

DATA FOR THERMAL INSULATION FOR TURBINE INTEGRAL PIPING

DOC.NO. 412114N8001

REV.00

DATE: 26/12/08

500 MW STEAM TURBINE PIPING

SL. NO.	SYSTEM DESCRIPTION	O.D. OF PIPE (MM)	HOT FACE TEMP. (DEG.C)	APPROX. LENGTH (M)	VALVES IN LINE		PIPE FITTINGS		
					NOS	SIZE NB (MM)	FLANGES (NOS)	BENDS (NOS)	ELBOWS (NOS)
SEAL STEAM SYSTEM									
01		13.7	330	5	-	-	-	1	-
02		21.3	100	9	-	-	-	2	-
03		26.7	100	1	-	-	-	-	-
04		26.7	500	7	-	-	-	1	-
05		26.7	565	8	-	-	-	1	-
06		33.4	100	45	2	25	-	9	-
07		33.4	330	1	-	-	-	-	-
08		33.4	500	35	-	-	-	7	-
09		48.3	526	15	-	-	-	3	-
10		48.3	537	80	-	-	-	16	-
11		48.3	565	80	-	-	-	16	-
12		60.3	526	65	-	-	-	13	-
13		73.0	330	4	3	65	-	-	2
14		88.9	285	50	-	-	-	-	12
15		88.9	300	10	-	-	-	-	3
16		88.9	330	6	-	-	-	-	3
17		88.9	470	12	-	-	-	-	3
18		114.3	300	40	-	-	-	-	12
19		114.3	320	16	3	100	3	-	12
20		114.3	500	12	-	-	-	-	2
21		114.3	526	15	-	-	-	-	3
22		141.3	285	40	-	-	3	-	12
23		141.3	300	6	-	-	-	-	2
24		141.3	470	14	2	125	5	-	5
25		168.3	100	24	2	150	2	-	11
26		168.3	320	24	1	150	1	-	10
27		168.3	460	35	-	-	-	-	7

PREPARED BY

(S.R. GUPTA)

APPROVED BY

(S. GOEL)

DATA FOR THERMAL INSULATION FOR TURBINE INTEGRAL PIPING

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SL. NO.	SYSTEM DESCRIPTION	O.D. OF PIPE (MM)	HOT FACE TEMP. (DEG.C)	APPROX. LENGTH (M)	VALVES IN LINE		PIPE FITTINGS		
					NOS	SIZE NB (MM)	FLANGES (NOS)	BENDS (NOS)	ELBOWS (NOS)
28		168.3	500	11	1	150	-	-	4
29		168.3	540	15	-	-	2	-	6
30		219.1	100	70	-	-	-	-	11
31		219.1	295	15	2	200	-	-	4
32		219.1	460	6	-	-	-	-	1
33		273.1	295	10	1	250	-	-	4
34		273.1	330	2	-	-	-	-	-
35		273.1	500	8	-	-	-	-	2
36		323.9	295	36	2	300	-	-	4
37		323.9	330	20	-	-	-	-	10
38		508	330	3	-	-	-	-	-

TURBINE DRAINAGE SYSTEM

01		26.7	450	60	-	-	-	12	-
02		33.4	295	100	8	-	-	20	-
03		33.4	320	30	-	-	-	5	-
04		33.4	350	15	-	-	1	2	-
05		33.4	440	40	-	-	-	8	-
06		33.4	540	35	-	-	2	7	-
07		48.3	300	1	-	-	-	-	-
08		48.3	540	30	2	-	-	6	-
09		48.3	565	70	4	-	-	14	-
10		60.3	155	40	-	-	-	8	-
11		60.3	190	40	4	-	-	8	-
12		60.3	340	35	2	-	-	6	-
13		60.3	540	25	2	-	-	5	-
14		60.3	565	90	4	-	-	18	-
15		73	540	55	4	-	-	10	-
16		168.3	325	1	-	-	-	-	-

PREPARED BY

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S.K. GOEL
(S.GOEL)

DATA FOR THERMAL INSULATION FOR TURBINE INTEGRAL PIPING

DOC.NO. 412114N8001

REV.00

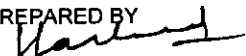
DATE: 26/12/08

500 MW STEAM TURBINE PIPING

SL. NO.	SYSTEM DESCRIPTION	O.D. OF PIPE (MM)	HOT FACE TEMP. (DEG.C)	APPROX. LENGTH (M)	VALVES IN LINE		PIPE FITTINGS		
					NOS	SIZE NB (MM)	FLANGES (NOS)	BENDS (NOS)	ELBOWS (NOS)
17		323.9	400	5	-	-	-	-	3
18		323.9	450	1	-	-	-	-	-
19		323.9	550	5	-	-	-	-	1
20		711	450	24	-	-	-	-	2

Note: Above data may vary by $\pm 5\%$.

PREPARED BY


 (S.K. GUPTA)

APPROVED BY


 (S. GOEL)

DOC. NO. 412114N5000

REV. NO. 01

DATE: 08/03/11

THERMAL INSULATION SCHEDULE FOR TG INTEGRAL PIPING

PROJECT: 500 MW

PROJECT STAGE: CONTRACT

APPLICABLE SPEC. NO. ST29005

DESIGN PARAMETERS:

COLD FACE TEMPERATURE: 60 DEG C

AMBIENT TEMPERATURE: 45 DEG C

EMISSIVITY OF AL. SHEET: 0.2

WIND VELOCITY: 0.5 M/S

MATERIALS:

INSULATION MATERIAL: LIGHTLY RESIN BONDED ROCKWOOL
AS PER IS: 8183

DENSITY: 150 KG/M3

CLADDING MATERIAL: ALUMINIUM SHEET

DESIGN HEAT LOSS AT
CLADDING SURFACE: 180 KCAL/SQM hr

(NILESH KUMAR)

