



**Bill of Materials for Thermal Insulation of TIP
Turbine Drainage System**

SI 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	498	114.3	-							1		
2		CAP	498	323.9	-							1		
3		ELBOW	498	1219	-	1								
4		FLANGE	498	285	-				1					
5		WELDOLET	498	1219	-								2	
6		TUBE/PIPE	498	114.3	0.5									
7		TUBE/PIPE	498	168.3	0.5									
8		TUBE/PIPE	498	1219	5.5									
9	MAG10BR101	ELBOW	80	323.9	-	1								
10		FLANGE	80	485	-				2					
11		TEE	80	323.8	-		1							
12		TUBE/PIPE	80	323.9	5.0									
13	MAG10BR102	TUBE/PIPE	498	323.9	2.5									
14	MAG10BR110	CAP	498	323.8	-							1		
15		CAP	498	114.3	-							1		
16		ELBOW	498	1219	-	1								
17		FLANGE	498	285	-				1					
18		WELDOLET	498	1219	-								2	
19		TUBE/PIPE	498	168.3	0.5									
20		TUBE/PIPE	498	114.3	0.5									
21		TUBE/PIPE	498	323.9	6.0									
22	MAG10BR111	ELBOW	80	323.9	-	1								
23		FLANGE	80	485					2					
24		TEE	80	323.8			1							
25		TUBE/PIPE	80	323.9	8.0									
26	MAG10BR112	TUBE/PIPE	499	323.9	2.5									
27	MAL01BR001	ELBOW	617	323.8	-	1								
28		CAP	617	323.8	-							1		
29		TUBE/PIPE	617	323.8	2.0									
30		WELDOLET	617	323.8	-								8	

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31	MAL02BR001	ELBOW	617	323.8	-	1								
32		CAP	617	323.8	-							1		
33		TUBE/PIPE	617	323.8	1.8									
34		WELDOLET	617	323.8	-								6	
35	MAL03BR001	ELBOW	617	323.8	-	1								
36		CAP	617	323.8								1		
37		TUBE/PIPE	617	323.8	4.5									
38		WELDOLET	617	323.8	-								7	
39	MAL04BR001	ELBOW	617	323.8	-	2								
40		CAP	617	323.8	-							1		
41		TUBE/PIPE	617	323.8	3.0									
42		WELDOLET	617	323.8	-								12	
43	MAL11BR001	TEE	601	60.3	-		2							
44		CAP	601	60.3	-							1		
45		BEND	601	60.3	-						7			
46		VALVE	601	60.3	-					2				
47		TUBE/PIPE	601	60.3	15.0									
48		TUBE/PIPE	601	73	0.5									
49	MAL12BR001	TEE	601	60.3	-		2							
50		CAP	601	60.3	-							1		
51		BEND	601	60.3	-						12			
52		TUBE/PIPE	601	60.3	14.0									
53		TUBE/PIPE	601	73	0.5									
54		VALVE	601	60.3	-					2				
55	MAL14BR001	VALVE	587	48.3	-					2				
56		TEE	587	48.3	-		2							
57		CAP	587	48.3	-							1		
58		BEND	587	48.3	-						8			
59		ELBOW	587	48.3	-	2								
60		TUBE/PIPE	587	48.3	22.5									
61		TUBE/PIPE	587	60.3	0.5									

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62	MAL19BR001	CAP	601	60.3	-							1		
63		TEE	601	60.3	-		2							
64		VALVE	601	60.3	-					2				
65		BEND	601	60.3	-						10			
66		TUBE/PIPE	601	73	0.5									
67		TUBE/PIPE	601	60.3	15.0									
68	MAL20BR001	CAP	570	60.3	-							1		
69		TEE	570	60.3	-		2							
70		BEND	570	60.3	-						4			
71		TUBE/PIPE	570	73	0.5									
72		TUBE/PIPE	570	60.3	16.0									
73		VALVE	570	60.3	-					2				
74	MAL22BR001	ELBOW	541	48.3	-	2								
75		REDUCER	541	60.3				1						
76		TUBE/PIPE	541	48.3	2.5					3				
77	MAL22BR002	ELBOW	541	48.3	-	2								
78		TUBE/PIPE	541	48.3	2.0					3				
79	MAL22BR003	CAP	541	60.3	-							1		
80		VALVE	541	60.3	-					2				
81		TEE	541	60.3	-		3							
82		BEND	541	60.3	-						8			
83		TUBE/PIPE	541	60.3	15.0									
84		TUBE/PIPE	541	73	0.5									
85	MAL23BR001 MAL23BR002	BEND	601	60.3	-						13			
86		BEND	601	33.4	-						3			
87		CAP	601	60.3	-							1		
88		TEE	601	60.3	-		2							
89		VALVE	601	60.3	-					2				
90		TUBE/PIPE	601	33.4	2.0									
91		TUBE/PIPE	601	73	0.5									
92		TUBE/PIPE	601	60.3	20.0									

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93		ELBOW	601	60.3		2								
94		VALVE	601	33.4	-					3				
95		BEND	601	60.3	-						9			
96		CAP	601	60.3	-							1		
97		TEE	601	60.3	-		2							
98		TUBE/PIPE	601	73	0.5									
99		VALVE	601	60.3	-					2				
100		TUBE/PIPE	601	60.3	28.0									
101		BEND	601	33.4	-						2			
102		TUBE/PIPE	601	33.4	1.0									
103		VALVE	601	33.4	-					3				
104		BEND	442	48.3	-						12			
105		VALVE	442	48.3	-					2				
106		CAP	442	48.3	-							1		
107		TEE	442	48.3	-		1							
108		TUBE/PIPE	442	60.3	0.5									
109		TUBE/PIPE	442	48.3	15.0									
110		ELBOW	601	60.3		15								
111		CAP	601	60.3								1		
112		TEE	601	60.3			2							
113		TUBE/PIPE	601	73	0.5									
114		TUBE/PIPE	601	60.3	19.0									
115		VALVE	601	60.3						2				
116		BEND	601	33.4	-						2			
117		TUBE/PIPE	601	33.4	2.0									
118		VALVE	601	33.4	-					3				
119		BEND	601	60.3							12			
120		CAP	601	60.3								1		
121		ELBOW	601	60.3		1								
122		TEE	601	60.3			2							
123		TUBE/PIPE	601	60.3	21.0									

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124	MAL27BR002	TUBE/PIPE	601	73	0.5									
125		VALVE	601	60.3						2				
126		BEND	601	33.4	-						2			
127		TUBE/PIPE	601	33.4	1.5									
128		VALVE	601	33.4	-					3				
129	MAL31BR001	BEND	601	33.4	-						2			
130		TUBE/PIPE	601	33.4	10.5									
131		ELBOW	601	33.4	-	4								
132	MAL31BR002	TUBE/PIPE	601	33.4	3.0									
133		ELBOW	601	33.4	-	2								
134	MAL31BR003	BEND	601	60.3							6			
135		CAP	601	60.3								1		
136		REDUCER	601	60.3				1						
137		TEE	601	60.3			3							
138		VALVE	601	60.3						2				
139		TUBE/PIPE	601	60.3	10.5									
140		TUBE/PIPE	601	73	0.5									
141	MAL41BR001	CAP	432	60.3								1		
142		ELBO	432	60.3		5								
143		TEE	432	60.3			3							
144		VALVE	432	60.3						2				
145		TUBE/PIPE	432	73	0.5									
146		TUBE/PIPE	432	60.3	9.0									
147	MAL41BR002	BEND	432	48.3	-						1			
148		TUBE/PIPE	432	48.3	11.5									
149		ELBO	432	48.3	-	5								
150	MAL45BR001	CAP	496	60.3								1		
151		TEE	496	60.3			1							
152		BEND	496	60.3							2			
153		VALVE	496	60.3						2				
154		ELBOW	496	60.3		2								

