Annexure-1

Enquiry No. B/4066/6/3837/V1

PRE-QUALIFICATION REQUIREMENTS

Bidders are required to meet the pre-qualification requirements (PQR) for supply of Thermal Insulation of TIP as per criteria stipulated below:

Sl. No.	Pre-Qualification Requirements	Vendor's confirmation Indicating page no. where documents are placed
1.	Vendor should have an experience in Design, Supply & Application of Thermal Insulation of Hot Pipes (as per ASTM C 680-89 or equivalent) of at least 1 complete SG/TG Sets of 200 MW or above projects, and satisfying the criteria below - A. Min Pipe Size covered = Nb400 B. Temperature of Operating Fluid = 350 ^{0}C and above	
2.	Vendor should furnish the following documents - a. Purchase Order copy in support of sl no.1 above, along with all Technical Annexures like BOM, Site Data conditions etc. This Purchase Order should not be older than 5 years, as on the date of bid opening. b. An End User Certificate or a Work Completion Certificate from end user/client in support of sl no 2(a) above. This certificate should not be older than 5 years, as on the date of bid opening.	
3.	Those vendors who have already received Purchase Orders from BHEL, Haridwar for Thermal Insulation as per sl no 1 above, need to furnish only the Purchase Order number and date. They need not furnish the cross referred documents pertaining to sl no 2 above.	
4.	BHEL reserves the right to verify information submitted by vendor. In case the information is found false/ incorrect, the offer shall be rejected.	

Notes:

1. BHEL would consider the offers and open the price bids of only those bidders, who fulfill the Pre-Qualification requirements (PQRs).

(47)

Project Engineering Department
HEEP, Haridwar

DOC.NO. 412114V4000
REV.NO. 00
DATE: 05.12.2016

THERMAL INSULATION SCHEDULE FOR TG INTEGRAL PIPING

PROJECT: 800 MW

PROJECT STAGE: CONTRACT **SPEC.NO**. ST29005 Rev_04

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
- ASBESTOS USE IN INSULATION IS NOT PERMITTED.

MATERIALS:

- INSULATION MATERIAL: LIGHTLY RESIN BONDED ROCKWOOL AS PER IS: 8183
- DENSITY: 1. 100 kg/m^3 FOR HOT FACE TEMP. ≤ 400°C
  2. 150 kg/m^3 FOR HOT FACE TEMP. > 400°C
- CLADDING MATERIAL: ALUMINIUM SHEET

DESIGN HEAT LOSS AT CLADDING SURFACE: AS PER ASTM C 680-89.

Prepared by	Approved by
Navneet Chakrapani Sr Engineer- PED	S K Gupta AGM/PED

Bill of Materials for Thermal Insulation of TiP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
1	MAG10BR100	CAP	450	114.3	-							1		
2		CAP	450	323.9	-							1		
3		ELBOW	450	1219	-	1								
4		TEE	450	1219	-		5							
5		TUBE/PIPE	450	114.3	1									
6		TUBE/PIPE	450	33.4	0.5									
7		TUBE/PIPE	450	168.3	0.5									
8		TUBE/PIPE	450	323.9	0.5									
9		TUBE/PIPE	450	1219	10									
10	MAG10BR101	ELBOW	450	323.9	-	2								
11		TUBE/PIPE	450	323.9	2									
12	MAG10BR102	ELBOW	80	323.9	-	1								
13		FLANGE	80	323.9	-				2					
14		TEE	80	323.9	-		1							
15		TUBE/PIPE	80	323.9	11									
16	MAG10BR110	CAP	450	1219	-									
17		CAP	450	114.3	-									
18		ELBOW	450	1219	-	1								
19		TEE	450	1219	-		5							
20		TUBE/PIPE	450	168.3	0.5									
21		TUBE/PIPE	450	33.4	0.5									
22		TUBE/PIPE	450	114.3	0.5									
23		TUBE/PIPE	450	323.9	1									
24		TUBE/PIPE	450	1219	9									
25	MAG10BR111	ELBOW	450	323.9	-	2								
26		TUBE/PIPE	450	323.9	2									
27	MAG10BR112	ELBOW	80	323.9	-	1								
28		TEE	80	323.9	-		1							
29		TUBE/PIPE	80	323.9	12.5									
30	MAL01BR001	ELBOW	593	323.8	-	1								
31		CAP	593	323.8										
32		TUBE/PIPE	593	323.8	3									
33		TEE	593	323.8	-		8							
34		WELDOLET	593	33.4	-								4	
35		WELDOLET	593	73	-								4	

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
36	MAL02BR001	TEE	593	323.8	-		6							
37		CAP	593	323.8	-									
38		TUBE/PIPE	593	323.8	3									
39		WELDOLET	593	323.8	-								3	
40	MAL03BR001	ELBOW	593	323.8	-	2								
41		TUBE/PIPE	593	323.8	4									
42		WELDOLET	593	60.3	-								1	
43		WELDOLET	593	73	-								5	
44		WELDOLET	593	114.3	-								1	
45		WELDOLET	593	48.3	-								1	
46		CAP	593	323.8	-									
47	MAL04BR001	ELBOW	593	323.8	-	2								
48		CAP	593	323.8	-							1		
49		TUBE/PIPE	593	323.8	4									
50		WELDOLET	593	60.3	-								1	
51		WELDOLET	593	73	-								5	
52		TEE	593	323.8	-		12							
53	MAL11BR001	TEE	573	60.3	-		1							
54		CAP	573	60.3	-							1		
55		TEE	573	60.3	-		1							
56		BEND	573	60.3	-						13			
57		VALVE	573	60.3	-					2				
58		TUBE/PIPE	573	60.3	19									
59		VALVE	573	33.4	-					1				
60	MAL12BR001	TEE	573	60.3	-		1							
61		CAP	573	60.3	-							1		
62		BEND	573	33.4	-						3			
63		BEND	573	60.3	-						7			
64		TUBE/PIPE	573	60.3	24									
65		VALVE	573	33.4	-					2				
66	MAL14BR001	VALVE	500	33.4	-					2				
67		TEE	500	48.3	-		1							
68		CAP	500	48.3	-							1		
69		BEND	500	48.3	-						7			
70		TUBE/PIPE	500	48.3	17									

Seal and Signature of Vendor

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
71		CAP	573	60.3	-							1		
72		TEE	573	60.3	-		1							
73	MAL19BR001	VALVE	573	60.3	-					2				
74		BEND	573	60.3	-						12			
75		TUBE/PIPE	573	60.3	17									
76		CAP	517	60.3	-							1		
77		TEE	517	60.3	-		1							
78	MAL20BR001	BEND	517	60.3	-						6			
79		TUBE/PIPE	517	60.3	16									
80		VALVE	517	60.3	-					2				
81		VALVE	520	60.3	-					2				
82		BEND	520	60.3	-						8			
83		CAP	520	60.3	-							1		
84	MAL22BR001	REDUCER	520	60.3	-			1						
85	MAL22BR002	TEE	520	60.3	-		2							
86	MAL22BR003	ELBOW	520	48.3	-	1								
87		BEND	520	48.3	-						13			
88		TUBE/PIPE	520	48.3	7									
89		TUBE/PIPE	520	60.3	14									
90		BEND	593	60.3	-						12			
91		BEND	593	60.3	-						3			
92		CAP	593	60.3	-							1		
93	MAL23BR001	TEE	593	60.3	-		2							
94	MAL23BR002	VALVE	593	60.3	-					2				
95		TUBE/PIPE	593	33.4	2									
96		TUBE/PIPE	593	60.3	19									
97		VALVE	593	33.4	-					3				
98		BEND	593	33.4	-						3			
99		BEND	593	60.3	-						9			
100		CAP	593	60.3	-							1		
101		TEE	593	60.3	-		2							
102	MAL24BR001	TUBE/PIPE	593	33.4	1.5									
103		VALVE	593	60.3	-					2				
104		ELBOW	593	60.3	-	1								
105		TUBE/PIPE	593	60.3	22									
106		VALVE	593	33.4	-					3				