DOC. NO. 412114N8000

REV. NO. 00

DATE: 26/12/08

THERMAL INSULATION SCHEDULE FOR TG INTEGRAL PIPING

PROJECT: 500 MW

PROJECT STAGE: CONTRACT

APPLICABLE SPEC. NO. ST29005

DESIGN PARAMETERS:

COLD FACE TEMPERATURE: 60 DEG C

AMBIENT TEMPERATURE: 40 DEG C

EMISSIVITY OF AL. SHEET: 0.2

WIND VELOCITY: 0.5 M/S

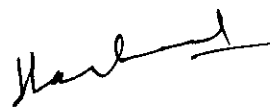
MATERIALS:

INSULATION MATERIAL: LIGHTLY RESIN BONDED ROCKWOOL
AS PER IS:8183

DENSITY : 1. 100 KG/M3 FOR HOT FACE TEMP. UPTO 400°C
2. 120-150 KG/M3 FOR HOT FACE TEMP. ABOVE 400°C

CLADDING MATERIAL: ALUMINIUM SHEET

DESIGN HEAT LOSS AT
CLADDING SURFACE: 180 KCAL/SQM hr


(S.K.GUPTA)

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD	ST 29005			
			पृष्ठ 23 का 1 Page 1 of 23	BASED ON: BHEL EXPERIENCE		
समीचीन सूची संख्या को अधिकृत करवा है SUPERSEDES INVENTORY NO.	SPECIFICATION FOR THERMAL INSULATION FOR T.G.INTEGRAL PIPING SYSTEM					
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स्वत्वाधिकार एवं गोपनीय इस प्रलेख में, जो पूर्ण रूप से भारत भारती इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं आशयका बना के किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।						
हस्ताक्षर एवं दिनांक SIGN & DATE 1-12-03						
समीचीन सूची संख्या INVENTORY NO. A-5788	सहमत विभाग AGREED DEPTT. QAX TSX	नाम NAME S.S. CHAUHAN KISHAN LAL	दिनांक एवं हस्ताक्षर DATE & SIGNATURE 27.11.03	अनुवादक TRANSLATED BY निर्माणकर्ता WORKED BY जांचकर्ता CHECKED BY परीक्षणकर्ता SUPERVISED BY	नाम NAME S.K.GUPTA S.K.GUPTA V.K.GUPTA	दिनांक एवं हस्ताक्षर SIGNATURE & DATE 12.11.03 12.11.03 12.11.03
स्वीकृति APPROVED : (B.K. BHALLA) AGM (STE)			ST 8.20			
REV.NO. 04 Dt 04.02.05	निर्माण PREPARED : STE		जारी ISSUED : STE (TL)		दिनांक DATE : 1-6-89	

निर्माण एवं इस्तेमाल SIGN & DATE		उत्पाद मानक PRODUCT STANDARD STEAM TURBINE ENGINEERING		ST29005	
				पृष्ठ 23 का 02 Page 02 of 23	
SUPERSEDES INVENTORY NO.	सामग्री सूची संख्या को अधिकतम करना है	1.0 INTRODUCTION In a thermal power station, thermal insulation of all piping carrying hot fluids is essential for heat economy and protection of operating personnel. In any pipe which is at a temperature higher than its surroundings will loose heat and the amount of heat lost will depend upon the temperature of the fluid conveyed and the thermal conductivity of the piping material. The heat lost through bare pipes increases with: (a) Increase in the temperature of fluid conveyed. (b) Air velocity of the surroundings. Providing proper and adequate insulation on to the facilities and equipments controls heat transfer and maintain the required skin temperature. The use of high quality insulation can return 20% or more per year on the investment. 2.0 SCOPE This specifications covers the design, technical requirements and essential particulars for the supply, application & finishing of the thermal insulation complete with all auxiliary materials for the integral piping systems for thermal power stations. Thermal insulation will be applied over integral steam piping having a rated operated temperature of above 60°C for the protection of the operating person & for energy conservation. 2.1 The scope of supply shall be defined in data sheet of the project. (a) The description of the components to be insulated. (b) Maximum continuous operating temperature of the components. (c) Design ambient temperature. (d) Type of insulation ordered. (e) Cold face temperature of the insulation above ambient. (f) Other instruction and notes concerning the design, manufacture and supply of Insulation. 2.2 Attachment, devices & accessories shall form the part of the scope of supply. 2.3 Application of the insulation shall be done at site after consultation with or at the request of the chief of the erection group of BHEL at site. 2.4 In case the requirements specified in the data sheet for a particular project are different than what is given in this specification, the data sheet requirements shall be considered as final and binding for that project. 2.5 The pipe lengths given in data of the insulation schedule are inclusive of the equivalent length of tees/stub and reducer. The vertical / near vertical runs of piping are included in the pipe length given in the data of insulation schedule. Additional supporting arrangements are required for insulation on vertical / near vertical piping. The bidder should include the charges for these supporting arrangements in the contract cost based on his experience. No breakup of vertical and horizontal runs are to be furnished to the bidder.			
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स्वतंत्राधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत भारती इलेक्ट्रिकल्स की संपत्ति है इसका प्रकाश एवं आशयका रूप से किसी भी तरह प्रकाश, जो कि कंपनी के हित में अधिकतम हो स किया जाए ।					
निर्माण एवं दिनांक SIGN & DATE	12/11/03				
सामग्री सूची संख्या INVENTORY NO.	P-5788	REV. NO. 04	निर्माणकर्ता WORKED BY	S.K.G.	12.11.03
			जांचकर्ता CHECKED BY	V.K.G.	12.11.03