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SI 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
155		TUBE/PIPE	496	60.3	11.0									
156		TUBE/PIPE	496	73	0.5									
157	MAL47BR001	CAP	408	60.3								1		
158		ELBOW	408	60.3		4								
159		VALVE	408	60.3						2				
160		TEE	408	60.3			1							
161		TUBE/PIPE	408	60.3	5.5									
162		TUBE/PIPE	408	73	0.5									
163	MAL51BR001	CAP	277	60.3				1				1		
164		VALVE	277	60.3						2				
165		TEE	277	60.3			2							
166		ELBOW	277	60.3		5								
167		TUBE/PIPE	277	60.3	3.0									
168		TUBE/PIPE	277	73	0.5									
169	MAL51BR003	TUBE/PIPE	277	33.4	8.5									
170		BEND	277	33.4	-						4			
171	MAL51BR004	BEND	277	33.4	-						7			
172		TUBE/PIPE	277	33.4	13.0									
173		TEE	277	33.4	-		1							
174	MAL54BR001	BEND	148	60.3							9			
175		CAP	148	60.3								1		
176		ELBOW	148	60.3		1								
177		TEE	148	60.3			1							
178		VALVE	148	60.3						2				
179		TUBE/PIPE	148	60.3	34.0									
180		TUBE/PIPE	148	73	0.5									
181	MAL55BR001	BEND	220	60.3							10			
182		CAP	220	60.3								1		
183		ELBOW	220	60.3		1								
184		TEE	220	60.3			1							
185		VALVE	220	60.3						2				

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186		TUBE/PIPE	220	60.3	31.0									
187		TUBE/PIPE	220	73	0.5									
188	MAL65BR001	BEND	382	60.3							4			
189		CAP	382	60.3								1		
190		TEE	382	60.3			2							
191		ELBOW	382	60.3		3								
192		TUBE/PIPE	382	60.3	18.0									
193		VALVE	382	60.3						2				
194	MAL81BR001	BEND	585	33.4							8			
195		CAP	585	33.4								1		
196		VALVE	585	33.4						2				
197		TEE	585	33.4			3							
198		TUBE/PIPE	585	33.4	16.0									
199		TUBE/PIPE	585	48.3	0.5									
200	MAL81BR002	TUBE/PIPE	585	33.4	5.5									
201		BEND	585	33.4	-						7			
202	MAL81BR003	BEND	585	33.4	-						8			
203		TUBE/PIPE	585	33.4	11.5									
204		INST	585	33.4	-					3				

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Seal Steam System**

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1	LBC41BR001	ELBOW	480	168.3		5								
2		VALVE	480	168.3						1				
3		TUBE/PIPE	480	273.1	9									
4	LBC41BR002	TUBE/PIPE	382	273.1	1									
5		ELBO	382	273.1		2								
6	MAM10BR001	BEND	549	48.3							9			
7		TUBE/PIPE	549	48.3	16.5									
8	MAM10BR002	BEND	549	48.3							9			
9		TUBE/PIPE	549	48.3	15									
10	MAM10BR003	BEND	549	48.3							10			
11		TUBE/PIPE	549	48.3	26									
12	MAM10BR004	BEND	549	48.3							5			
13		TUBE/PIPE	549	48.3	6									
14	MAM10BR005	BEND	549	26.7							11			
15		TUBE/PIPE	549	26.7	20									
16	MAM10BR008	BEND	549	60.3							6			
17		CAP	549	60.3								1		
18		TEE	549	60.3			2							
19		TUBE/PIPE	549	60.3	7.5									
20	MAM10BR010	BEND	549	60.3							7			
21		CAP	549	60.3								1		
22		TEE	549	60.3			2							
23		TUBE/PIPE	549	60.3	13.5									
24	MAM20BR002	BEND	277	33.4							5			
25		TUBE/PIPE	277	33.4	4									
26	MAM20BR003	BEND	277	33.4							5			
27		TUBE/PIPE	277	33.4	3.6									
28	MAM20BR004	BEND	432	48.3							7			
29		WELDOLET	432	48.3								1		
30		TUBE/PIPE	432	48.3	9.7									
31	MAM20BR001	CAP	432	88.9								1		
32		ELBOW	432	88.9		3								
33		BEND	432	33.4			2							
34		BEND	432	48.3			1							
35		TUBE/PIPE	432	33.4	0.5									
36		TUBE/PIPE	432	48.3	0.5									
37		TUBE/PIPE	432	88.9	8.2									
38	MAM20BR006	BEND	549	48.3							9			
39		WELDOLET	549	48.3								1		
40		TUBE/PIPE	549	48.3	7.5									

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Seal Steam System**

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41	MAM20BR007	BEND	549	48.3							2			
42		ELBOW	549	48.3		7								
43		WELDOLET	549	48.3									1	
44		TUBE/PIPE	549	48.3	8									
45	MAM20BR010	CAP	549	114.3								1		
46		ELBOW	549	114.3		1								
47		BEND	549	114.3							1			
48		TEE	549	114.3			4							
49		TUBE/PIPE	549	114.3	8.5									
50	MAM20BR009	BEND	585	48.3							1			
51		ELBOW	585	48.3		9								
52		WELDOLET	585	48.3									1	
53		TUBE/PIPE	585	48.3	8.8									
54	MAM20BR008	BEND	585	48.3							9			
55		WELDOLET	585	48.3									1	
56		TUBE/PIPE	585	48.3	10									
57	MAM30BR001	BEND	585	42.2							9			
58		TUBE/PIPE	585	42.2	14									
59	MAM30BR002	BEND	585	42.2							15			
60		TUBE/PIPE	585	42.2	28									
61	MAM30BR003	BEND	585	42.2							17			
62		TUBE/PIPE	585	42.2	43									
63	MAM30BR004	BEND	585	42.2							1			
64		TUBE/PIPE	585	42.2	4.5									
65	MAM30BR008	CAP	585	60.3								1		
66		BEND	585	60.3		4								
67		TEE	585	60.3			2							
68		TUBE/PIPE	585	60.3	8									
69	MAM30BR010	CAP	585	60.3								1		
70		BEND	585	60.3							4			
71		TEE	585	60.3			2							
72		ELBOW	585	60.3		2								
73		TUBE/PIPE	585	60.3	14									
75	MAM40BR001	BEND	585	42.2							5			
78		TUBE/PIPE	585	42.2	7.6									
80	MAM40BR002	BEND	585	42.2							11			
83		TUBE/PIPE	585	42.2	16									
85	MAM40BR003	BEND	585	42.2							8			
88		TUBE/PIPE	585	42.2	14									
90	MAM40BR004	BEND	585	42.2							11			
93		TUBE/PIPE	585	42.2	13									

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94	MAM40BR005	CAP	585	88.9								1		
97		ELBOW	585	88.9		2								
98		TUBE/PIPE	585	88.9	5.5									
99	MAW10BR001	ELBOW	335	88.9		2								
100		TEE	335	88.9			1							
101		TUBE/PIPE	335	88.9	1									
102		VALVE	335	88.9						1				
103	MAW10BR002	VALVE	335	273						1				
104		VALVE	320	273						1				
105		ELBOW	320	273		2								
106		BEND	320	273							3			
107	MAW10BR003	TEE	320	273			1							
108		TUBE/PIPE	320	273	2									
109		VALVE	335	88.9						2				
110		ELBOW	335	88.9		1								
111	MAW10BR004	BEND	335	88.9							3			
112		REDUCER	335	88.9				1						
113		TUBE/PIPE	335	88.9	1									
114	MAW10BR005	VALVE	320	273						1				
115		BEND	320	273							4			
116		TUBE/PIPE	320	273	1.5									
117	MAW20BR001	REDUCER	470	323.8				1						
118		ELBOW	470	273		3								
119		FLANGE	470	273					2					
120		TEE	470	273			2							
121	MAW20BR002	TUBE/PIPE	470	273	4									
122		BEND	470	323.8							5			
123		WELDOLET	470	323.8								1		
124		REDUCER	470	323.8				1						
125	MAW20BR003	TEE	470	323.8			3							
126		TUBE/PIPE	470	323.8	4									
127		ELBOW	360	273		2								
128		FLANGE	360	273					2					
129	MAW20BR004	TEE	360	273			5							
130		TUBE/PIPE	360	273	13.5									
131		FLANGE	360	88.9					2					
132		WELDOLET	360	88.9								1		
133	MAW20BR005	BEND	360	88.9							1			
134		TUBE/PIPE	360	88.9	0.5									