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
107		BEND	420	48.3	-						11			
108		VALVE	420	48.3	-					2				
109	MAL25BR001	CAP	420	48.3	-							1		
110		TEE	420	48.3	-		1							
111		TUBE/PIPE	420	48.3	16									
112		BEND	593	60.3							12			
113		CAP	593	60.3								1		
114	MAL26BR001	TEE	593	60.3			1							
115		TUBE/PIPE	593	60.3	13									
116		VALVE	593	60.3						2				
117		BEND	593	60.3							3			
118		CAP	593	60.3								1		
119	MAL27BR001	TEE	593	60.3			1							
120		TUBE/PIPE	593	60.3	18									
121		VALVE	593	60.3						2				
122		BEND	593	33.4							14			
123		BEND	593	60.3							8			
124		CAP	593	60.3								1		
125	MAL31BR001	REDUCER	593	60.3				1						
126	MAL31BR002	TEE	593	33.4			1							
127	MAL31BR003	TEE	593	60.3			2							
128		VALVE	593	60.3						2				
129		TUBE/PIPE	593	33.4	13									
130		TUBE/PIPE	593	60.3	15									
131		BEND	420	48.3							3			
132		BEND	420	60.3							5			
133		CAP	420	60.3								1		
134	MAL41BR001	ELBO	420	60.3		1								
135	MAL41BR002	TEE	420	60.3			1							
136		VALVE	420	60.3						2				
137		TUBE/PIPE	420	48.3	1.5									
138		TUBE/PIPE	420	60.3	9									
139		CAP	490	60.3								1		
140		TEE	490	60.3			1							
141	MAL45BR001	BEND	490	60.3			1				7			
142		VALVE	490	60.3						2				
143		TUBE/PIPE	490	60.3	11.5									

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
144		CAP	431	60.3								1		
145		VALVE	431	60.3						2				
146	MAL47BR001	BEND	431	60.3							9			
147		TEE	431	60.3			1							
148		TUBE/PIPE	431	60.3	14									
149		BEND	291	60.3							8			
150		BEND	291	33.4							16			
151		CAP	291	60.3								1		
152	MAL51BR001	VALVE	291	60.3						2				
153	MAL51BR002	TEE	291	33.4			1							
154	MAL51BR003	ELBOW	291	60.3		1								
155		TEE	291	60.3			2							
156		TUBE/PIPE	291	33.4	6.5									
157		TUBE/PIPE	291	60.3	10									
158		BEND	230	88.9							11			
159		CAP	230	88.9								1		
160	MAL54BR001	TEE	230	88.9			1							
161		VALVE	230	88.9						2				
162		TUBE/PIPE	230	88.9	23									
163		BEND	230	88.9							7			
164		CAP	230	88.9								1		
165	MAL55BR001	TEE	230	60.3			1							
166		VALVE	230	60.3						2				
167		TUBE/PIPE	230	60.3	11									
168		BEND	393	60.3							10			
169		CAP	393	60.3								1		
170	MAL65BR001	TEE	393	60.3			1							
171		TUBE/PIPE	393	60.3	14									
172		VALVE	393	60.3						2				
173		BEND	520	33.4							15			
174		CAP	520	33.4								1		
175	MAL81BR001 MAL81BR002 MAL81BR004	ELBOW	520	33.4		1								
176		VALVE	520	33.4						2				
177		TEE	520	33.4			3							
178		TUBE/PIPE	520	33.4	23.5									

Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
179	MAL91BR001	BEND	593	33.4							10			
180		INST	593	33.4										
181		REDUCER	593	60.3				1						
182		TEE	593	33.4			1							
183		TUBE/PIPE	593	33.4	19									
184	MAL92BR001	BEND	593	33.4							6			
185		INST	593	33.4										
186		REDUCER	593	60.3				1						
187		TUBE/PIPE	593	33.4	11									

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
1	LBC41BR001	BEND	379	114.3							9			
2		REDUCER	379	168.3/114.3				1						
3		TUBE/PIPE	379	114.3	11									
4	LBC41BR002	BEND	379	273							2			
5		TUBE/PIPE	379	273	3									
6		ELBO	379	273		2								
7		VALVE	379	273						1				
8	MAM10BR001	BEND	459	48.3							1			
9		ELBO	459	48.3		6								
10		TUBE/PIPE	459	48.3	7									
11	MAM10BR002	BEND	459	48.3							9			
12		ELBO	459	48.3		1								
13		TUBE/PIPE	459	48.3	18									
14	MAM10BR003	BEND	459	48.3							12			
15		ELBO	459	48.3		2								
16		REDUCER	459	73				1						
17		TUBE/PIPE	459	48.3	20									
18	MAM10BR004	BEND	459	48.3							1			
19		TUBE/PIPE	459	48.3	6									
20	MAM10BR005	BEND	459	26.7							8			
21		TUBE/PIPE	459	26.7	17									
22	MAM10BR008	ELBO	459	60.3							6			
23		CAP	459	60.3								1		
24		TEE	459	60.3			2							
25		TUBE/PIPE	459	60.3	16									
26	MAM10BR010	BEND	459	60.3							5			
27		CAP	459	60.3								1		
28		TEE	459	60.3			2							
29		TUBE/PIPE	459	60.3	18									
30	MAM20BR001	BEND	293	33.4							4			
31		TUBE/PIPE	293	33.4	3									
32	MAM20BR002	BEND	293	33.4							6			
33		TUBE/PIPE	293	33.4	4									
34	MAM20BR003	BEND	411	48.3							5			
35		TUBE/PIPE	411	48.3	11									

ll of Materials for Thermal Insulation of Tl
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
36		CAP	411	88.9								1		
37		ELBOW	411	88.9		5								
38	MAM20BR005	WELDOLET	411	88.9									1	
39		TEE	411	88.9			1							
40		TUBE/PIPE	411	88.9	9									
41	MAM20BR006	BEND	459	48.3							5			
42		TUBE/PIPE	459	48.3	5									
43	MAM20BR007	BEND	459	48.3							6			
44		TUBE/PIPE	459	48.3	5									
45	MAM20BR008	CAP	459	114.3								1		
46		ELBOW	459	114.3		2								
47		TEE	459	114.3			4							
48		TUBE/PIPE	459	114.3	11									
49	MAM20BR009	BEND	459	48.3							4			
50		TUBE/PIPE	459	48.3	6									
51	MAM20BR010	BEND	459	48.3							6			
52		TUBE/PIPE	459	48.3	6									
53	MAM30BR001	BEND	574	42.2							7			
54		TUBE/PIPE	574	42.2	5									
55	MAM30BR002	BEND	574	42.2							16			
56		TUBE/PIPE	574	42.2	28									
57	MAM30BR003	BEND	574	42.2							18			
58		TUBE/PIPE	574	42.2	28									
59	MAM30BR004	BEND	574	42.2		6					7			
60		TUBE/PIPE	574	42.2	5									
61	MAM30BR008	CAP	574	60.3								1		
62		BEND	574	60.3		9								
63		TEE	574	60.3			2							
64		TUBE/PIPE	574	60.3	18									
65	MAM30BR010	CAP	574	60.3								1		
66		BEND	574	60.3		5								
67		TEE	574	60.3			2							
68		TUBE/PIPE	574	60.3	20									

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
69	MAW10BR001	BEND	320	273							3			
70		TEE	320	273			1							
71		OLET	320	273									1	
72		TUBE/PIPE	320	273	2									
73		VALVE	320	273						1				
74	MAW10BR002	FLANGE	320	168.3						2				
75		TEE	320	168.3			1							
76		TUBE/PIPE	320	168.3	0.5									
77	MAW10BR101	BEND	335	88.9							1			
78		TEE	335	88.9			1							
79		TUBE/PIPE	335	88.9	1.5									
80		VALVE	335	88.9						1				
81		VALVE	335	273						1				
82	MAW10BR103	BEND	335	88.9							4			
83		REDUCER	335	168.3				1						
84		REDUCER	335	273				1						
85		TUBE/PIPE	335	88.9	2									
86		VALVE	335	88.9						1				
87	MAW10BR104	BEND	320	273							2			
88		TUBE/PIPE	320	273	2									
89	MAM20BR001	REDUCER	470	323.8				1						
90		BEND	470	273							2			
91		FLANGE	470	273					2					
92		TEE	470	273			2							
93		TUBE/PIPE	470	273	4									
94	MAW20BR002	ELBOW	470	323.9		2								
95		REDUCER	470	323.9				1						
96		TEE	470	323.9			3							
97		TUBE/PIPE	470	323.9	4.5									
98	MAW20BR003	ELBOW	340	273		2								
99		REDUCER	340	273				1						
100		TEE	340	273			3							
101		TUBE/PIPE	340	273	9									