SIGN & DATE 14.8.04		SUPERSEDES INVENTORY NO. P-5788		COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		स्वत्वाधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत भारी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं प्रसारण के बिना की जाने वाली किसी भी तरह प्रयोग, जो कि कंपनी के हित में हितकारक हो न किया जाए।		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD		ST29005 पृष्ठ 23 का 3 Page 3 of 23	
2.6 Data furnished for the items to be insulated is based on pipe erection drawings. No physical measurement of insulation work will be done. The conversion factors for the valve and fittings will be taken from IS:14164. 3.0 DESIGN AND PERFORMANCE REQUIREMENTS 3.1 For the design of the insulation shall be assumed that the surface temperature of the equipment is taken equal to the temperature of the steam. Heat loss at the surface of insulation shall not exceed 180 Kcal / m²h unless specified in data sheet. 3.2 In principal all the equipments operating above 60°C shall be insulated. However the contractor shall be guided by BHEL regarding the scope as per clause No.2. 3.3 If the ambient temperature is not specified in the data sheet, the same shall be assumed as 40°C. 3.4 Insulation thickness shall be completed based on the design parameters given in data sheet of the project. The thickness given in insulation schedule shall be reviewed by the bidder. 3.5 Insulation shall be supplied in thickness 25, 40, 50, 65 and 75mm. Higher thickness shall be made up in multiple layers from them. The breakup of thickness of multiple layers is given under the column insulation thickness in the insulation schedule. 4.0 MATERIALS 4.1 INSULATING MATERIALS The insulating materials and protective covering shall be new and fresh, incombustible, non-hygroscopic and shall be guaranteed to withstand continuously and without deterioration the maximum temperature to which they will be subjected under the specified application. The insulation material and any component of the finished insulation job shall not react chemically by itself or in combination with water or moisture to form the substances which are more actively corrosive to the applied surfaces than water or moisture alone. The material shall not offer substance to fungus or vermin and must not pose a health hazard. The bidder shall submit with the bid the details of application of protective coatings or other methods he proposes to use for corrosion protection of insulated surface.											
INVENTORY NO. P-5788		REV. NO. 04		निर्माणकर्ता WORKED BY S.K.G.		जांचकर्ता CHECKED BY V.K.G.		7/7/04		7.7.04	



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STEAM TURBINE ENGINEERING

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The material of insulation used for mattress shall be bonded mineral (rock) as per IS 8193.

If preformed pipe section are used, it shall be as per IS 9842.

4.2 SHEATHING MATERIAL

The sheathing material for all insulated piping & equipment shall be aluminium sheet confirming to IS 737. Unless otherwise specified in Data sheet, the thickness of aluminium sheathing to be used shall be as follows:

a) Pipes of 450 mm (18 inch.) and above; over outside diameter of insulation :- 1.219 mm (18 SWG).

b) Pipes of 150 mm (6 inch) and above; over outside diameter of insulation :- 0.914 mm (20 SWG).

c) Pipes less than 150 mm (6 inch); over outside diameter of insulation :- 0.711 mm (22 SWG)

4.3 BINDING & LACING WIRE

Binding & lacing wire shall be 20 SWG galvanized steel wire. Where interface temperature is 400°C or more, the binding wire shall be 20 SWG stainless steel wire.

4.4 STRAPS & BANDS

All straps & bands shall be galvanized steel. For securing aluminium sheathing material, stainless steel or anodized aluminium bands shall be used. Bands shall be 20 mm wide & 0.6 mm thick.

4.5 SCREWS

Screws shall be of self tapping type & shall be cadmium/zinc plated.

5.0 APPLICATION OF INSULATION

5.1 GENERAL

The application of thermal insulation is highly skilled job contrary to the general belief. Badly fitted/laid insulation can lead to greater heat loss or surface

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temperature than that estimated & also to constant maintenance. Ample provision shall be made for maximum possible thermal movement & the insulation shall be applied in a manner which will avoid breaking or telescoping due to alternate periods of expansion & contraction. A single layer of insulation shall not be more than 75 mm thick.

The following are some of the points to be considered in the application of insulation

a) Surfaces must be clean, dry, & free from grease, loose scale, moisture etc. before application of insulation.

b) Insulation thickness on flanges & valves should be equal to that of the adjacent/associated pipes.

c) Where contamination by chemicals or oil spillage is possible, it is important that precaution be taken to avoid contamination of insulation.

d) Pipe hangers & supports and any penetrations should be covered in such a way that moisture cannot penetrate.

e) The bare insulation must be stored in a proper place (indoor) to avoid contamination which will lead to change in weight & thermal conductivity values.

f) Rigid sections should have staggered joints where more than one layer is involved & they must be held in close contact with pipe & fitting face by means of wire or bands.

5.2 PIPING :-

5.2.1 For insulation of piping with preformed pipe sections the same shall be applied over the pipe and finally insulation shall be held in position with 15 mm wide aluminium band at not greater than 400 mm spacing.

5.2.2 For insulation of piping with mattresses having backing GI wire or SS wire netting, the required lengths & shapes are cut from the blankets & wrapped on the piping with edges pulled together tightly at the longitudinal joint and secured by lacing wire & this joint shall be at lower side.

If the interface temperature is 400°C or more the wire netting shall be from 20 SWG stainless steel wire and having hexagonal opening of 25 mm size. Otherwise each layer of mattress shall have GI wire netting from 20 SWG & having hexagonal opening of 25 mm size. The ends of all wire loops shall be firmly twisted together with pliers, bent over & carefully pressed into the surface of the insulation.

Preformed insulation & mattress insulation on vertical or near vertical piping must be supported in position by means of metal rings & at intervals as per enclosed sketches.

GI band/Aluminium bands are to be used for tightly securing the different layers of insulation.

5.2.3 Piping bends shall be insulated to the same specification/ as adjacent straight piping and should form a smooth external surface. Where preformed material is used, it

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should be cut lobster back finish and wired or strapped into position.

5.2.4 All insulation shall be protected by an outer covering of aluminium sheathing. All insulation sheathing joints shall be sealed and made effectively weather & waterproof. All flat surfaces shall be adequately sloped to prevent pools of water collecting. The sheathing shall be protected internally with two coats of anti corrosive paint as per IS 158. The jackets shall be installed with the longitudinal lap joint at 45° below the horizontal for horizontal pipes and the joints sealed with sealing compound.