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135	MAW20BR005	VALVE	360	21.3					2					
136		TUBE/PIPE	360	21.3	0.5									
137		TUBE/PIPE	360	33.4	1									
138		TUBE/PIPE	360	88.9	4.5									
139		WELDOLET	360	88.9									2	
140		ELBOW	360	88.9		2								
141		CAP	360	88.9								1		
142		BEND	360	88.9							4			
143		REDUCER	360	33.4				2						
144	MAW21BR001	TUBE/PIPE	470	114.3	6									
145		FLANGE	470	141.3					2					
146	MAW21BR002	ELBOW	470	114.3		5								
147		TUBE/PIPE	470	114.3	7.5									
148		FLANGE	470	141.3					2					
149	MAW21BR003	ELBOW	470	114.3		5								
150		TUBE/PIPE	470	168.3	6.5									
151		TEE	470	168.3			1							
152		REDUCER	470	168.3				1						
153	MAW22BR001	BEND	470	168.3							3			
154		TUBE/PIPE	470	168.3	8									
155		TEE	470	168.3			1							
156		REDUCER	470	168.3				1						
157	MAW22BR002	ELBOW	470	168.3		4								
158		TUBE/PIPE	470	114.3	5.5									
159		BEND	470	114.3							1			
160		FLANGE	470	141.3					2					
161	MAW22BR003	ELBOW	470	114.3		4								
162		TUBE/PIPE	470	114.3	4.5									
163		FLANGE	470	141.3					2					
164		ELBOW	470	114.3		4								
165	MAW23BR001	BEND	470	114.3							1			
166		TUBE/PIPE	470	114.3	5.5									
167		FLANGE	470	141.3					2					
168		ELBOW	470	114.3		4								
169	MAW23BR002	TUBE/PIPE	470	114.3	6									
170		FLANGE	470	141.3					2					
171		ELBOW	470	114.3		3								

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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
172	MAW23BR003	TUBE/PIPE	470	219	5									
173		TUBE/PIPE	470	168.3	8.5									
174		TEE	470	168.3			1							
175		REDUCER	470	168.3				1						
176		ELBOW	470	168.3		5								
177	MAW24BR001	TUBE/PIPE	470	141.3	5			1						
178		REDUCER	470	141.3				1						
179		ELBOW	470	141.3		2								
180	MAW24BR002	TUBE/PIPE	470	141.3	4									
181		ELBOW	470	141.3		2								
182		REDUCER	470	141.3				1						
183	MAW24BR003	TEE	470	168.3			1							
184		TUBE/PIPE	470	168.3	8									
185		REDUCER	470	168.3				1						
186		ELBOW	470	168.3					5					
187	MAW24BR004	TUBE/PIPE	470	114.3	3									
188		ELBOW	470	114.3		2								
189		FLANGE	470	141.3					2					
190	MAW24BR005	TUBE/PIPE	470	114.3	2.5									
191		ELBOW	470	114.3		2								
192		FLANGE	470	141.3					2					
193	MAW25BR001	BEND	360	114.3							6			
194		TUBE/PIPE	360	114.3	11.5									
195		FLANGE	360	141.3				2						
196		ELBOW	360	114.3		4								
197	MAW26BR001	TUBE/PIPE	360	114.3	10.5									
198		FLANGE	360	114.3					2					
199		ELBOW	360	114.3		4								
200		BEND	360	114.3							5			
201	MAW27BR001	BEND	360	114.3							3			
202		ELBOW	360	114.3		6								
203		FLANGE	360	114.3					2					
204		TUBE/PIPE	360	114.3	12									
205	MAW28BR001	BEND	360	114.3							8			
206		ELBOW	360	114.3		3								
207		FLANGE	360	114.3					2					
208		TUBE/PIPE	360	114.3	10									
209	MAW50BR003	ELBOW	585	457.2		1								
210		TUBE/PIPE	585	457.2	1		1						1	
211		VALVE	585	457.2						1				

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**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
212	MAW50BR002	VALVE	585	457.2						1				
213		TUBE/PIPE	585	457.2	13									
214		TEE	585	457.2			1							
215		ELBOW	585	457.2		9								
216	MAW50BR004	VALVE	585	457.2						1				
217		TUBE/PIPE	585	457.2	1									
218		ELBOW	585	457.2		4								
219	MAW50BR005	BEND	585	168.3		1								
220		FLANGE	585	168.3					2					
221		WELDOLET	585	168.3								1		
222		TUBE/PIPE	585	168.3	1									
223	MAW50BR006	ELBOW	585	457.2		2								
224		REDUCER	585	457.2				1						
225		TEE	585	457.2			1							
226		VALVE	585	457.2						1				
227		TUBE/PIPE	585	457.2	3									
228		TUBE/PIPE	585	406.4	0.5									
229	MAW60BR002	TUBE/PIPE	442	114.3	0.5									
230		TUBE/PIPE	442	48.3	0.5									
231		CAP	442	141.3								1		
232	MAW60BR004	TUBE/PIPE	510	168.3	5.5									
233		TEE	510	168.3			2							
234		CAP	510	168.3								1		
235		BEND	510	168.3							1			
236		ELBOW	510	168.3		2								
237	MAW60BR005	TUBE/PIPE	510	114.3	4.5									
238		ELBOW	510	114.3		4								
239		BEND	510	114.3							1			
240	MAW60BR006	TUBE/PIPE	510	114.3	4.5									
241		ELBOW	510	114.3		2								
242		BEND	510	114.3							1			
243	MAW60BR007	TUBE/PIPE	442	219.1	2									
244		TUBE/PIPE	510	219.1	15.5									
245		TEE	510	219.1			2							
246		WELDOLET	510	219.1									2	
247		BEND	510	219.1							3			
248		ELBOW	510	219.1		6								
249		CAP	510	219.1				1						

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**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
250	MAW60BR009	TUBE/PIPE	510	168.3	3									
251		TEE	510	168.3			2							
252		BEND	510	168.3							1			
253		ELBOW	510	168.3		2								
254		CAP	510	168.3								1		
256	MAW60BR010	TUBE/PIPE	510	114.3	5.5									
257		BEND	510	114.3							1			
258		ELBOW	510	114.3		5								
259	MAW60BR011	TUBE/PIPE	510	114.3	5.5									
260		BEND	510	114.3							1			
261		ELBOW	510	114.3		5								
262	MAW80BR001	VALVE	320	323.8						2				
263		TUBE/PIPE	320	323.8	53									
264		TUBE/PIPE	320	141.3	0.5									
265		TEE	320	323.8			3							
266		REDUCER	320	323.8				1						
267		FLANGE	320	141.3					1					
268	MAW80BR002	ELBOW	320	323.8		10								
269		TUBE/PIPE	320	273.1	4									
270		TEE	320	273.1			2							
271		REDUCER	320	273.1							1			
272		ELBOW	320	273.1		2								
273	MAW80BR003	TUBE/PIPE	320	219.1	3									
274		TEE	320	219.1			2							
275		CAP	320	219.1								1		
276	MAW80BR004	TUBE/PIPE	320	273	6									
277		TUBE/PIPE	320	60.3	0.5									
278		FLANGE	320	60.3					2					
279		ELBOW	320	273		5								
280	MAW80BR005	TUBE/PIPE	320	33.4	2.5									
281		TEE	320	33.4			1							
282		REDUCER	320	33.4				2						
283		BEND	320	33.4							6			
284		ELBOW	320	33.4		1								
285	MAW80BR006	TUBE/PIPE	320	33.4	3.5									
286		TEE	320	33.4			1							
287		REDUCER	320	33.4				2						
288		ELBOW	320	33.4		5								