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
102	MAW20BR004	FLANGE	340	219.1					2					
103		OLET	340	219.1									3	
104		TEE	340	219.1			2							
105		TUBE/PIPE	340	219.1	4									
106	MAW20BR005	VALVE	340	21.3					3					
107		TUBE/PIPE	340	88.9	5									
108		TUBE/PIPE	340	33.4	1									
109		ELBOW	340	88.9		2								
110		BEND	340	33.4							3			
111		FLANGE	340	88.9					2					
112		REDUCER	340	33.4				3						
113	MAW21BR001	TUBE/PIPE	470	141.3	4									
114		TUBE/PIPE	470	114.3	2.5									
115		REDUCER	470	141.3				1						
116		FLANGE	470	114.3					2					
117		ELBOW	470	141.3		2								
118		ELBOW	470	114.3		1								
119		BEND	470	141.3							1			
120		BEND	470	114.3							3			
121	MAW21BR002	TUBE/PIPE	470	141.3	4									
122		TUBE/PIPE	470	114.3	2.5									
123		REDUCER	470	141.3				1						
124		FLANGE	470	114.3					2					
125		ELBOW	470	114.3		2								
126		BEND	470	141.3							2			
127		BEND	470	114.3							3			
128	MAW21BR003	TUBE/PIPE	470	219.1	5.5									
129		TEE	470	219.1			1							
130		REDUCER	470	219.1				1						
131		BEND	470	219.1							3			
132	MAW22BR001	TUBE/PIPE	470	219.1	6									
133		TEE	470	219.1			1							
134		REDUCER	470	219.1				1						
135		BEND	470	219.1							5			

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND		WELDOLET	Insulation Thickness (mm) To be filled by vendor
136	MAW22BR002	TUBE/PIPE	470	141.3	2.5									
137		TUBE/PIPE	470	114.3	2.5									
138		REDUCER	470	141.3				1						
139		FLANGE	470	114.3					2					
140		ELBOW	470	114.3		2								
141	MAW22BR003	TUBE/PIPE	470	141.3	4									
142		TUBE/PIPE	470	114.3	2.5									
143		REDUCER	470	141.3				1						
144		FLANGE	470	114.3					2					
145		ELBOW	470	141.3		1								
146		ELBOW	470	114.3		2								
147		BEND	470	114.3							1			
148	MAW23BR001	TUBE/PIPE	470	141.3	6									
149		TUBE/PIPE	470	114.3	3									
150		REDUCER	470	141.3				1						
151		BEND	470	114.3							1			
152		BEND	470	141.3							1			
153		FLANGE	470	114.3					2					
154		ELBOW	470	141.3		1								
155		ELBOW	470	114.3		1								
156	MAW23BR002	TUBE/PIPE	470	141.3	1.5									
157		TUBE/PIPE	470	114.3	3.5									
158		REDUCER	470	141.3				1						
159		FLANGE	470	114.3					2					
160		ELBOW	470	114.3		1								
161		BEND	470	114.3							1			
162		BEND	470	141.3							2			
163	MAW23BR003	TUBE/PIPE	470	219.1	7.5									
164		TEE	470	219.1			1							
165		REDUCER	470	219.1				1						
166		BEND	470	219.1							4			
167	MAW24BR001	TUBE/PIPE	470	141.3	2.5									
168		TUBE/PIPE	470	114.3	1.5									
169		REDUCER	470	141.3				1						
170		FLANGE	470	114.3					2					
171		BEND	470	141.3							2			
172		BEND	470	114.3							2			
173	MAW24BR003	TUBE/PIPE	470	219.3	7.5									
174		TEE	470	219.3			1							
175		REDUCER	470	219.3				1						
176		BEND	470	219.3							6			

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND		WELDOLET	Insulation Thickness (mm) To be filled by vendor
177	MAW24BR002	TUBE/PIPE	470	141.3	2.5									
178		TUBE/PIPE	470	114.3	1.5									
179		REDUCER	470	141.3				1						
180		FLANGE	470	114.3					2					
181		BEND	470	114.3							2			
182		BEND	470	141.3							3			
183	MAW25BR001	TUBE/PIPE	340	141.3	8									
184		TUBE/PIPE	340	114.3	2									
185		REDUCER	340	141.3				1						
186		FLANGE	340	141.3					2					
187		BEND	340	141.3							6			
188		BEND	340	114.3							2			
189	MAW26BR001	TUBE/PIPE	340	141.3	8									
190		TUBE/PIPE	340	114.3	2									
191		REDUCER	340	114.3				1						
192		FLANGE	340	141.3					2					
193		ELBOW	340	141.3		2								
194		BEND	340	114.3							2			
195		BEND	340	141.3							4			
196	MAW27BR001	BEND	340	141.3							5			
197		BEND	340	114.3							2			
198		ELBOW	340	141.3		2								
199		FLANGE	340	141.3					2					
200		REDUCER	340	141.3				1						
201		TUBE/PIPE	340	114.3	2									
202		TUBE/PIPE	340	141.3	8									
203	MAW28BR001	BEND	340	114.3							2			
204		BEND	340	141.3							3			
205		ELBOW	340	141.3		2								
206		FLANGE	340	141.3					2					
207		REDUCER	340	141.3				1						
208		TUBE/PIPE	340	114.3	2									
209		TUBE/PIPE	340	141.3	9									
210	MAW50BR003	TUBE/PIPE	530	219.3	0.5									
211		OLET	530	219.3			1						1	
212		FLANGE	530	219.3					2					

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
213	MAW50BR001	VALVE	530	457						2				
214		TUBE/PIPE	530	457	3									
215		TEE	530	457			1							
216		OLET	530	457									3	
217		REDUCER	530	457				1						
218		BEND	530	457							4			
219		ELBOW	530	457		1								
220	MAW50BR002	VALVE	530	457						1				
221		TUBE/PIPE	530	457	13									
222		TEE	530	457			1							
223		ELBOW	530	457		9								
224		BEND	530	457							4			
225	MAW50BR103	VALVE	530	457						1				
226		TUBE/PIPE	530	457	1.5									
227		BEND	530	457		2								
228	MAW50BR104	ELBOW	530	457		3								
229		TUBE/PIPE	530	457	1									
230	MAW60BR001	TUBE/PIPE	510	114.3	2									
231		TUBE/PIPE	510	141.3	3									
232		REDUCER	510	141.3				1						
233		ELBOW	510	114.3		1								
234		BEND	510	141.3							2			
235	MAW60BR002	TUBE/PIPE	510	114.3	2									
236		TUBE/PIPE	510	141.3	3									
237		REDUCER	510	141.3				1						
238		BEND	510	114.3							1			
239		ELBOW	510	114.3		1								
240		BEND	510	141.3							2			
241	MAW60BR003	TUBE/PIPE	510	168.3	5.5									
242		TEE	510	168.3			2							
243		BEND	510	219.1							2			
244		ELBOW	510	168.3		1								
245		CAP	510	168.3								1		
246	MAW60BR004	TUBE/PIPE	510	114.3	2									
247		TUBE/PIPE	510	141.3	2.5									
248		REDUCER	510	141.3				1						
249		ELBOW	510	114.3		1								
250		BEND	510	114.3							2			
251		BEND	510	141.3							2			