Arrangements for securing the metal finish over the insulation shall ensure that direct metal contact between the insulated surface and outer metal cladding is avoided. 4 mm thick asbestos board packing shall be used as interfaces to thermally isolate the metal covering from supporting arrangements. There shall be over lapping of 50 mm on both longitudinal & circumferential joints. The screws shall be provided at not greater than 150 mm spacing. Sealing compound is to be applied at all sheathing joints. The overlapping in outer casing should always be at the bottom for horizontal piping so that no rain water enters into the insulation through the joints & the lapping must be done so that water will have a natural drainage. In case of vertical & inclined piping, circumferential overlapping is made such that no rain water enters into the insulation through the joints by proper lapping sequence.

5.2.5 All joints in the insulation shall be staggered. For multiple layers of insulation the different layers shall be applied so that the butt joints of one layer do not coincide with those of the other layer.

6.0 VALVES & FLANGES INSULATION

The insulation on all valves & 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. A typical arrangements shown in drawing at sheet no 15.

7.0 GENERAL INSTRUCTIONS FOR ERECTION OF INSULATION

a) Persons doing the actual job can alter the method of fixing of sheet metal as and when necessary, only after consulting the concerned field engineer.

b) Care shall be taken to see that the flexible insulation mattresses are not unduly compressed.

c) The day to day insulation works are covered by sheathing or with suitable protective materials to prevent the rain water entry.

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NO.
04

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SUPERSEDES
INVENTORY No.

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d) The indicated insulation thickness are minimum requirements which should be maintained, and are based on LRB mattresses. If the bidder desires to use pipe section or combination of pipe section & LRB mattresses, the same should be done after prior approval of design engineer.

e) Where junctions between bodies of different diameter occur and difference of 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 smaller body.

f) Once the insulation is laid walking on the insulated pipe should be avoided. Suitable scaffoldings are to be used. Similarly slinging of pipes over the insulation should be avoided.

g) The layers** of wool mattresses to be adopted, to obtain the specified insulation thickness, are as per table below unless otherwise specified

Thickness of insulation(mm)	Ist layer	IIInd layer	IIIrd layer	IVth layer
80	40	40	--	--
100	50	50	--	--
110	65	50	--	--
120	75	50	--	--
130	65	40	25	--
140	75	65	--	--
150	75	75	--	--
200	75	75	50	--

**If the mattress thickness combination are indicated in the insulation schedule, the above instruction is to be ignored. The necessary guide lines of fixing arrangement for pipe section & mattresses are given in the drawings at sheet nos 10 & 11.

h) Insulation Fixing Arrangements:-

Typical fixing arrangements for insulation of pipes & pipe fittings are shown vide drawings listed below;

i) Fixing arrangement pipe section and lightly bonded mattresses/ mattresses at sheet nos. 10, 12 & 13.

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04

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22/6/89

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- ii) Fixing arrangements for lightly bonded mattress at sheet nos 11, 12 & 13.
- iii) Lugs at sheet no 14.
- iv) Flats at sheet no. 15.
- v) Fixing of insulation on valves at sheet no. 16.
- vi) Insulation of tee at sheet no. 17.
- vii) Insulation of elbow at sheet no. 18.
- viii) Pipe clamp carbon steel at sheet no. 19.
- ix) Pipe clamp alloy steel at sheet no. 20.

8.0 PROTECTION OF MATERIALS DURING STORAGE

The supplier shall protect the insulation materials from weather at all times from delivery to finish. Decking & covering tarpaulins alone are not adequate for any length of time & shall not be allowed except in extreme emergencies and only for short periods. Stacking of insulating materials directly on ground shall not be done.

9.0 GUARANTEES

The supplier shall guarantee that if the specified maximum surface temperatures are exceeded on actual measurement, the supplier shall either replace the insulation with a superior material or provide additional insulation thickness at the BHEL'S/ site engineers discretion at no extra cost to the BHEL.

The supplier shall also guarantee the quality of the materials used & workmanship for a period of 18 months from the date of commissioning. Any defects arising from faulty materials or workmanship during this period shall be rectified by the supplier at no extra cost to BHEL.

10.0 INSPECTION & TESTING

10.1 Thermal insulating material :-

Supplier shall arrange for carrying out all the tests for establishing thermal conductivity values, physical & chemical properties as required by relevant IS & or BS codes and standards. The tests shall be done on representative samples drawn from each lot of insulation material to be supplied under this specification & prior intimation shall be given so that BHEL can depute their representative to witness any or all the tests. For thermal conductivity values, test certificates from independent authorized testing agency (subject to BHEL'S approval) shall be furnished to BHEL for approval.

10.2 Other materials :-

For other materials i.e. cladding sheet, wire netting, binding wires, stitching & lacing wires etc., manufacturers correlated test certificates as per relevant codes & standards shall be furnished. In case correlating test certificates are not available, the supplier shall arrange to carry out necessary tests in presence of BHEL'S representative.

WORKED BY: - *Rizwan*

CHECKED BY: - *Shankar*

निम्न एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD		ST29005	
				पृष्ठ 23 का 9 Page 9 of 23	
सामग्री सूची संख्या को अतिरिक्तित्व करना है	SUPERSEDES INVENTORY NO.	All test certificates shall be furnished & written approval shall be taken from BHEL before commencement of the supply of material. 11.0 DOCUMENTS TO BE SUBMITTED Two copies of the following pre-approval documents shall be submitted by the bidder along with the offer :- (i) Thermal conductivity values of the insulating materials at various mean temperatures not older than 2 years for densities 100, 120 & 150 Kg / m³ from government approved lab for information. (ii) Manufacturer's descriptive and illustrative literature for insulating materials offered with complete properties as per relevant standards. (iii) Quality plan duly signed on BHEL format for approval. (iv) Total bill of material of each item, giving the material specification, density / size / thickness, quantity and the wastage allowance considered shall be indicated in Data Sheet / Insulation schedule. alongwith its thickness calculation.			
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स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं आश्रयण रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।					
हस्ताक्षर एवं तिथि SIGN & DATE	11/2/05				
सामग्री सूची संख्या INVENTORY NO.	P-5788	REV. NO. 04	निर्माणकर्ता WORKED BY	S.K.G.	4/2/05
			जाँचकर्ता CHECKED BY	V.K.G.	04.02.05

INVENTORY No. P-5788		SIGN & DATE 22/6/87		COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.		SUPERSEDES INVENTORY No.		SIGN & DATE	
PRODUCT STANDARD STEAM TURBINE ENGINEERING ST 29005 PAGE 10 OF 23									
GI BAND 30X0.71 SECURED TIGHTLY ON FINAL LAYER AS PER DETAIL-A AND FASTENED WITH TWO NOS OF SELF TAPPING SCREWS SELF TAPPING SCREWS 2 Nos.									