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**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
289	MAW80BR008	VALVE	320	168.3						1				
290		TUBE/PIPE	320	168.3	8									
291		TEE	320	168.3			1							
292		FLANGE	320	168.3					2					
293		REDUCER	320	219.1				1						
294		CAP	320	168.3								1		
295		ELBOW	320	168.3		5								
296	MAW80BR009	VALVE	320	168.3						1				
297		TUBE/PIPE	320	168.3	1									
298		FLANGE	320	168.3					2					
299		REDUCER	320	219.1				1						
300		CAP	320	168.3								1		
301	MAW80BR012	ELBOW	320	168.3		2								
302		TUBE/PIPE	320	33.4	0.5									
303		VALVE	320	219.1						1				
304		ELBOW	320	219.1		2								
305		FLANGE	320	219.1					2					
306	MAW80BR013	TUBE/PIPE	320	219.1	2.5									
307		TUBE/PIPE	320	33.4	0.5									
308		ELBOW	320	219.1		5								
309		TEE	320	219.1			1							
310		FLANGE	320	219.1					2					
311		VALVE	320	219.1						1				
312	MAW80BR020	TUBE/PIPE	320	219.1	9.5									
313		TUBE/PIPE	320	33.4	11									
314	MAW80BR021	BEND	320	33.4							6			
315		TUBE/PIPE	320	33.4	12									
316	MAW81BR001	BEND	320	33.4							6			
317		ELBOW	320	114.3		2								
318		BEND	320	114.3							1			
319	MAW81BR002	TUBE/PIPE	320	114.3	4									
320		ELBOW	320	114.3		3								
321	MAW81BR003	TUBE/PIPE	320	114.3	4.5									
322		VALVE	320	168.3						1				
323		BEND	320	168.3							1			
324		TUBE/PIPE	320	168.3	7.5									
325		TEE	320	168.3			1							
326		REDUCER	320	168.3				1						
327		ELBOW	320	168.3		2								
328		FLANGE	320	168.3					2					

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**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
329	MAW82BR001	ELBOW	320	114.3		3								
330		BEND	320	114.3							1			
331		TUBE/PIPE	320	114.3	4									
332	MAW82BR002	ELBOW	320	114.3		4								
333		TUBE/PIPE	320	114.3	4									
334		ELBOW	320	168.3		4								
335	MAW82BR003	TUBE/PIPE	320	168.3	7.5									
336		REDUCER	320	168.3				1						
337		FLANGE	320	168.3					2					
338		BEND	320	168.3							1			
339		TEE	320	168.3			1							
340		VALVE	320	168.3						1				
341	MAW83BR001	FLANGE	320	114.3					2					
342		BEND	320	114.3							1			
343		ELBOW	320	114.3		6								
344		TUBE/PIPE	320	114.3	12.5									
345		TUBE/PIPE	320	141.3	2									
346		VALVE	320	114.3						1				
347	MAW84BR001	FLANGE	320	141.3					2					
348		TUBE/PIPE	320	141.3	10.5									
349		REDUCER	320	141.3				1						
350		VALVE	320	141.3						1				
351		ELBOW	320	141.3		5								
352	MAW84BR002	BEND	320	141.3							2			
353		TUBE/PIPE	320	141.3	2.5									
354	MAW85BR001	ELBOW	190	88.9		5								
355		FLANGE	190	88.9					2					
356		VALVE	190	88.9						1				
357		TUBE/PIPE	190	88.9	6									
358		TUBE/PIPE	190	114.3	2									
359	MAW86BR001	ELBOW	190	88.9		7								
360		FLANGE	190	88.9					2					
361		TUBE/PIPE	190	88.9	6									
362		TUBE/PIPE	190	114.3	2									
363		VALVE	190	88.9						1				
364	MAW87BR001	ELBOW	190	88.9		7								
365		FLANGE	190	88.9					2					
366		VALVE	190	88.9						1				
367		TUBE/PIPE	190	114.3	2									
368		TUBE/PIPE	190	88.9	6									
369	MAW88BR001	ELBOW	190	88.9		7								
370		FLANGE	190	88.9					2					
371		VALVE	190	88.9						1				
372		TUBE/PIPE	190	88.9	6.5									
373		TUBE/PIPE	190	88.9	6.5									

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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	593	219.1	12								
3		WELDOLET	593	219.1	-							1	
4		BEND	593	219.1	-						6		
5	MAA14BR002	TUBE/PIPE	593	219.1	13								
6		BEND	593	219.1	-						6		
7		WELDOLET	593	219.1	-							7	
8	MAA14BR003	TUBE/PIPE	570	219.1	11								
9		REDUCER	570	219.1	-			1					
10		ELBOW	570	219.1	-	5							
11	MAA14BR004	TUBE/PIPE	570	219.1	19								
12		ELBOW	570	219.1	-	9							
13		REDUCER	570	219.1	-			1					
14	MAA14BR005	TUBE	570	168.3	3								
15		ELBOW	570	168.3	-	2							
16		VALVE	570	33.4	-					2			
17		WELDOLET	570	168.3	-							1	
18		REDUCER	570	33.4	-			1					
19		TUBE	570	33.4	1								
20	MAA14BR006	ELBOW	570	168.3	-	2							
21		TUBE/PIPE	570	168.3	3								
22		WELDOLET	570	168.3	-							1	

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

1. This BOM may vary by +/- 3%.
2. Components 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 18 (Eighteen) pages. Turbine Drainage System = 7 Pages, Seal Steam System = 9 Pages & Overload Piping System = 2 Page.

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SPECIAL INSTRUCTIONS:			
Checklist for Vendors	SI No	BHEL REQUIREMENTS	VENDOR's CHECKPOINT (To be filled by Vendor) [YES/NO]
	1	<i>Vendor has indicated insulation thicknesses for all items covered in this document.</i>	
	2	<i>Vendor has considered design criteria as per doc no 412114W4000 , ST29005 REV_04 & Annexure-1 (Customer Spec.).</i>	
	3	<i>Vendor has furnished Sample Calculations for min 10 different cases.</i>	
	4	<i>Vendor has furnished k-values of insulation mattresses at different mean temperatures ranging from 100-300 °C.</i>	
	5	<i>Vendor has furnished BOM containing breakup of quantity of mattresses (in m²) & Aluminium (in kg, for 18,20 & 22 SWG separately) in their standard format along with Wt in Kg.</i>	

Rajeev Kumar

29.07.2020

PREPARED BY: RAJEEV KUMAR (Dy. Mgr-TL)

APPROVED BY: Sh ANUJ JAIN (DGM-TL)



**THERMAL INSULATION SCHEDULE FOR
TURBINE INTEGRAL PIPING**
TURBINE LAYOUT GROUP

BHEL DOC. NO.

412114W4000

REV. – 0

DATE: 28.07.2020

MATERIAL CODE: W90313146110

Project

1X660MW PANKI TPP

SPEC DOC. NO.

ST29005 Rev_04

Specifications are as below:

1. DESIGN PARAMETERS:

Sl No	Description	Value
1	COLD FACE TEMPERATURE	60 DEG C
2	AMBIENT TEMPERATURE	40 DEG C
3	EMISSIVITY OF AL. SHEET	0.2
4	WIND VELOCITY	0.5 M/S
5	DESIGN HEAT LOSS AT CLADDING SURFACE	ASTM C-680 (LATEST EDITION OR EQUIVALENT)

2. MATERIALS:

Sl No	Description	Value
6	INSULATION MATERIAL	LIGHTLY RESIN BONDED ROCKWOOL AS PER IS: 8183.
7	DENSITY	1. 100 KG/M ³ FOR HOT FACE TEMP. UPTO 400°C 2. 150 KG/M ³ FOR HOT FACE TEMP. ABOVE 400°C
8	CLADDING MATERIAL	ALUMINIUM SHEET AS PER IS: 737

3. SPECIAL INSTRUCTIONS:

- ENTIRE INSULATION MATERIAL SHALL BE ASBESTOS FREE.

