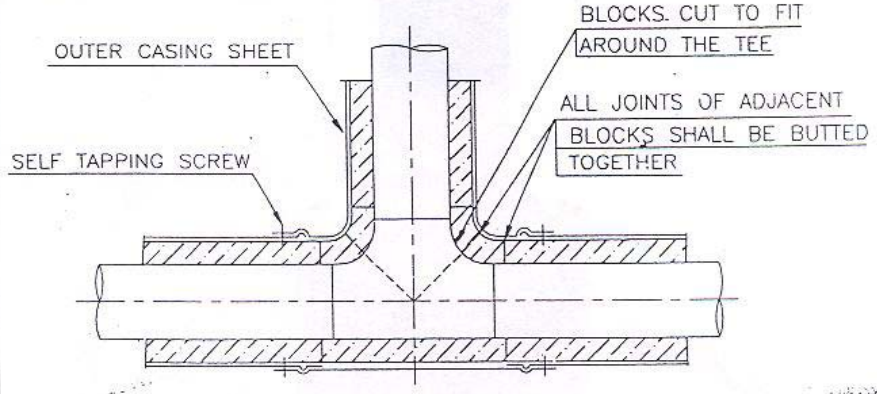
D12

A4

TEE INSULATION



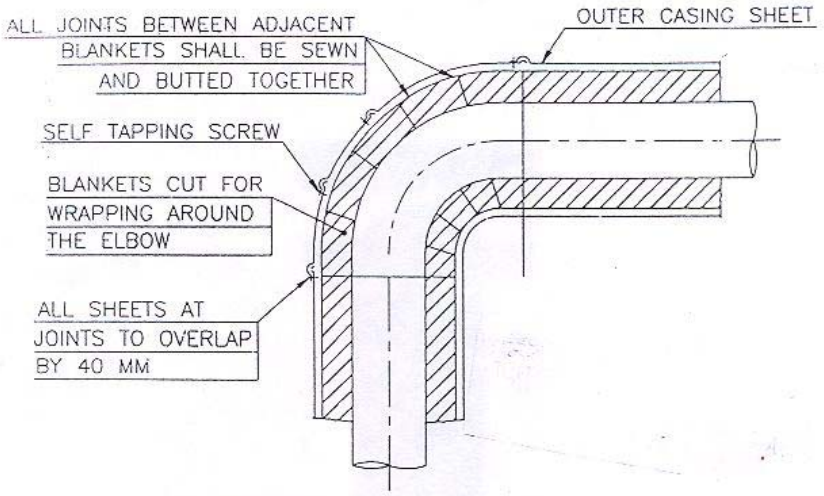
TEE INSULATION
(WITH WOOL MATTRESS)



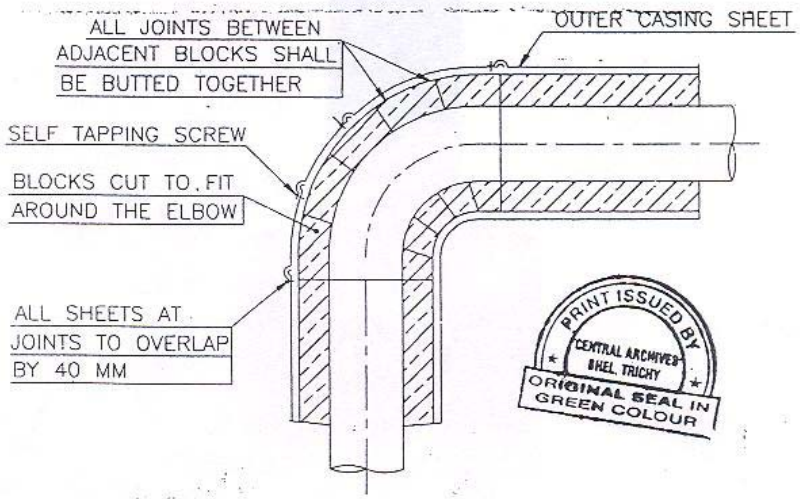
TEE INSULATION
(WITH CALCIUM SILICATE),

INSULATION	PREPARED	A.R.JOTHIGURUNATHAN	SIGNATURE	DATE 04.12.03	DRAWING NO : 4-00-235-08546	REV.
	CHECKED	K.KALIRAJAN				
	APPROVED	C.GUNASEKARAN				