REV. NO.
04

WORKED BY:- *Rigam*

CHECKED BY:- *Shundr*

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					PAGE 11 OF 23			

CLAMP S. (A.S. OR C.S.)
DEPENDING ON PIPE MATERIAL
BOLT & NUT FOR C.S. CLAMPS
STUD & NUT FOR A.S. CLAMPS

FLAT 3 IS THK. FOR C.S. &
5 THK FOR A.S.; SPACED
AS PER DETAIL - B.

AL. STRAP t=40 TO BE
TIGHTLY FASTENED AS PER
DETAIL - A

ASBESTOS MILL BOARD 8MM THICK

RIVET

LUGS A.S. OR C.S. DEPENDING
ON PIPE MATERIAL

CLAMPED A.S. OR C.S. DEPENDING
ON PIPE MATERIAL

BOLT & NUT FOR C.S. CLAMPS
STUD & NUT FOR A.S. CLAMPS

RIVET

ASBESTOS MILL BOARD 8MM THK

LUGS A.S. OR C.S. DEPENDING
ON PIPE MATERIAL.

SECTION - BB
FOR VERTICAL PIPES WITH
INSULATION THICKNESS 10MM AND ABOVE

REV. NO.

04

WORKED BY: - *Rigan*

CHECKED BY: - *Sh...*



PRODUCT STANDARD

ST 29005

STEAM TURBINE ENGINEERING

PAGE 12 OF 23

NOTES ON INSTRUCTION 1:-**A. (ONLY PIPE SECTION)**

1. Fix support spider on vertical pipes. Bottom most spider at tangent point of ~~spider~~.
2. Commence insulation of all layers except last layers of insulation, from support spider level in vertical pipes.
3. Fit each layer of insulation and secure with 30 x 0.71 GI bands at spacing as shown. Secure it tightly by cutting the alu. sheet as per detail-A.
4. Secure last layer of insulation and fasten it at a GI band 30 x 0.71 (as detail-A).
5. Fix cladding sheet and apply sealant.
6. For horizontal pipes use GI bands 30 x 0.71 and secure it as per detail-A.

B. FIRST LAYER PIPE SECTION AND SUBSEQUENT LAYERS LRB**MATTRESSES OR MATTRESSES.**

1. For horizontal pipes secure tightly the first layer of pipe section using 30 x 0.71 GI bands and as per detail-A.
2. Insert lugs for horizontal pipes and secure it tightly using alu. sheet 40 x 1 as per detail-A.
3. Fit in asbestos mill board and rivet.
4. Insert the LRB mattresses or mattresses with field cut slots from edge in felt and wire netting to clear lugs.
5. Fix cladding sheet and apply sealant.
6. For fixing of insulation in vertical pipes follow the same as the one for pipe section.

C. GENERAL

- a) After proper folding (as per detail-A) the ends are to be properly fastened by using ~~the~~ nos. self tapping screws per band.
- b) Lugs/flats are issued in standard length running meters. They are to be cut at site depending on insulation thickness.

D. NOTES ON APPLICATION

1. Fix insulation support spiders on vertical pipes. Bottom most spider at tangent point of band/tee at bottom.
2. Fix cladding support spacer ring at specified intervals by using aluminium strap tightly (as per detail-A).
3. Commence insulation on all layers of insulation except last layer from support spider level in vertical pipes.
4. Insert insulation at support spacer rings locations with field cut slots from edge in felt and wire netting to clean lugs/projection.
5. Stitch wire netting together at all edges and field cuts.

 REV.
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04
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INVENTORY No.

20/6/89

P-5788

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD		ST29005									
				पृष्ठ 23 का 13 Page 13 of 23									
सापेक्षी पूर्ण संख्या को अधिकारित करार है	SUPERSEDES INVENTORY NO.	6. Adjacent layers of insulation to be disposed to result in 50 mm overlap. 7. Fit last layer of insulation. 8. All gaps in insulation to be filled with cuttings & finished. 9. Provide and fix cladding with sealing compound. 10. Lugs and flats are issued for standard height. It has to be cut at site depending on insulation thickness (refer insulation schedule for the thickness of insulation). 11. This is applicable for LRB mattresses or mattresses (both for horizontal and vertical piping).											
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		DETAIL-B <table border="1"> <thead> <tr> <th>OUTER DIA. OF PIPE</th> <th>NO.OFF</th> </tr> </thead> <tbody> <tr> <td>Upto 219</td> <td>4</td> </tr> <tr> <td>273 to 406</td> <td>6</td> </tr> <tr> <td>Above 406</td> <td>8</td> </tr> </tbody> </table> E. Inspection at site during and after application of insulation shall be carried out as stipulated in the enclosed field quality plan. F. <u>CROSS REFERRED STANDARDS :-</u> IS:737 IS:8183 IS:9842 IS:14164				OUTER DIA. OF PIPE	NO.OFF	Upto 219	4	273 to 406	6	Above 406	8
OUTER DIA. OF PIPE	NO.OFF												
Upto 219	4												
273 to 406	6												
Above 406	8												
स्वसाधिकार एवं गोपनीय इस प्रलेख में की गई सूचना भारत भारती इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रयोग एवं अपरयोग अन्य से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो, न किया जाए।	दिनांक SIGN & DATE 14.8.04												
सापेक्षी पूर्ण संख्या INVENTORY NO. P-5788	REV. NO. 04	निर्माणकर्ता WORKED BY S.K.G.	जांचकर्ता CHECKED BY V.K.G.	7/7/04	7.7.04								