Sl No	TAG No of the Line	ELBOW	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
252		TUBE/PIPE	510	114.3	2									
253		TUBE/PIPE	510	141.3	2.5									
254	MAW60BR005	REDUCER	510	141.3				1						
255		ELBOW	510	114.3		1								
256		BEND	510	114.3							2			
257		BEND	510	141.3							2			
258		TUBE/PIPE	510	168.3	3									
259	MAW60BR006	TEE	510	168.3			2							
260		BEND	510	168.3							1			
261		CAP	510	168.3								1		
262		TUBE/PIPE	510	219.1	2									
263	MAW60BR007	TEE	510	219.1			2							
264		CAP	510	219.1								1		
265		TUBE/PIPE	420	48.3	0.5									
266		TUBE/PIPE	420	219.1	13.5									
267		OLET	420	219.1									2	
268	MAW60BR008	TEE	420	219.1			1							
269		BEND	420	219.1							4			
270		ELBOW	420	219.1		5								
271		CAP	420	114.3								1		
272		VALVE	190	355.6						1				
273		TUBE/PIPE	190	141.3	2									
274		TUBE/PIPE	190	355.6	34.5									
275	MAW80BR001	TEE	190	355.6			3							
276		REDUCER	190	355.6				2						
277		BEND	190	141.3							3			
278		ELBOW	190	355.6		5								
279		TUBE/PIPE	320	323.8	5									
280		TUBE/PIPE	320	141.3	9.5									
281	MAW80BR002	TEE	320	323.8			2							
282		BEND	320	323.8							1			
283		ELBOW	320	323.8		3								
284		TUBE/PIPE	320	273	4									
285	MAW80BR003	REDUCER	320	273				1						
286		TEE	320	273			2							
287		CAP	320	273								1		

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
288	MAW80BR004	TUBE/PIPE	190	33.4	0.5									
289		TUBE/PIPE	190	273	10									
290		TEE	190	273			3							
291		FLANGE	190	60.3					2					
292		ELBOW	190	273		7								
293	MAW80BR005	TUBE/PIPE	190	33.4	3									
294		TEE	190	33.4			1							
295		REDUCER	190	33.4				2						
296		ELBOW	190	33.4		8								
297	MAW80BR006	TUBE/PIPE	190	33.4	3									
298		TEE	190	33.4			1							
299		REDUCER	190	33.4				1						
300		BEND	190	33.4		4								
301	MAW80BR007	ELBOW	190	168.3		3								
302		TUBE/PIPE	190	168.3	3									
303	MAW80BR008	VALVE	190	168.3						1				
304		TUBE/PIPE	190	168.3	3									
305		TEE	190	168.3			1							
306		FLANGE	190	168.3					2					
307		ELBOW	190	168.3		4								
308	MAW80BR009	VALVE	190	168.3						1				
309		TUBE/PIPE	190	168.3	3									
310		ELBOW	190	168.3		3								
311		FLANGE	190	168.3					2					
312	MAW80BR010	TUBE/PIPE	190	219.1	0.5									
313		REDUCER	190	219.1				1						
314	MAW80BR011	TUBE/PIPE	190	219.1	0.5									
315		REDUCER	190	219.1				1						
316	MAW80BR012	TUBE/PIPE	190	33.4	12									
317		TEE	190	219.1			1							
318		BEND	190	33.4							5			
319		ELBOW	190	219.1		2								
320		FLANGE	190	219.1					2					
321		TUBE/PIPE	190	219.1	4									

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (M)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
322		TUBE/PIPE	190	33.4	12									
323		TEE	190	219.1			1							
324		BEND	190	33.4							5			
325	MAW80BR013	ELBOW	190	219.1		4								
326		FLANGE	190	219.1					2					
327		VALVE	190	219.1						1				
328		BEND	190	219.1							1			
329		TUBE/PIPE	190	219.1	10									
330		TUBE/PIPE	190	355.6	2									
331		VALVE	190	355.6						1				
332	MAW80BR014	TEE	190	355.6			1							
333		BEND	190	355.6							1			
334		ELBOW	190	355.6		2								
335		TUBE/PIPE	190	33.4	1.5									
336	MAW80BR015	REDUCER	190	33.4				1						
337		BEND	190	33.4							3			
338		ELBOW	320	114.3		1								
339		BEND	320	168.3							2			
340	MAW81BR001	REDUCER	320	168.3				1						
341		TUBE/PIPE	320	114.3	2									
342		TUBE/PIPE	320	168.3	2.5									
343		ELBOW	320	114.3		1								
344		ELBOW	320	168.3		1								
345	MAW81BR002	TUBE/PIPE	320	168.3	2.5									
346		TUBE/PIPE	320	114.3	2									
347		REDUCER	320	168.3				1						
348		BEND	320	168.3							1			
349		VALVE	320	219.1						1				
350		BEND	320	219.1							3			
351	MAW81BR003	TUBE/PIPE	320	219.5	6									
352		TEE	320	219.1			1							
353		REDUCER	320	219.1				1						
354		FLANGE	320	219.1					2					
355		ELBOW	320	114.3		1								
356		ELBOW	320	168.3		1								
357		BEND	320	114.3							2			
358	MAW82BR001	REDUCER	320	168.3				1						
359		BEND	320	168.3							2			
360		TUBE/PIPE	320	114.3	1.5									
361		TUBE/PIPE	320	168.3	1.5									

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
362	MAW82BR002	BEND	320	114.3							3			
363		BEND	320	168.3							2			
364		ELBOW	320	114.3		1								
365		REDUCER	320	168.3				1						
366		TUBE/PIPE	320	114.3	1.5									
367		TUBE/PIPE	320	168.3	1.5									
368	MAW82BR003	ELBOW	320	219.1		2								
369		TUBE/PIPE	320	219.1	7									
370		REDUCER	320	219.1				1						
371		FLANGE	320	219.1					2					
372		BEND	320	219.1							2			
373		TEE	320	219.1			1							
374		VALVE	320	219.1						1				
375	MAW83BR001	FLANGE	320	168.3					2					
376		BEND	320	114.3							2			
377		BEND	320	141.3							5			
378		REDUCER	320	141.3				1						
379		TUBE/PIPE	320	141.3	5.5									
380		TUBE/PIPE	320	114.3	1.5									
381		VALVE	320	141.3						1				
382	MAW84BR001	FLANGE	320	141.3					2					
383		TUBE/PIPE	320	141.3	7									
384		TUBE/PIPE	320	114.3	1.5									
385		REDUCER	320	141.3				1						
386		VALVE	320	141.3						1				
387		BEND	320	141.3							2			
388	MAW85BR001	BEND	190	88.9							3			
389		TUBE/PIPE	190	88.9	2									
390	MAW85BR002	BEND	190	141.3							3			
391		FLANGE	190	141.3					2					
392		REDUCER	190	141.3				1						
393		TUBE/PIPE	190	141.3	1									
394		VALVE	190	141.3						1				
395	MAW86BR001	TUBE/PIPE	190	88.9	1.5									
396		BEND	190	88.9							5			

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (M)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
397		REDUCER	190	141.3				1						
398		FLANGE	190	141.3					2					
399	MAW86BR002	VALVE	190	141.3						1				
400		TUBE/PIPE	190	141.3	1									
401		BEND	190	141.3							1			
402	MAW87BR001	BEND	190	88.9							3			
403		TUBE/PIPE	190	88.9	1.5									
404	MAW87BR002	ELBOW	190	141.3		1								
405		FLANGE	190	141.3					2					
406		VALVE	190	141.3						1				
407		REDUCER	190	141.3				1						
408		TUBE/PIPE	190	88.9	1									
409		TUBE/PIPE	190	141.3	2									
410	MAW88BR001	BEND	190	88.9							3			
411		TUBE/PIPE	190	88.9	1									
412	MAW88BR002	REDUCER	190	141.3				1						
413		FLANGE	190	141.3					2					
414		VALVE	190	141.3						1				
415		TUBE/PIPE	190	141.3	1.5									
416		BEND	190	141.3							2			

Seal and Signature of Vendor

Bill of Materials for Thermal Insulation of TIP
Overload Piping System

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Length (m)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	OLET	Insulation Thickness (mm) To be filled by vendor
1	MAA14BR001	TUBE/PIPE	565	219.1	16						8		
2		TUBE/PIPE	565	60.3	0.5								
3		WELDOLET	565	60.3								2	
4		ELBOW	565	60.3	-	1							
5	MAA14BR002	TUBE/PIPE	565	219.1	13		1				8		
6		TUBE/PIPE	565	60.3	1	1							
7		WELDOLET	565	60.3								2	
8	MAA14BR003	TUBE/PIPE	512	168.3	4	2							
9		WELDOLET	512	168.3	-							1	
10		TUBE/PIPE	512	219.1	9	5		1					
11		VALVE	512	33.4	-					2			
12		WELDOLET	512	33.4	-							1	
13		REDUCER	512	33.4	-			1					
14		TUBE/PIPE	512	33.4	1								
15	MAA14BR004	VALVE	512	33.4	-					2			
16		TUBE/PIPE	512	33.4	1			1				1	
17		TUBE/PIPE	512	168.3	4	3						1	
18		TUBE/PIPE	512	219.1	14	6		1			1		

General Notes for Seal Steam, Turbine Drainage & Overload Piping System:

1. This BOM may vary by +/- 3%.

2. TEEs and Reducers are not included in pipe length and are to be considered separately for Thermal Insulation as per the above table.This supercedes Clause 2.5 of ST29005 in this regard.