ELBOW INSULATION



WITH WOOL MATTRESS

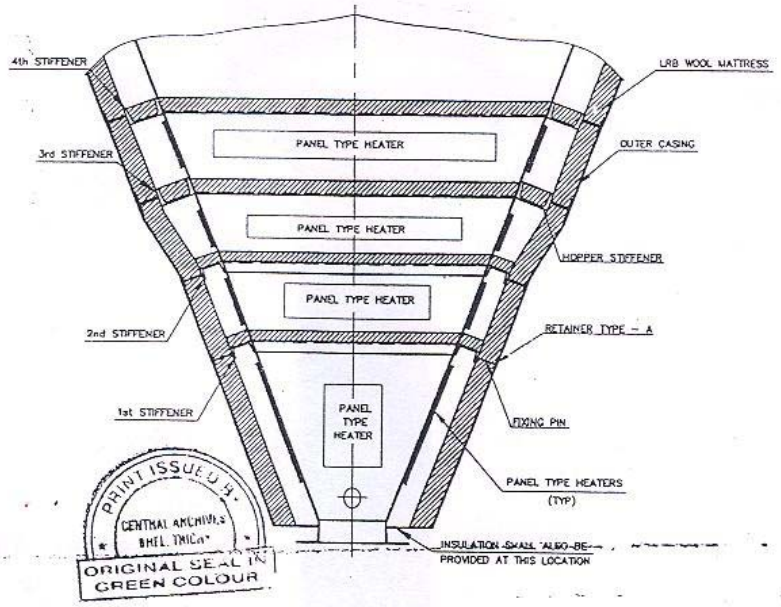


WITH CALCIUM SILICATE

INSULATION	PREPARED	A.R.JOTHIGURUNATHAN	SIGNATURE	DATE 04.12.03	DRAWING NO : 4-00-235-08547	REV
	CHECKED	K.KALIRAJAN				
	APPROVED	C.GUNASEKARAN				

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 HOPPERRS.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 .

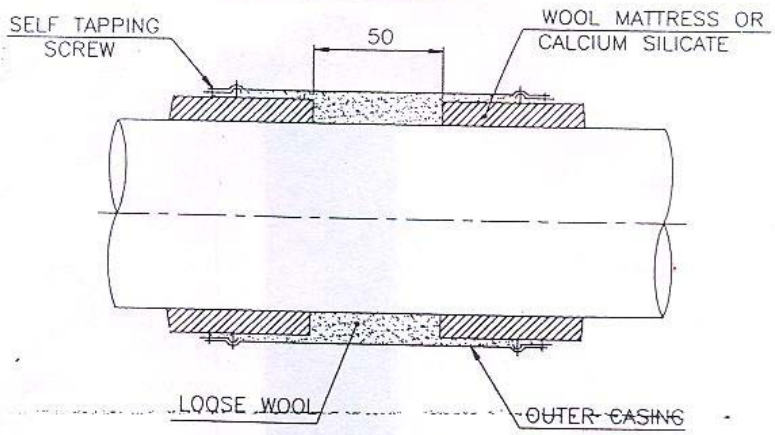
03. FOR OTHER INSULATION DETAILS, REFER DRG. 1-00-235-06654.

		NAME	SIGNATURE	DATE
Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI – 620014	DRN	A.R.J		20.09.05
355-056	CHD	C.G.S		22.09.05
	APPD	C.G.S		22.09.05