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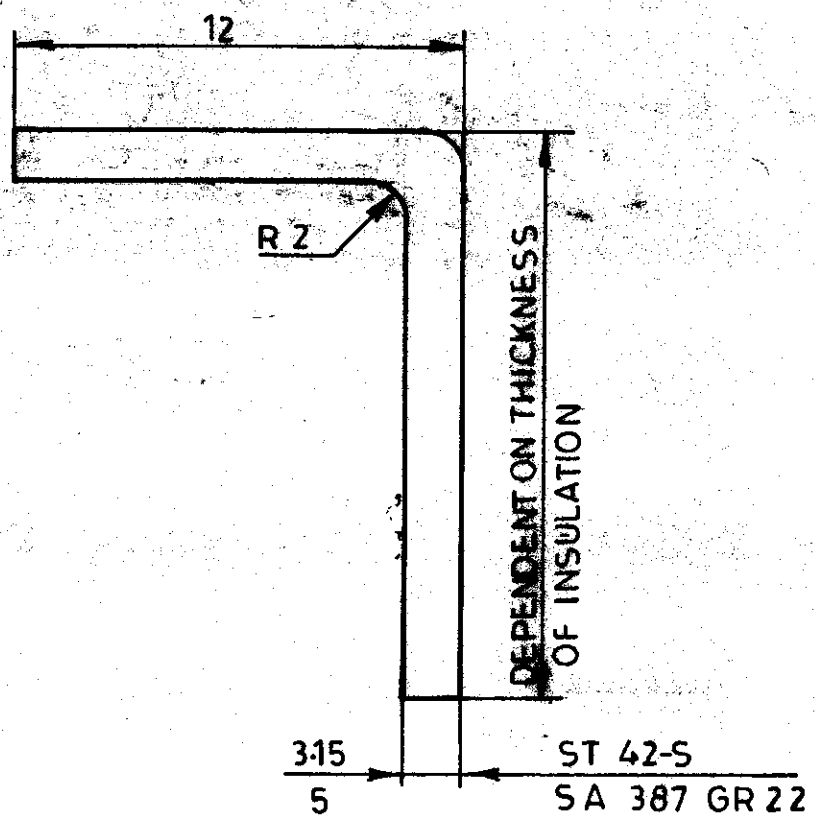
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P-5788

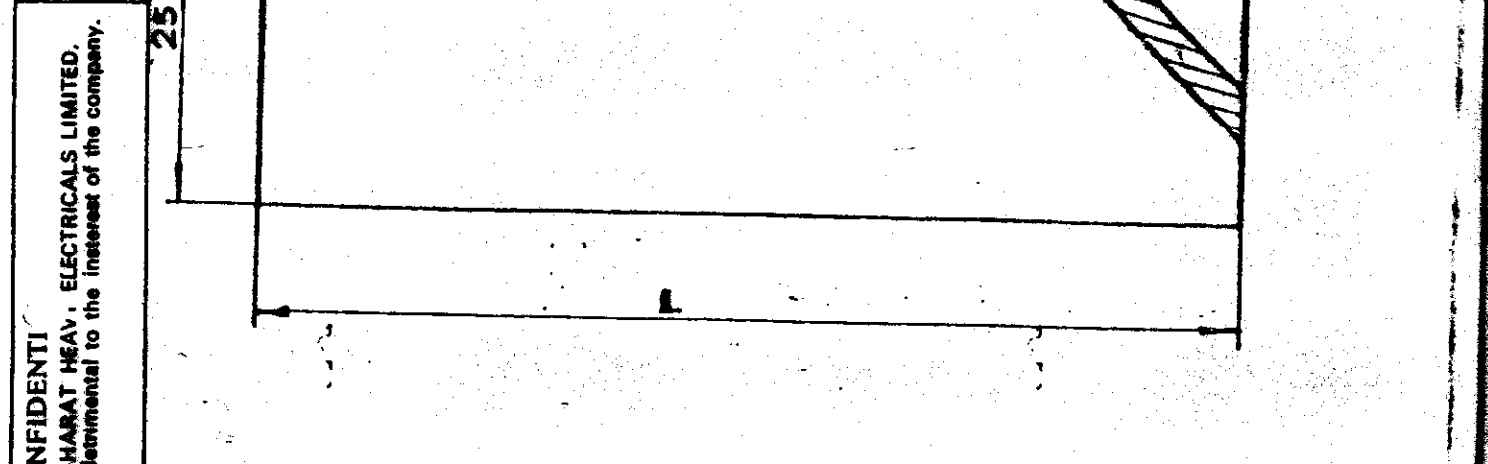
**REV.
No.**
04

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CHECKED BY: - *Shinde*



LUGS



NOTE:-

1. 'L' = 0.7 x INSULATION THICKNESS
2. 't' = 3.15 THK FOR CARBON STEEL (VAR. 01)
5 THK FOR ALLOY STEEL (VAR. 02)

02	PLATE-5mm Thk.	IS 942 206							
		SA 307 GR22							
01	PLATE-3.15mm-Thk	IS 942 206							
		6T 42-S							
VARIATION	DESCRIPTION	MAYL CODE	A/C	UNIT	UNIT WT				
		MAYL SPEC			QTY.				

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STEAM TURBINE ENGINEERING

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DETAILS OF INSULATION OF VALVES

INSULATION ON VALVE SHALL BE REMOVABLE TYPE.