3. This BOM consists of total 20 (Twenty) pages. Turbine Drainage System = 6 Pages, Seal Steam System = 12 Pages & Overload Piping System = 2 Page.

Seal and Signature of Vendor

SPECIAL INSTRUCTIONS:

	Sl No	BHEL REQUIREMENTS	VENDOR's CHECKPOINT (To be filled by Vendor) [YES/NO]
Checklist for Vendors	1	*Vendor has indicated insulation thicknesses for all items covered in this document.*	
	2	*Vendor has considered design criteria as per doc no 412114V4000 & ST29005 REV_04.*	
	3	*Vendor has furnished Sample Calculations for min 10 different cases.*	
	4	*Vendor has furnished k-values of insulation mattresses at different mean temperatures ranging from 100-300 ^{0}C.*	
	5	*Vendor has furnished BOM containing breakup of quantity of mattresses (in m^2) & Aluminium (in kg, for 18,20 & 22 SWG separately) in their standard format.*	

PREPARED BY: NAVNEET (Sr Engr-PED)

APPROVED BY: Sh S K GUPTA (AGM-PED)

(5)

Seal and Signature of Vendor

BASED ON :
BHEL EXPERIENCE

SPECIFICATION FOR THERMAL INSULATION

FOR T.G.INTEGRAL PIPING SYSTEM

				NAME	दिनांक एवं हस्ताक्षर SIGNATURE & DATE
हस्ताक्षर एवं दिनांक SIGN & DATE					
			अनुवादक TRANSLATED BY	-	-
QAX	S.S. CHAUHAN		निर्माणकर्ता WORKED BY	S.K.GUPTA	12.11.03
TSX	KISHAN LAL	27.11.03	जांचकर्ता CHECKED BY	S.K.GUPTA	12.11.03
सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	पर्यवेक्षणकर्ता SUPERVISED BY	V.K.GUPTA	12.11.03
			स्वीकृति APPROVED : (B.K. BHALLA) AGM (STE)		ST 8.20
सामग्री सूची संख्या INVENTORY NO. P-5788	REV.NO. 04 Dt. 04.02.05		निर्माण PREPARED : STE	जारी ISSUED : STE (TL)	दिनांक DATE : 1-6-89

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 temperatue. 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.

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 / m^2h unless specified in data sheet.

3.2 In principal all the equipments operating above 60^0C 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 40^0C.

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.

The material of insulation used for mattress shall be bonded mineral (rock) as per IS8183.

If Preformed pipe section are used, it shall be as per IS9842.

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

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

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

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

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.

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	IInd 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.

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.

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 / m^3 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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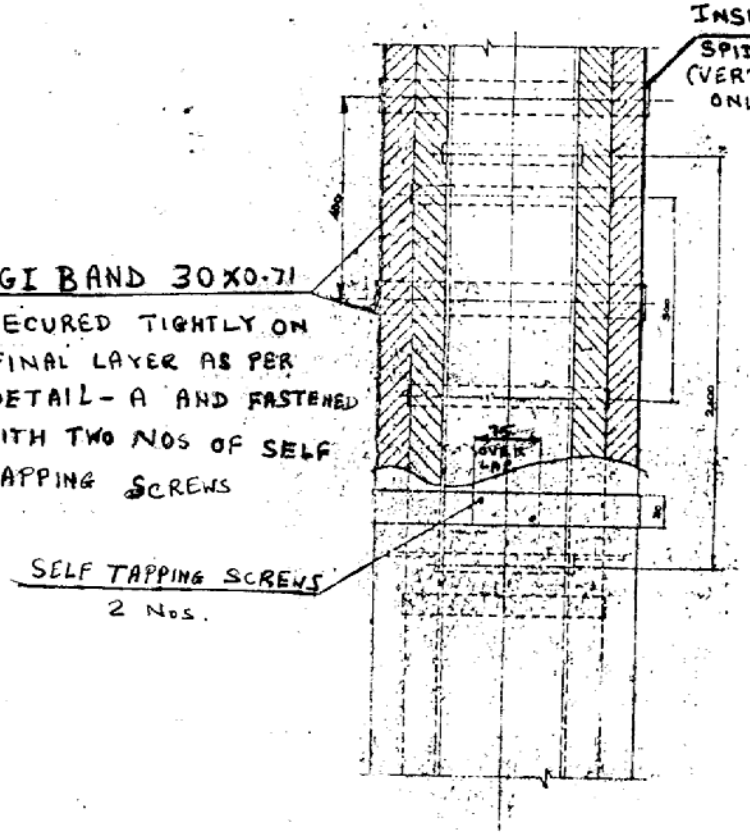
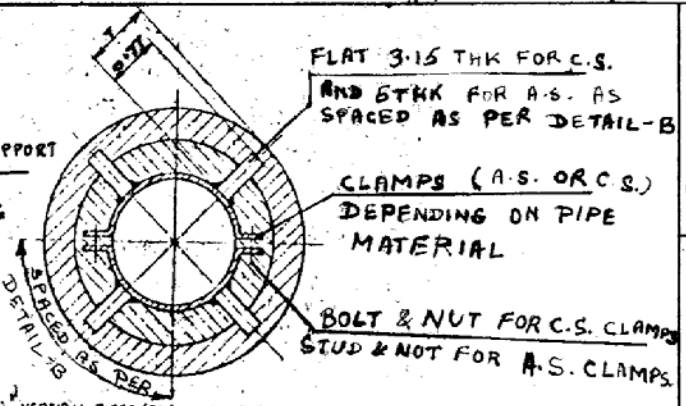
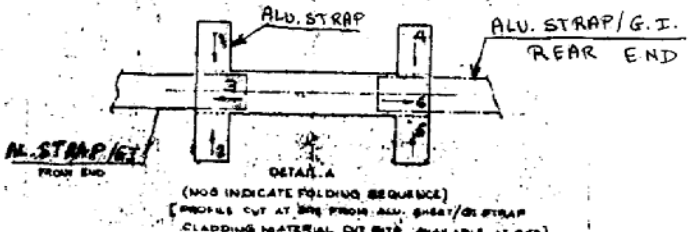
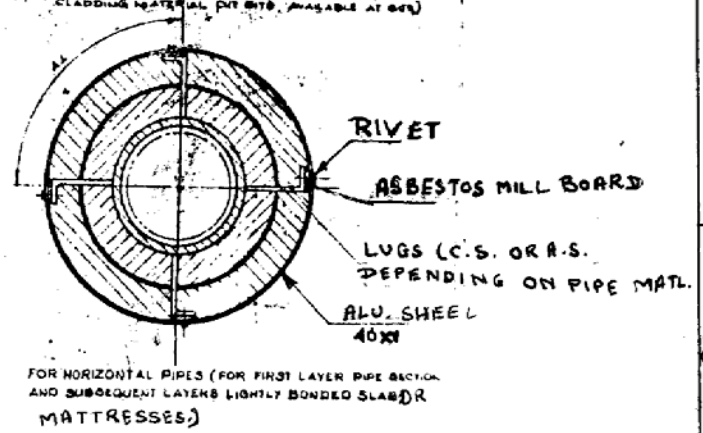
WORKED BY:- Rajan CHECKED BY:- Kumar