DEPT	ALL DIMENSIONS ARE IN MM	PROJECTION	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG
L&I					
CODE 123					

TITLE	DRAWING NO	REV
HOPPER INSULATION DETAIL FOR PANEL TYPE HEATERS	4-00-235-08702	01

EXPANSION JOINT FOR PIPES

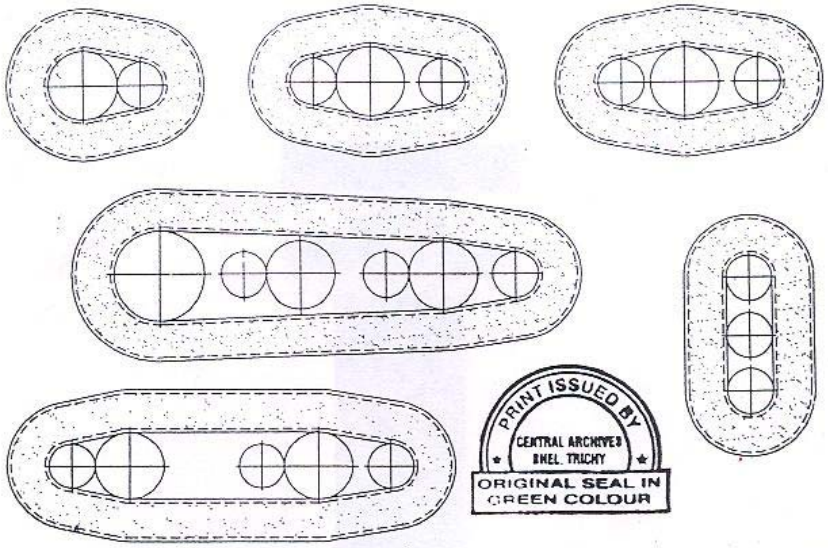


NOTE:-

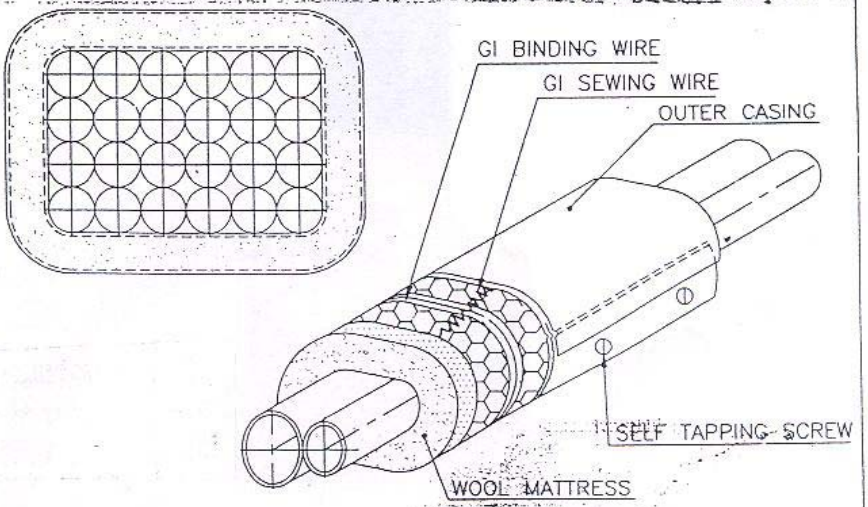
1. THIS ARRANGEMENT IS APPLICABLE FOR BOTH HORIZONTAL AND VERTICAL PIPE LINES,AT EVERY 5 METRES.
2. WHEN THE OPERATING TEMPERATURE IS BELOW 230°C,EXPANSION JOINTS ARE NOT REQUIRED.
3. FOR PIPES,WHERE THE FLOW IS ONLY INTERMITTANT,EXPANSION JOINTS ARE NOT REQUIRED.

INSULATION	PREPARED	A.R.JOTHI GURUNATHAN	SIGNATURE	DATE 04.12.03	DRAWING NO : 4-00-235-08549
	CHECKED	K.KALIRAJAN			REV
	APPROVED	C.GUNASEKARAN			

BUNCH INSULATION

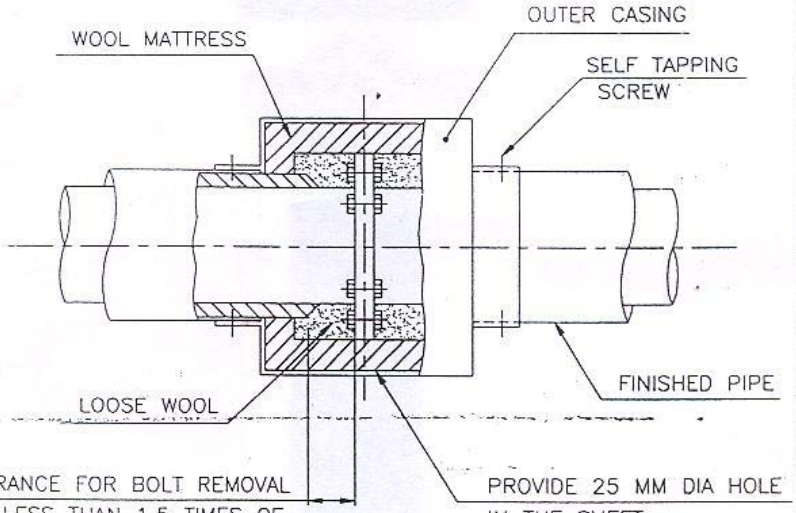


FOR NOTES REFER DRG 4-00-235-08541



INSULATION	PREPARED	A.R.JOTHIGURUNATHAN	SIGNATURE	DATE 04.12.03	DRAWING NO : 4-00-235-08550	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	A.R.JOTHI GURUNATHAN	SIGNATURE	DATE 04.12.03	DRAWING NO : 4-00-235-08548	REV
	CHECKED	K.KALIRAJAN				
	APPROVED	C.GUNASEKARAN				