Prepared by

Rajeev Kumar

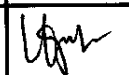
Rajeev kumar
Dy Manager- TL

01.08.2020

Approved by

Anuj Jain
DGM- TL

दिनांक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD	ST 29005	
			पृष्ठ 23 का 1 Page 1 of 23	
सामग्री सूची संख्या को अधिकृतित करता है	SUPERSEDES INVENTORY NO.	BASED ON: BHEL EXPERIENCE		
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.		SPECIFICATION FOR THERMAL INSULATION FOR T.G.INTEGRAL PIPING SYSTEM		
स्वत्वाधिकार एवं गोपनीय इस प्रलेख की कोई भी प्रतिलिपि भारत के बिना हस्तक्षेप के सम्पत्ति है इसका प्रयोग अन्यथा रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में सम्पत्तिकारक हो न किया जाए।				
हस्ताक्षर एवं दिनांक SIGN & DATE	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	अनुवादक TRANSLATED BY निर्माणकर्ता WORKED BY जांचकर्ता CHECKED BY पर्यवेक्षणकर्ता SUPERVISED BY		
सामग्री सूची संख्या INVENTORY NO.	दिनांक एवं हस्ताक्षर SIGNATURE & DATE	स्वीकृति APPROVED : (B.K. BHALLA) AGM (STE)		
1-12-03	12-11-03	ST 8.20		
P-5788	04	REV.NO. 04 Dt. 04.02.05		
सहमत विभाग AGREED DEPTT.	नाम NAME	दिनांक एवं हस्ताक्षर DATE & SIGNATURE	जारी ISSUED : STE (TL)	दिनांक : DATE : 1-6-89
QAX	S.S. CHAUHAN	27-11-03	V.K.GUPTA	12-11-03
TSX	KISHAN LAL	27-11-03	V.K.GUPTA	12-11-03
V.K.GUPTA	12-11-03	12-11-03		

दिनांक एवं हस्ताक्षर 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 अधिकृतित करता है	1.0 <u>INTRODUCTION</u> 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.			
COPYRIGHT AND CONFIDENTIAL The information on this documents 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		2.0 <u>SCOPE</u> 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.			
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।		11/11/03			
हस्ताक्षर एवं दिनांक SIGN & DATE	11/11/03	REV. NO. 04			
सामग्री सूची संख्या INVENTORY NO.	P-5788	निर्माणकर्ता WORKED BY जांचकर्ता CHECKED BY	S.K.G. V.K.G.	 	12.11.03 12.11.03

निम्नक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD		ST29005	
				पृष्ठ 23 का 3 Page 3 of 23	
समीची सूची संख्या INVENTORY NO.	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.				
समीची सूची संख्या को अधिकृतित करता है	3.0 <u>DESIGN AND PERFORMANCE REQUIREMENTS</u>				
COPYRIGHT AND CONFIDENTIAL The information on this documents 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	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 ² h unless specified in data sheet.				
स्वत्वाधिकार एवं गोपनीय इस प्रलेख में कोई भी सूचना भारत भारती इंजीनियरिंग्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह उपयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।	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.				
हस्ताक्षर एवं दिनांक SIGN & DATE	4.0 <u>MATERIALS</u>				
	4.1 <u>INSULATING MATERIALS</u>				
समीची सूची संख्या INVENTORY NO.	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.				
REV. NO.	निर्माणकर्ता WORKED BY				
P-5738	S.K.G.				
04	जांचकर्ता CHECKED BY				
	V.K.G.				
	7/7/04				
	7.7.04				

SIGN & DATE	SIGN & DATE	SIGN & DATE		PRODUCT STANDARD STEAM TURBINE ENGINEERING	ST 29005
					PAGE 4 OF 23
SUPERSEDES INVENTORY No.	SUPERSEDES INVENTORY No.	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 (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					
INVENTORY No.	INVENTORY No.	INVENTORY No.	REV. No.	WORKED BY:—	CHECKED BY:—
P-5788	P-5788	P-5788	04	Rizam	Shinde

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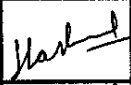
SIGN & DATE	SIGN & DATE	SIGN & DATE		PRODUCT STANDARD STEAM TURBINE ENGINEERING	ST 29005
					PAGE 5 OF 23
SUPERSEDES INVENTORY No.					temperature than that estimated & also to constant maintenance. Ample provision shall be made for maximum possible thermal movement & the insulation shall be applied 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
INVENTORY No.	INVENTORY No.	INVENTORY No.			
P. 5768	P. 5768	P. 5768			
REV. No.	REV. No.	REV. No.			
04	04	04			
WORKED BY:— <i>Rigam</i>			CHECKED BY:— <i>Shinde</i>		

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SIGN & DATE	SIGN & DATE	SIGN & DATE		PRODUCT STANDARD STEAM TURBINE ENGINEERING	FORM
					ST 29005
SUPERSEDES INVENTORY No.	SUPERSEDES INVENTORY No.	SUPERSEDES INVENTORY No.	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.	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.	PAGE 6 OF 23
INVENTORY No.	INVENTORY No.	INVENTORY No.			REV. NO. 04

SIGN & DATE	SIGNATURE	DATE		PRODUCT STANDARD		ST 29005																																													
				STEAM TURBINE ENGINEERING		PAGE 7 OF 23																																													
SUPERSEDES INVENTORY No.	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																																																		
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SIGN & DATE		<table border="1"> <thead> <tr> <th>Thickness of insulation(mm)</th> <th>Ist layer</th> <th>IIInd layer</th> <th>IIIrd layer</th> <th>IVth layer</th> </tr> </thead> <tbody> <tr><td>80</td><td>40</td><td>40</td><td>--</td><td>--</td></tr> <tr><td>100</td><td>50</td><td>50</td><td>--</td><td>--</td></tr> <tr><td>110</td><td>65</td><td>50</td><td>--</td><td>--</td></tr> <tr><td>120</td><td>75</td><td>50</td><td>--</td><td>--</td></tr> <tr><td>130</td><td>65</td><td>40</td><td>25</td><td>--</td></tr> <tr><td>140</td><td>75</td><td>65</td><td>--</td><td>--</td></tr> <tr><td>150</td><td>75</td><td>75</td><td>--</td><td>--</td></tr> <tr><td>200</td><td>75</td><td>75</td><td>50</td><td>--</td></tr> </tbody> </table>					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	--
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140	75	65	--	--																																															
150	75	75	--	--																																															
200	75	75	50	--																																															
SIGN & DATE		**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.																																																	
INVENTORY No.		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.																																																	
REV. No.		WORKED BY: - <i>Rigam</i>																																																	
P. 5788		CHECKED BY: - <i>humb</i>																																																	

SIGN & DATE	SIGNATURE	INVENTORY No.	REV. NO.		PRODUCT STANDARD STEAM TURBINE ENGINEERING	ST 29005
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SUPERSEDES INVENTORY No.				ii) Fixing arrangements for lightly banded 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.		
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.				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.		
INVENTORY No.	SIGN & DATE	22/6/89	04	WORKED BY: - <i>Rigam</i>		
P- 5768				CHECKED BY: - <i>Shinde</i>		

दिनांक एवं हस्ताक्षर SIGN & DATE			उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD		ST29005 पृष्ठ 23 का 9 Page 9 of 23	
शीर्षक सूची संख्या को अधिकृतित करता 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 दस्तावेज में दी गई सूचना भारत भारी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।						
दिनांक SIGN & DATE		11/12/05				
शीर्षक सूची संख्या INVENTORY NO.	P-5788	REV. NO. 04		निर्माणकर्ता WORKED BY	S.K.G.	 4/2/05
				जांचकर्ता CHECKED BY	V.K.G.	 04.02.05