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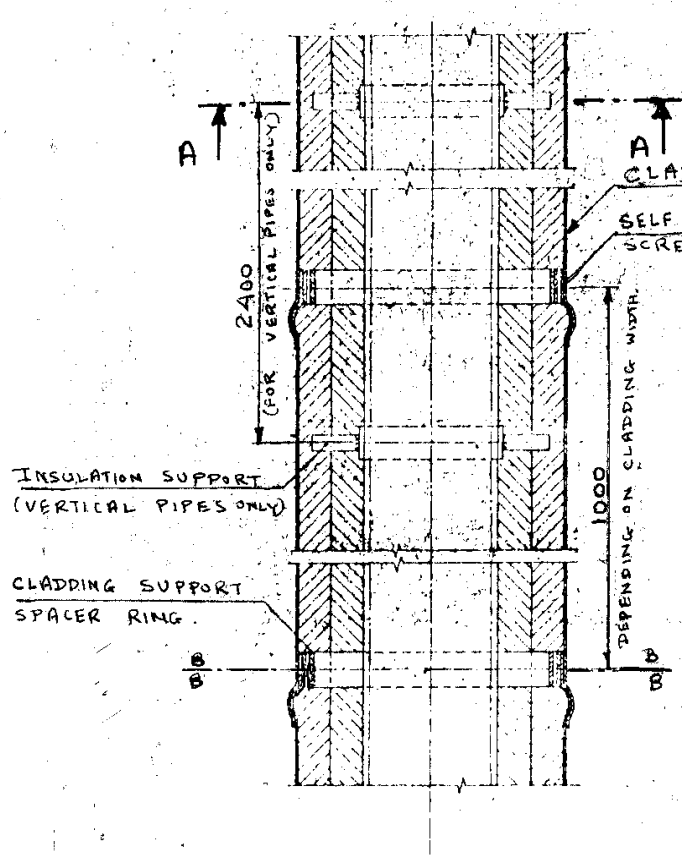
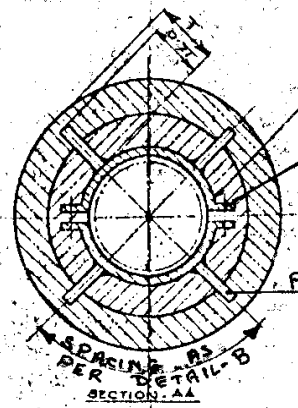




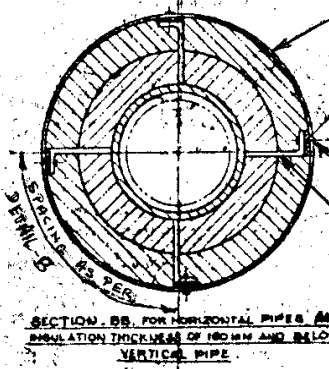
SECTION - AA

CLAMPS (AS. OR C.S.) DEPENDING ON PIPE MATERIAL

BOLT & NUT FOR C.S. CLAMPS

STUD & NUT FOR A.S. CLAMPS

FLAT 3·15 THK. FOR C.S. & 5 THK FOR A.S.; SPACED AS PER DETAIL-B.



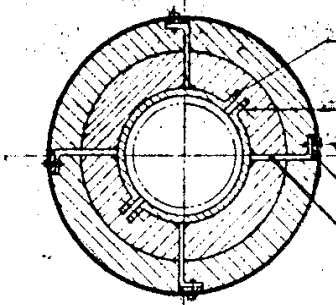
AL. STRAP t=40 TO BE TIGHTLY FASTENED AS PER DETAIL-A

ASBESTOS MILL BOARD 8MM THICK

RIVET

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

SECTION - BB FOR HORIZONTAL PIPES AND FOR INSULATION THICKNESS OF 160 MM AND BELOW IN VERTICAL PIPE.



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 8 MM THK.

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

SECTION - BB

FOR VERTICAL PIPES WITH INSULATION THICKNESS 161 MM AND ABOVE.

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NOTES ON ERECTION :-

A. (ONLY PIPE SECTION)

1.Fix support spider on vertical pipes. Bottom most spider at tangent point of bend/tee.
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 x0.71 (as detail-A).
5.Fix cladding sheet and apply sealant.
6.For horizontal pipes use GI bands 30 x0.71 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 x1 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 two 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 bend/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. NO. 04

WORKED BY:- Rajan

CHECKED BY:-

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).

DETAIL-B

OUTER DIA. OF PIPE	NO.OFF
Upto 219	4
273 to 406	6
Above 406	8

E. Inspection at site during and after application of insulation shall be carried out as stipulated in the enclosed field quality plan.

F. CROSS REFERRED STANDARDS :-

IS:737

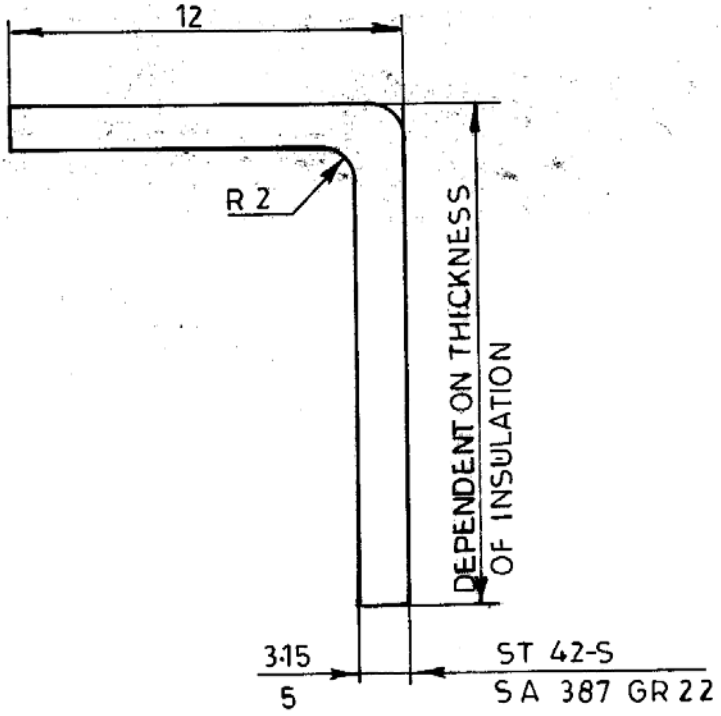
IS:8183

IS:9842

IS:14164

SIGN & DATE

SUPERSEDES INVENTORY No.



LUGS

INVENTORY No. P-5788

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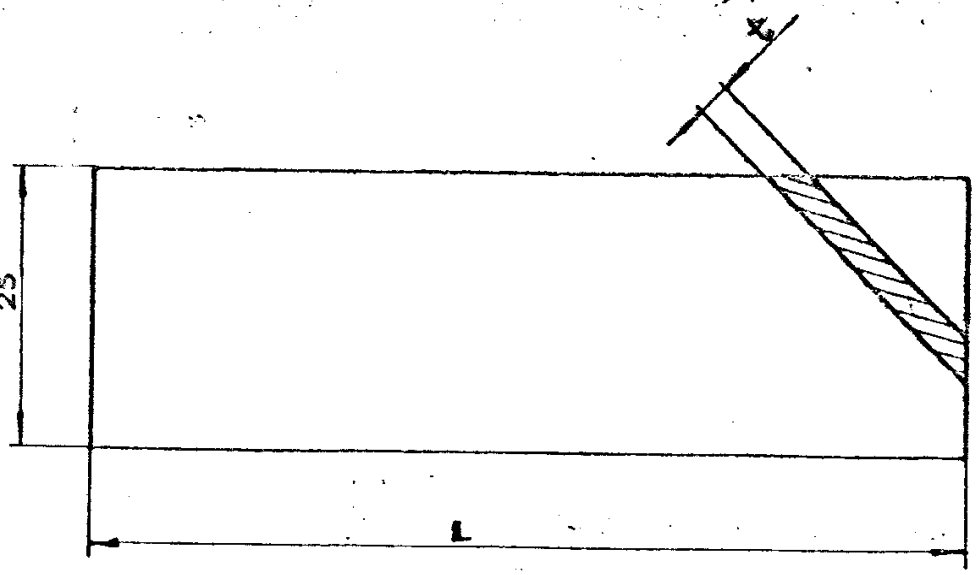

NOTE :-

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

VARIANT NO.	DESCRIPTION	STD	MATL CODE	A/C	UNIT	UNIT WT
			MATL SPEC			QTY.
02	PLATE-5mm Thk.		IS 962 255 / SA 387 GR22			1
01	PLATE-3/5mm-Thk		ST 42-S			1