PIPE INSULATION

NOTES :

SEC. 16

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PRODUCT STANDARD

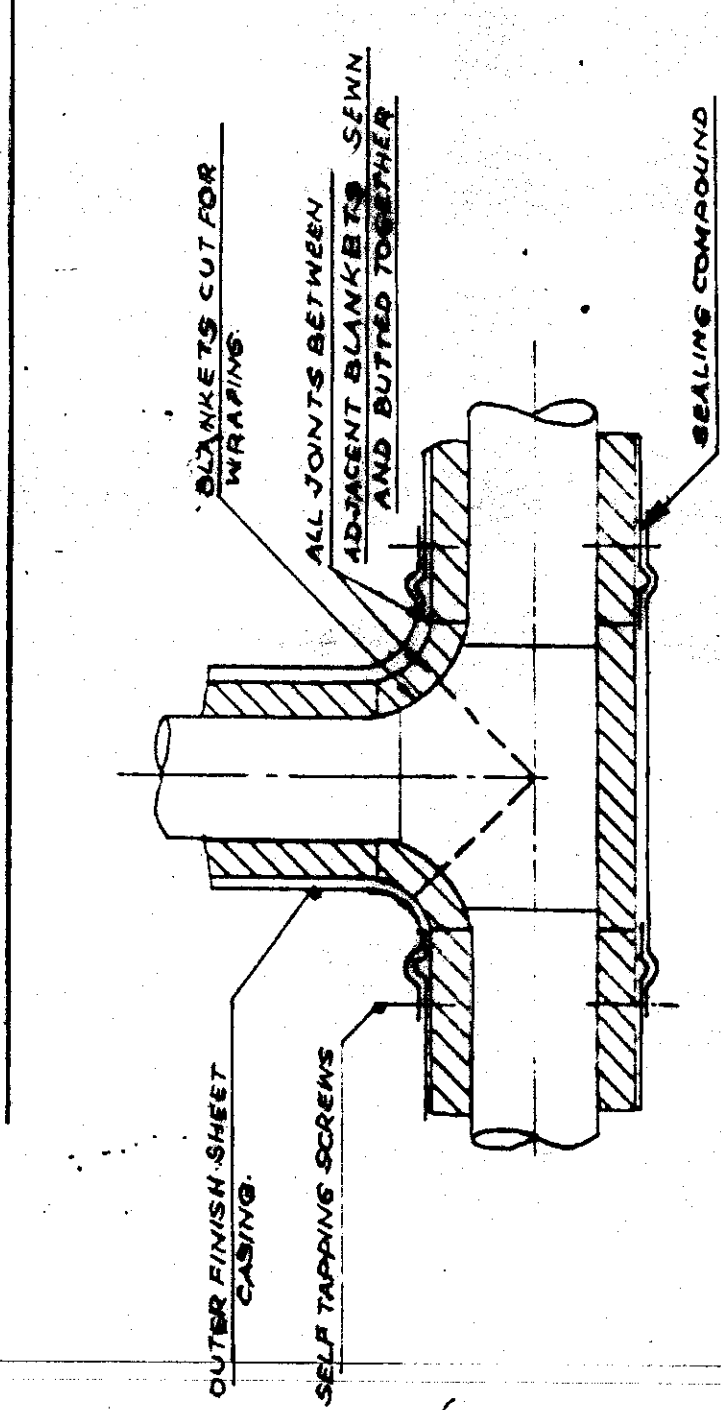
STEAM TURBINE ENGINEERING

FORM

ST 29005

PAGE 17 OF 25

FIXING OF INSULATION ON TEES



TEE INSULATION (WITH MATTRESS INSULATION)

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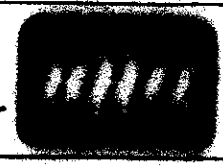
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WORKED BY: - *Rajan*