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P-5788	22/6/87			

REV. NO
04

WORKED BY:- *Rigam*

CHECKED BY:- *Shunder*

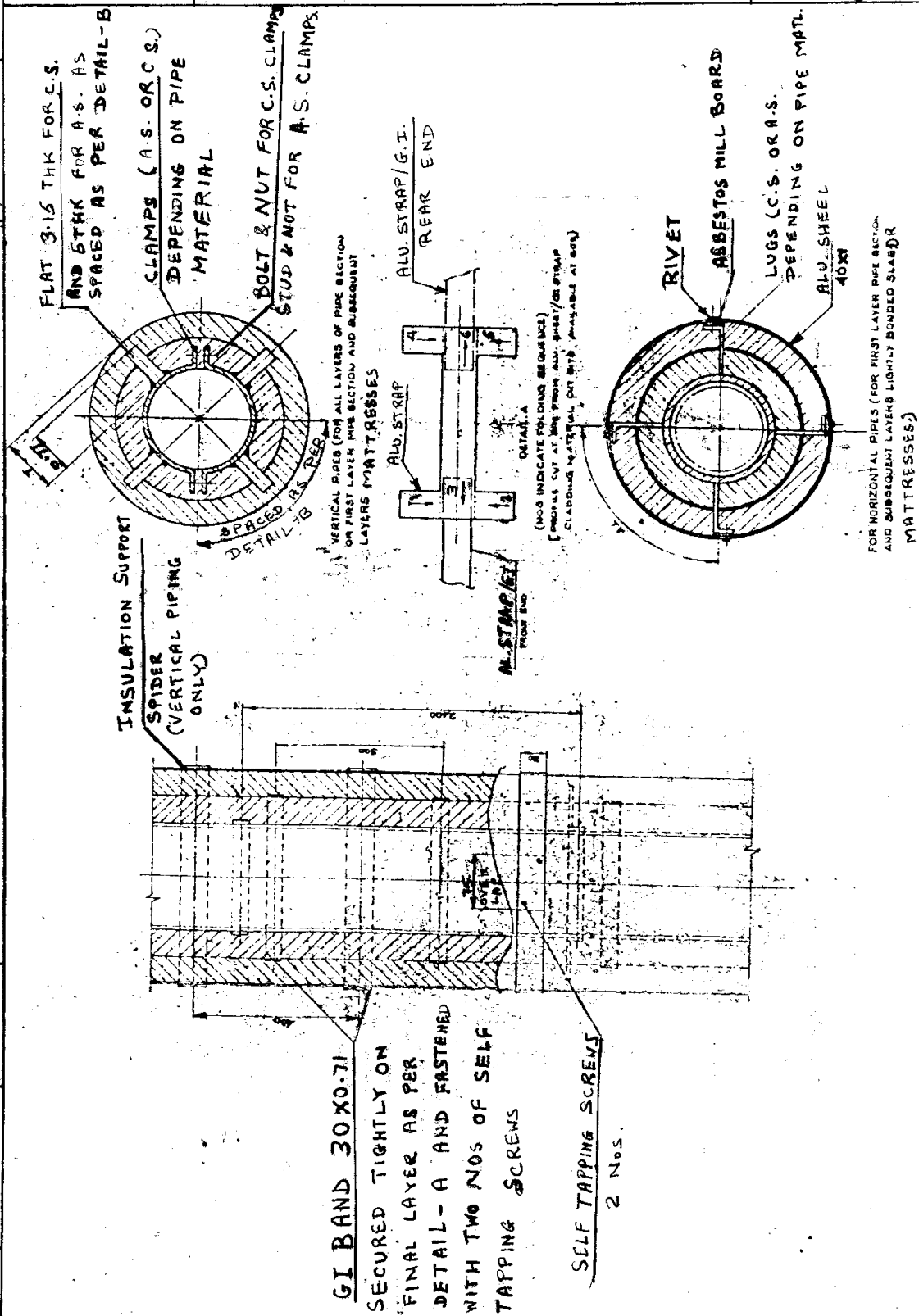


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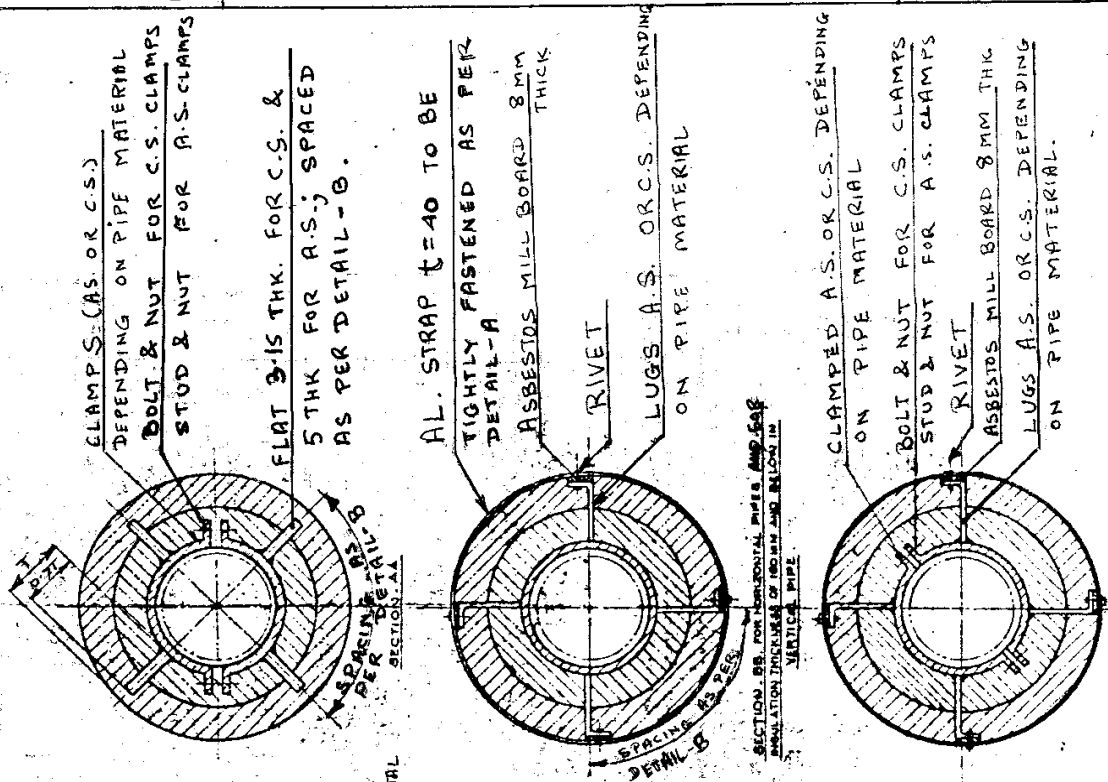


P-5788

REV. NO.
04

WORKED BY:— Rigan

CHECKED BY:- *[Signature]*



SECTION - BB
FOR VERTICAL PIPES WITH
INSULATION THICKNESS 161 MM AND ABOVE



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INVENTORY No.