FLAT

INVENTORY No. P.57888

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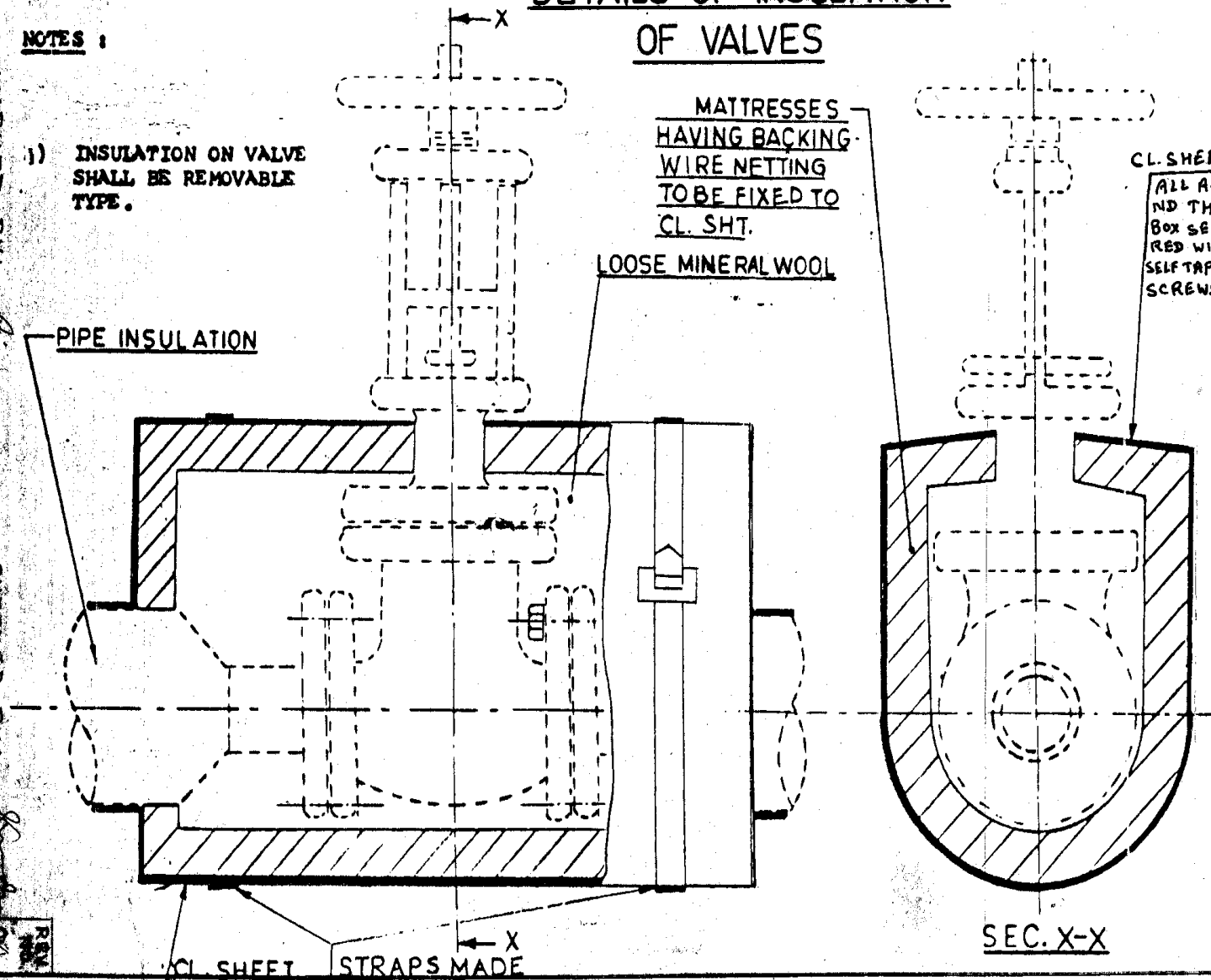
DETAILS OF INSULATION OF VALVES

NOTES :

1) **INSULATION ON VALVE SHALL BE REMOVABLE TYPE.**



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WORKED BY:- Rajan

CHECKED BY:- Kumar

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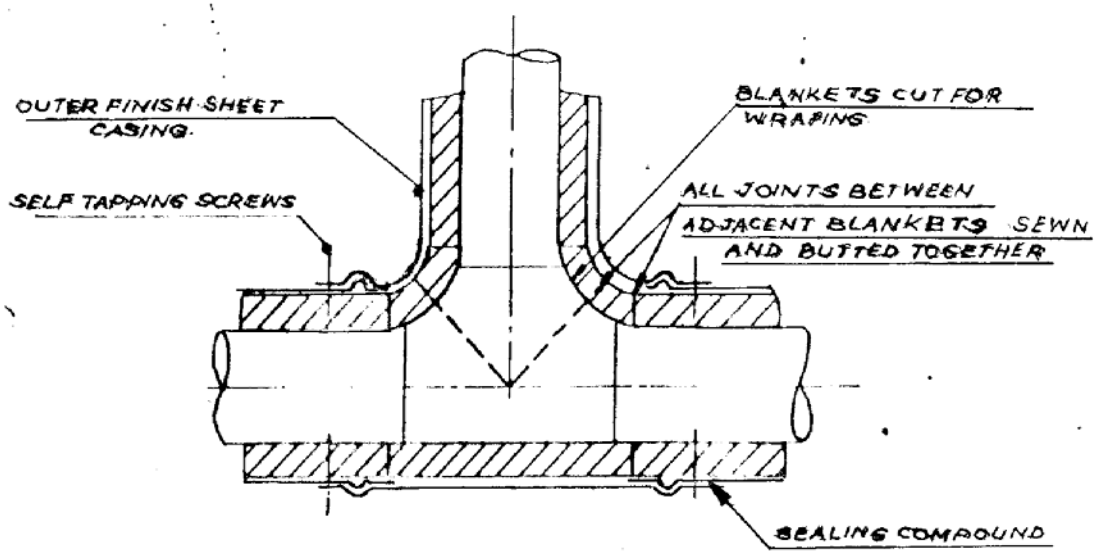
FIXING OF INSULATION ON TEES



TEE INSULATION
(WITH MATTRESS INSULATION)

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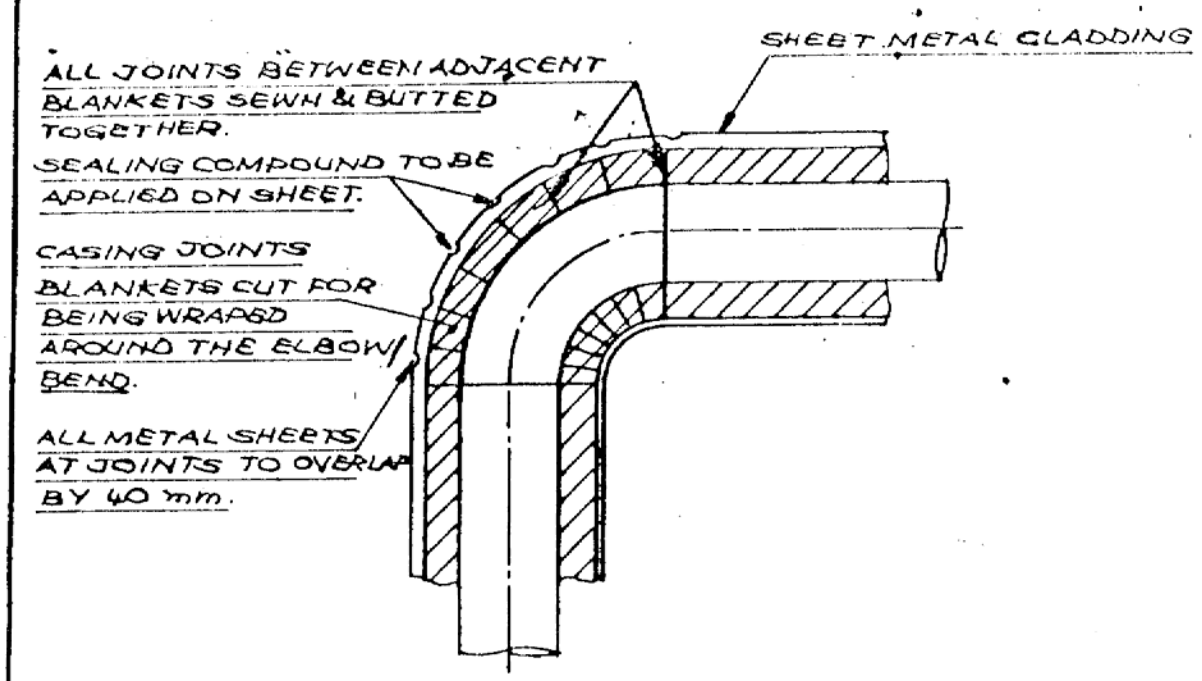
WORKED BY:- Rajan