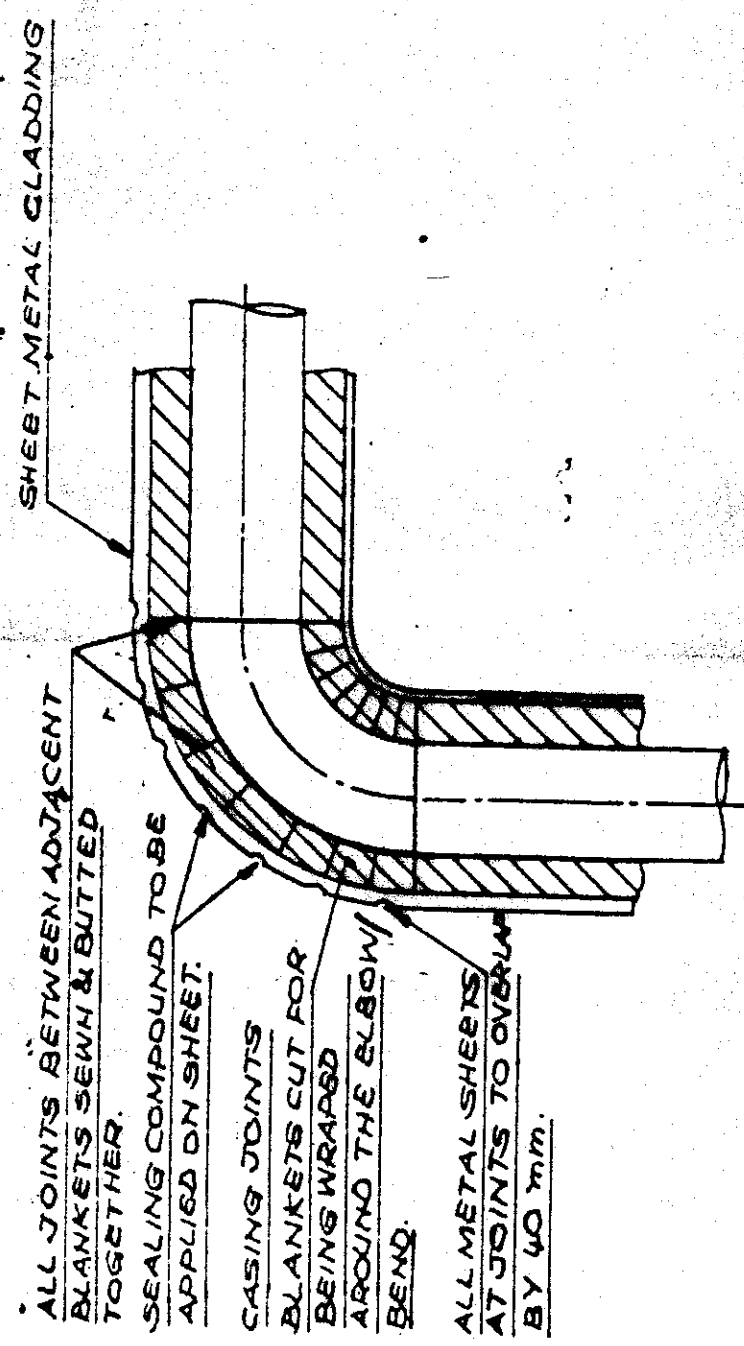
CHECKED BY: - *Shankar*



PRODUCT STANDARD
 STEAM TURBINE ENGINEERING

FORM
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 PAGE 18 OF 23

FIXING OF INSULATION
 ON BENDS / ELBOWS

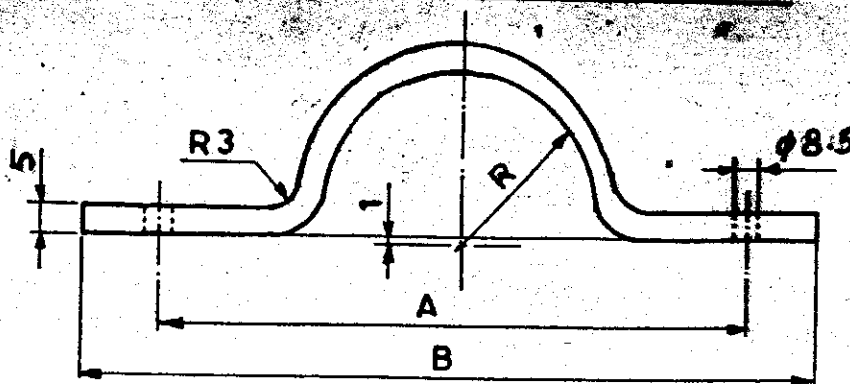


WITH MATTRESS



PRODUCT STANDARD STEAM TURBINE ENGINEERING

PIPE CLAMPS (CARBON STEEL)

[illegible]

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NO.

04. WORKED BY:— Riga

CHECKED BY:

CHECKED BY:- *[Signature]*

PRODUCT STANDARD
STEAM TURBINE ENGINEERING

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SUPERSEDES
INVENTORY No.FIELD QUALITY PLAN :

Sl. No.	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	TEST METHOD	FORMAT OF RECORD	REMARKS
01	Damage in transit and handling	MA	Visual	100%	Specif. & IS 10236	Specif. & IS 10236	Log Sheet	No breakage of insulating material is. No distortion coming off the plates.
	Storage location	MA	-do-	-do-	-do-	-do-	-do-	Stacked under shed.
	Storage space and surroundings.	MA	-do-	-do-	-do-	-do-	-do-	Free from damp, fume and sulphur fumes.
	Stacking height	MA	-do-	-do-	-do-	-do-	-do-	2 M. for pipe and 3 M. for plates.
	Platform	MA	-do-	-do-	-do-	-do-	-do-	Concrete or wooden.

Contd. on page 22

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INVENTORY No.

22/6/89

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PRODUCT STANDARD
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FIELD QUALITY PLAN :-

SL. NO.	COMPONENT / OPERATION	CHARACTERISTIC / DEFECT	CAT	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE STANDARD	ACCEPTANCE CRITERIA	PERCENT OF TESTING	REMARKS
01	INSULATION	Surface cleanliness	NA	Visual	Random	Specification	Specification	Log Sheet	Surface shall be free from dirt, rust, scale, etc. and dried.
		Insulation material appearance.	NA	-do-	-do-	-do-	-do-	-do-	Material shall be uniform and free from cracks, voids etc.
		Bonding wires/ Leads spacing	NA	-do-	-do-	Appd. drg & specif.	Appd. drg & specif.	-do-	
		Wire setting dimensions and location.	NA	-do-	-do-	-do-	-do-	-do-	
		Wire ends	NA	-do-	-do-	-do-	-do-	-do-	Wire ends shall be twisted and bent inside.
		Supports arrangements & spacing	NA	-do-	-do-	-do-	-do-	-do-	
		Expansion joints spacing.	NA	-do-	-do-	-do-	-do-	-do-	
		Insulation thickness test	NA	Physical	10%	IS 7413 & Specf.	IS 7413 & Specf.	-do-	
		Uniformity of thickness	NA	-do-	-do-	-do-	-do-	-do-	
		Bulk density test	NA	-do-	-do-	-do-	-do-	-do-	

Contd. on page 23

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FIELD QUALITY PLAN

Sl. No.	CHARACTERISTIC / FUNCTION	CHARACTERISTIC CHECKED	CAT	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE CRITERIA	FORMAT OF RECORD	REMARKS
03	FINEWORKING	Cladding material thickness	MA	Visual	Random	Appd. Drg. & Specif.	Appd. Drg. & Specif.	Log Sheet	
		ST Screws	MA	-do-	-do-	-do-	-do-	-do-	
		Grooving/ overlapping	MA	-do-	-do-	-do-	-do-	-do-	
		Joints Sealing	MA	-do-	-do-	-do-	-do-	-do-	
		Appearance	MA	-do-	-do-	-do-	-do-	-do-	Surfaces shall be uniform & free from cracks, dents etc.
04	PERFORMANCE TESTING This shall be conducted after commissioning the plant.	Ambient temperat.	MA	Physical	10%	Specif.	Specif.	Log sheet	Shall be measured at a distance of 1 M from the insulation surface
		Ambient air velocity	MA	-do-	-do-	-do-	-do-	-do-	-do-
		Cold face temperature	MA	-do-	-do-	-do-	-do-	-do-	Shall be measured at insulation cladding surface. This shall not be more than the specified value at the specified design conditions.

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