P-5788

REV.
NO.
04**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 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

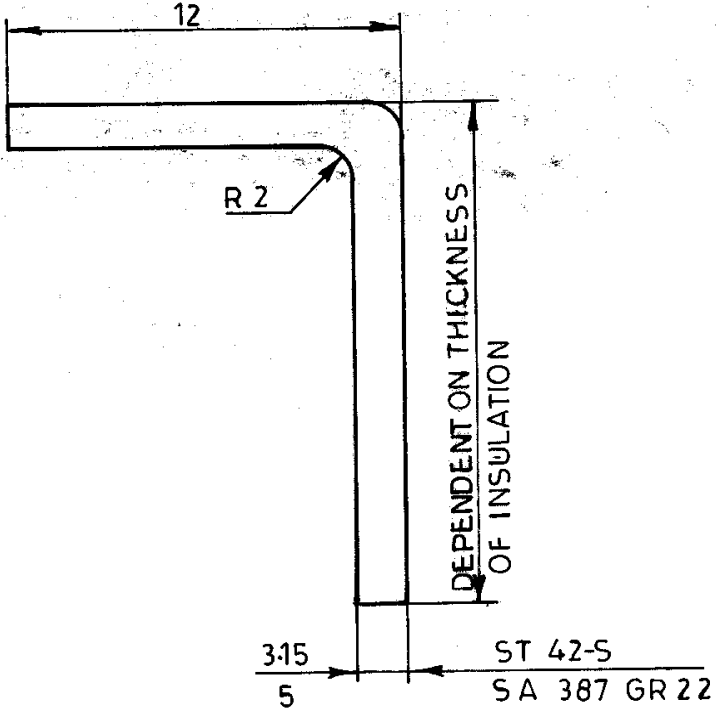
- a) After proper folding (as per detail-A) the ends are to be properly fastened by using two nos. self tapping screws per band.
- b) Lugs/flats are issued in standard length running meters. They are to be cut at site depending on insulation thickness.

D. NOTES ON APPLICATION

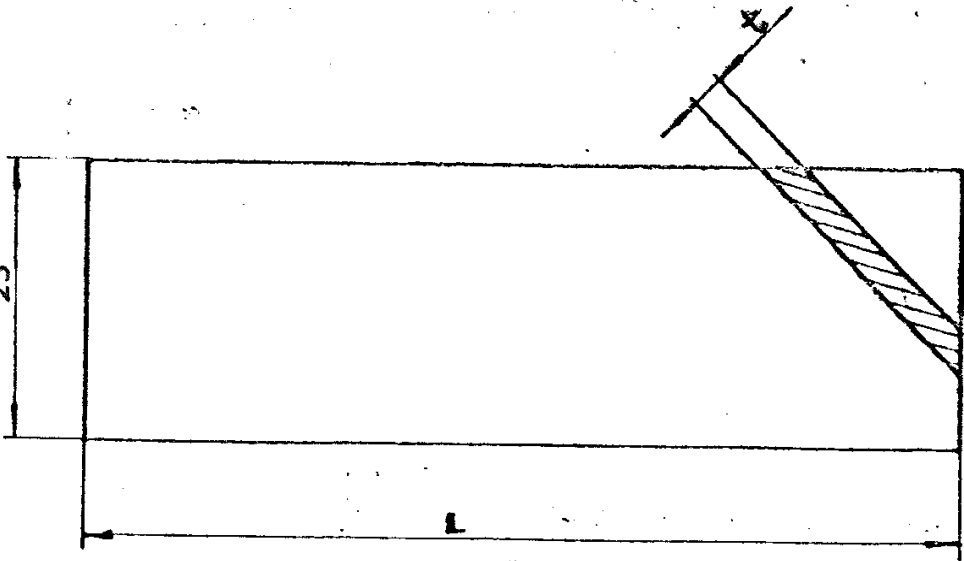
1. Fix insulation support spiders on vertical pipes. Bottom most spider at tangent point of bend/tee at bottom.
2. Fix cladding support spacer ring at specified intervals by using aluminium strap tightly (as per detail-A).
3. Commence insulation on all layers of insulation except last layer from support 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.

WORKED BY:- *Rigam*CHECKED BY:- *Rigam*

चिह्नक एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक STEAM TURBINE ENGINEERING PRODUCT STANDARD		ST29005									
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सामग्री सूची संख्या को 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).												
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स्वत्वाधिकार एवं गोपनीय इस दस्तावेज में की गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं अपरयोग अन्य से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।	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												
हस्ताक्षर एवं चिह्नक SIGN & DATE 14.8.04	REV. NO. 04												
सामग्री सूची संख्या INVENTORY NO. P-5788	निर्माणकर्ता WORKED BY S.K.G.		जांचकर्ता CHECKED BY V.K.G.		7/7/04 7.7.04								

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INVENTORY No.	SIGN & DATE				
P-5788	22/6/89				
REV. NO. 04	WORKED BY: — <i>Rigam</i>				
		CHECKED BY: — <i>Shinde</i>			

LUGS

SIGN & DATE	SIGN & DATE	INVENTORY No. P. 5788	INVENTORY No. 22/6/88	REV. NO. 04	WORKED BY:- <i>Rigam</i>	CHECKED BY:- <i>Shinde</i>																												
		PRODUCT STANDARD STEAM TURBINE ENGINEERING			ST 29005 PAGE 15 OF 23																													
SUPERSEDES INVENTORY No.				SIGN & DATE																														
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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)																																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">02</td> <td style="width: 40%;">PLATE-5mm Thk.</td> <td style="width: 15%;">IS 942 255</td> <td style="width: 10%;">SA 387 GR22</td> <td style="width: 10%;">1</td> <td style="width: 10%;"></td> <td style="width: 5%;"></td> </tr> <tr> <td>01</td> <td>PLATE-3/35mm-Thk</td> <td>ST A2-S</td> <td></td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>VARIANT No.</td> <td>DESCRIPTION</td> <td>STD</td> <td>MATL CODE</td> <td>A/C</td> <td>UNIT</td> <td>UNIT WT</td> </tr> <tr> <td></td> <td></td> <td></td> <td>MATL SPEC</td> <td></td> <td></td> <td>QTY.</td> </tr> </table>							02	PLATE-5mm Thk.	IS 942 255	SA 387 GR22	1			01	PLATE-3/35mm-Thk	ST A2-S		1			VARIANT No.	DESCRIPTION	STD	MATL CODE	A/C	UNIT	UNIT WT				MATL SPEC			QTY.
02	PLATE-5mm Thk.	IS 942 255	SA 387 GR22	1																														
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VARIANT No.	DESCRIPTION	STD	MATL CODE	A/C	UNIT	UNIT WT																												
			MATL SPEC			QTY.																												
<u>FLAT</u>																																		

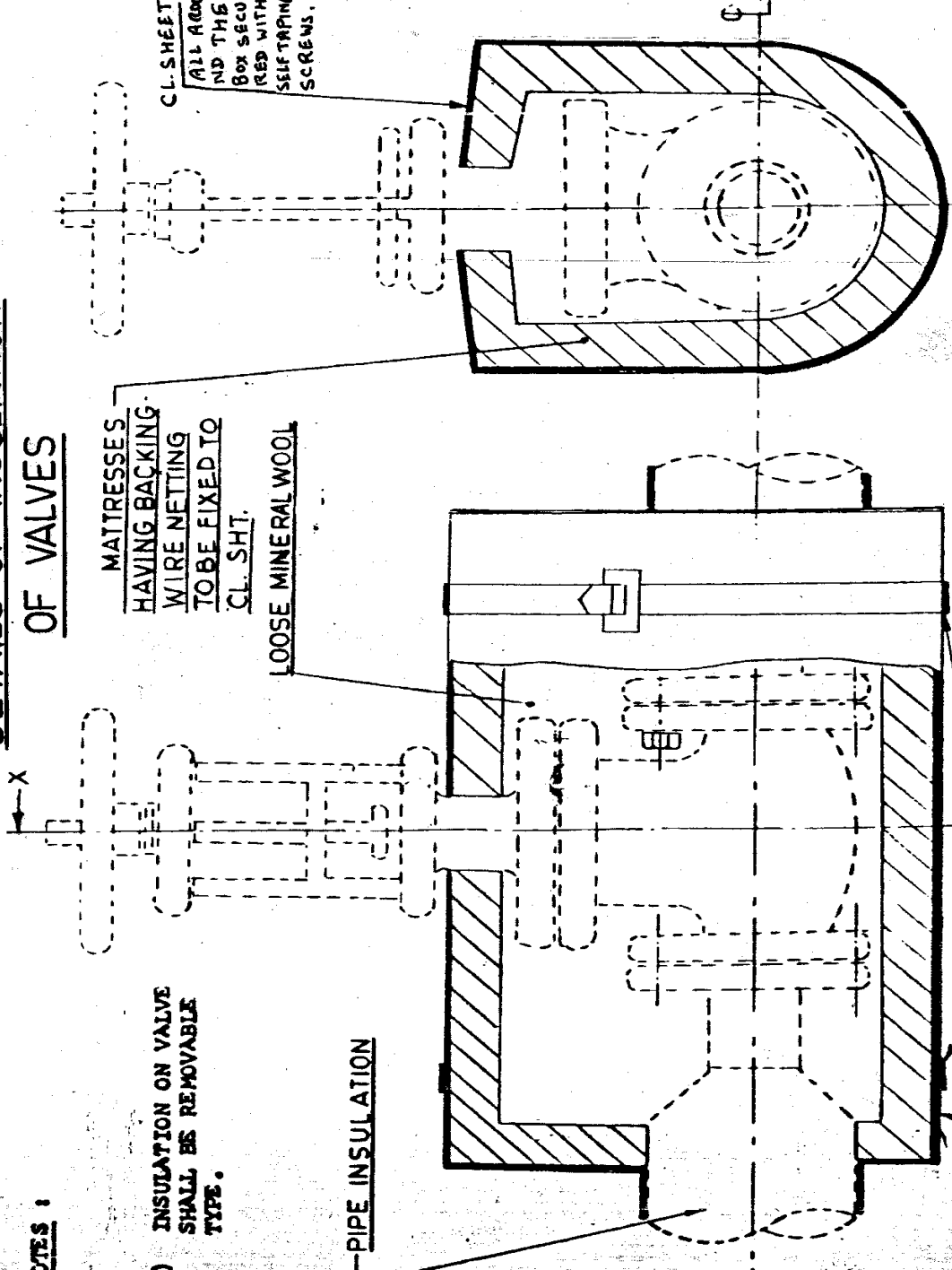
INVENTORY No. P-5788	SIGN & DATE 22/6/89	COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.	SUPERSEDES INVENTORY No.	SIGN & DATE
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PRODUCT STANDARD
STEAM TURBINE ENGINEERING