CHECKED BY:-

FIXING OF INSULATION ON BENDS / ELBOWS



WITH MATTRESS

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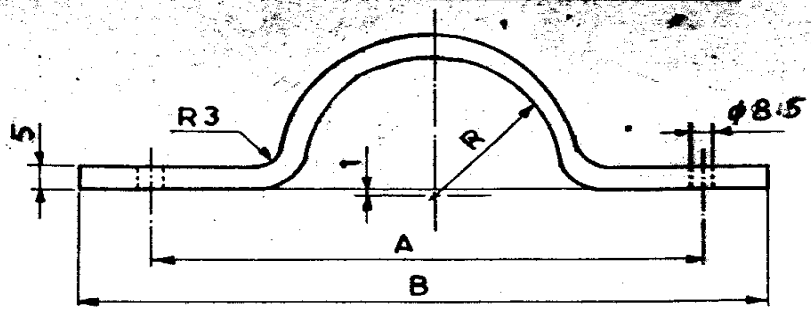
PIPE CLAMPS (CARBON STEEL)



VAR.	A	B	R	NB	DESCRIPTION	MATL SPCN.	UNIT WT.
01	76	91	30	50	PL. 5X50X120	ST 42-S/IS226	0.240
02	88	103	37	65	PL. 5X50X142		0.280
03	104	119	44	80	PL 5X50X166		0.320
04	129	144	57	100	PL. 5X50X210		0.45
05	183	198	84	150	PL. 5X50X288		0.570
06	234	249	110	200	PL. 5X50X371		0.730
07	288	303	137	250	PL. 5X50X455		0.900
08	339	354	162	300	PL. 5X50X 534		1.050
09	371	386	178	350	PL. 5X50X 584		1.150
10	421	436	203	400	PL 5X50X 663		1.300
11	473	488	229	450	PL. 5X50X746		1.400
12	523	538	254	500	PL 5X50X 820		1.620
13	123	138	54	100	PL 5X50X200		0.400
14	174	189	80	150	PL 5X50X 282		0.550
15	579	594	280	550	PL 5X50X910		1.800
16	156	171	70	125	PL 5X50X248	ST 42-S/IS226	0.480

SUPERSEDES INVENTORY No.

SIGN & DATE

INVENTORY NO. P-5788

SIGN & DATE 2/4/89

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FORM

PRODUCT STANDARD
STEAM TURBINE ENGINEERING

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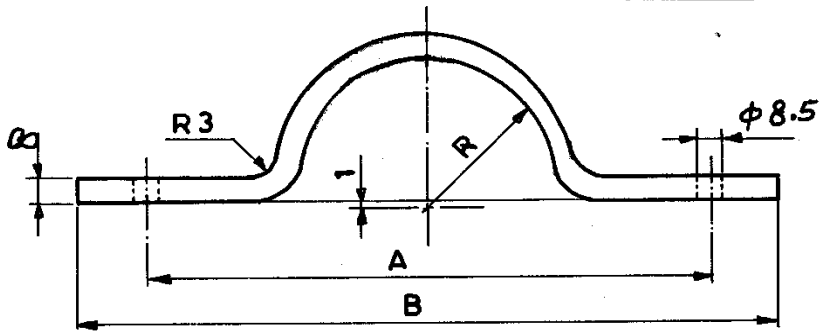
PIPE CLAMPS (ALLOY STEEL)



VAR.	A	B	R	NB	DESCRIPTION	MATL. SPCN.	UNIT WT.
01	76	91	30	50	PL. 8 X 50 X 125	13 Cr M044	0 400
02	88	103	37	65	PL 8X50X 150	↑	0 480
03	183	198	84	150	PL 8X50 X 295		0 920
04	234	249	110	200	PL 8X50X 380		1 200
05	288	303	137	250	PL 8X50X 460		1 450
06	371	306	178	350	PL. 8X50X 590		1 850
07	421	436	203	400	PL. 8X50X 670		2 100
08	473	488	229	450	PL. 8X50X 752		2 400
09	523	538	254	500	PL. 8X50X 824		2 600
10	626	644	305	600	PL. 8X50 X 990		3 000
11	123	138	54	100	PL. 8X50 X 200		0 630
12	129	144	57	100	PL. 8X50 X 210		0 660
13	174	189	80	150	PL. 8X50 X 282		0 900
14	339	354	162	300	PL. 8X50X 540		1 700
15	365	380	175	350	PL. 8X50X 580		1 820
16	569	584	280	550	PL. 8X50X910		2 860
17	104	119	44	80	PL. 8X50X166		0 520
18	156	171	70	125	PL. 8X50X 248	↓	0 78
19	730	745	356	700	PL. 8X50 X 1150	13 Cr Mo 44	3 610

SIGN & DATE

SUPERSEDES INVENTORY No.

SIGN & DATE 27/6/89

INVENTORY NO. P-57888

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WORKED BY :- Rajan

CHECKED BY :-

FIELD QUALITY PLAN :

SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
01	STORAGE AND HANDLING	Damage in transit and handling	MA	Visual	100%	Specif. & IS 10556	Specif. & IS 10556	Log Sheet	No breakage and damage of insulating materials. No distortion or tearing off the packing.
		Storage location	MA	-do-	-do-	-do-	-do-	-do-	Stacked under covered shed.
		Storage space and surroundings.	MA	-do-	-do-	-do-	-do-	-do-	Free from damp, oil, fume and sulphur bearing gases.
		Stacking height	MA	-do-	-do-	-do-	-do-	-do-	2 M. for pipe sections and 3 M. for mattresses.
		Platform	MA	-do-	-do-	-do-	-do-	-do-	Concrete or wooden.

Contd. on page 22

WORKED BY :- Rigam

CHECKED BY :-

REV. NO. 04

FIELD QUALITY PLAN :-

SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
02	APLLICATION	Surface cleanliness	MA	Visual	Random	Specification	Specification	Log Sheet	Surface shall be from dirt, rust, scale, oil etc. and dried.
		Insulation material appearence.	MA	-do-	-do-	-do-	-do-	-do-	Material shall be uniform and free from cracks, voide etc.
		Binding wires/ Bands spacing	MA	-do-	-do-	Appd. drg & specif.	Appd. drg & specif.	-do-	
		Wire netting dimensions and location.	MA	-do-	-do-	-do-	-do-	-do-	
		Wire ends	MA	-do-	-do-	-do-	-do-	-do-	Wire ends shall be twisted and bent inside.
		Supports arrangements & spacing	MA	-do-	-do-	-do-	-do-	-do-	
		Expansion joints spacing.	MA	-do-	-do-	-do-	-do-	-do-	
		Insulation thickness test	MA	Physical	10%	IS 7413 & Specf.	IS 7413 & Specf.	-do-	
		Uniformity of thickness	MA	-do-	-do-	-do-	-do-	-do-	
		Bulk density test	MA	-do-	-do-	-do-	-do-	-do-	

Contd. on page 23

WORKED BY :- Rajan

REV. NO. 04

CHECKED BY :- [illegible]

FIELD QUALITY PLAN

SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
03	FINISHING	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.

WORKED BY:- Rajan

REV. NO. 04

CHECKED BY:-

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN		TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME	ITEM	QP NO.		
			DATED		
		DRG. NO.			
		SPEC.			
		REV	Page 1 of 3		

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
										M	B	N	
1	2	3	4	5	6	7	8	9	D	10			11

		LEGEND:	FOR CUSTOMER USE	
MANUFACTURER/SUBCONTRACTOR		! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER		APPROVED BY

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