FORM
ST 29005
 PAGE 16 OF 23

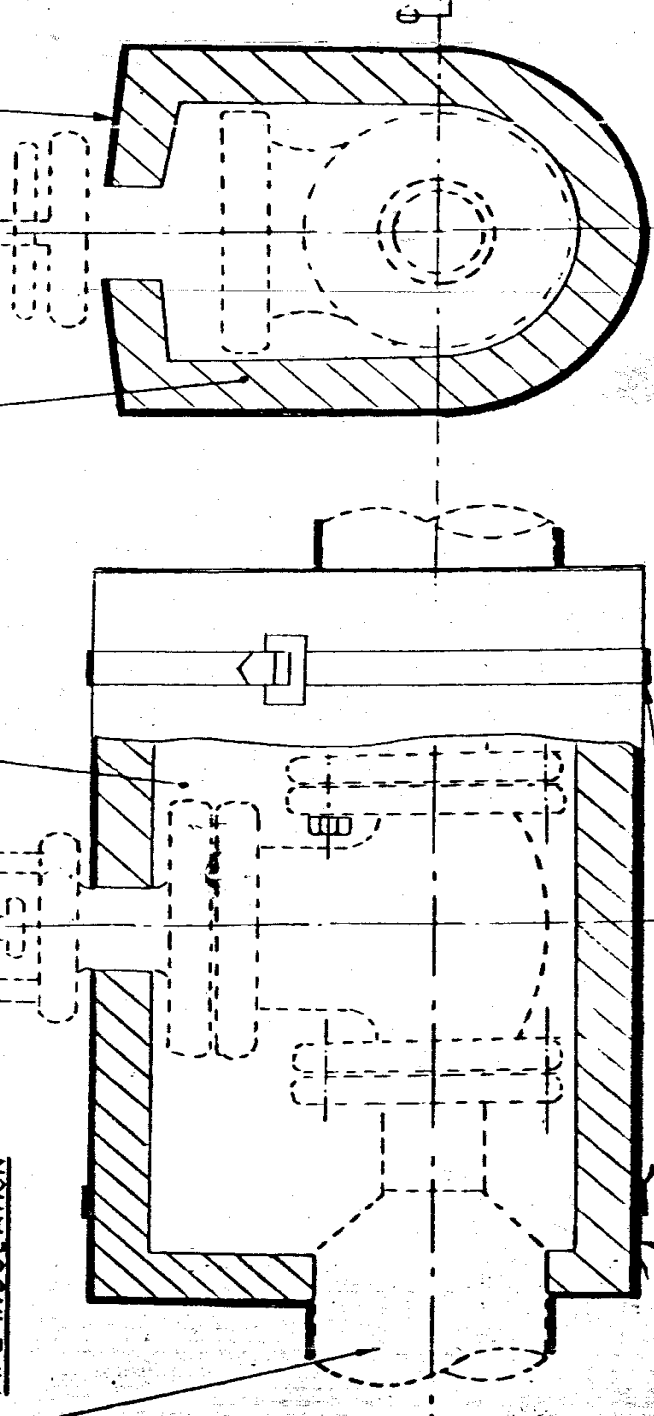
DETAILS OF INSULATION OF VALVES



NOTES :

1) INSULATION ON VALVE SHALL BE REMOVABLE TYPE.

PIPE INSULATION



CL. SHEET

ALL ABOVE AND THE BOX SECURED WITH SELF TAPPING SCREWS.

PIPE

SEC. X-X

MATTRESSES HAVING BACKING WIRE NETTING TO BE FIXED TO CL. SHT.

LOOSE MINERAL WOOL

CL. SHEET

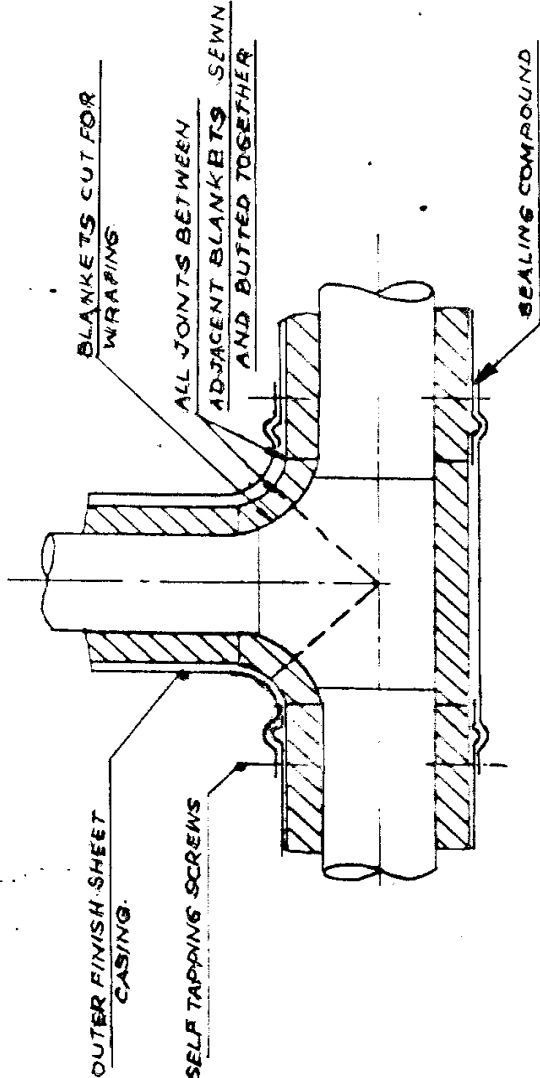
STRAPS MADE FROM CL. SHEET

WORKED BY: *Riga*

CHECKED BY: *[Signature]*

INVENTORY No. P-5788		SIGN & DATE 22/6/89		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				FORM			
						ST 29005 PAGE 17 OF 23			

FIXING OF INSULATION ON TEES



TEE INSULATION (WITH MATTRESS INSULATION)

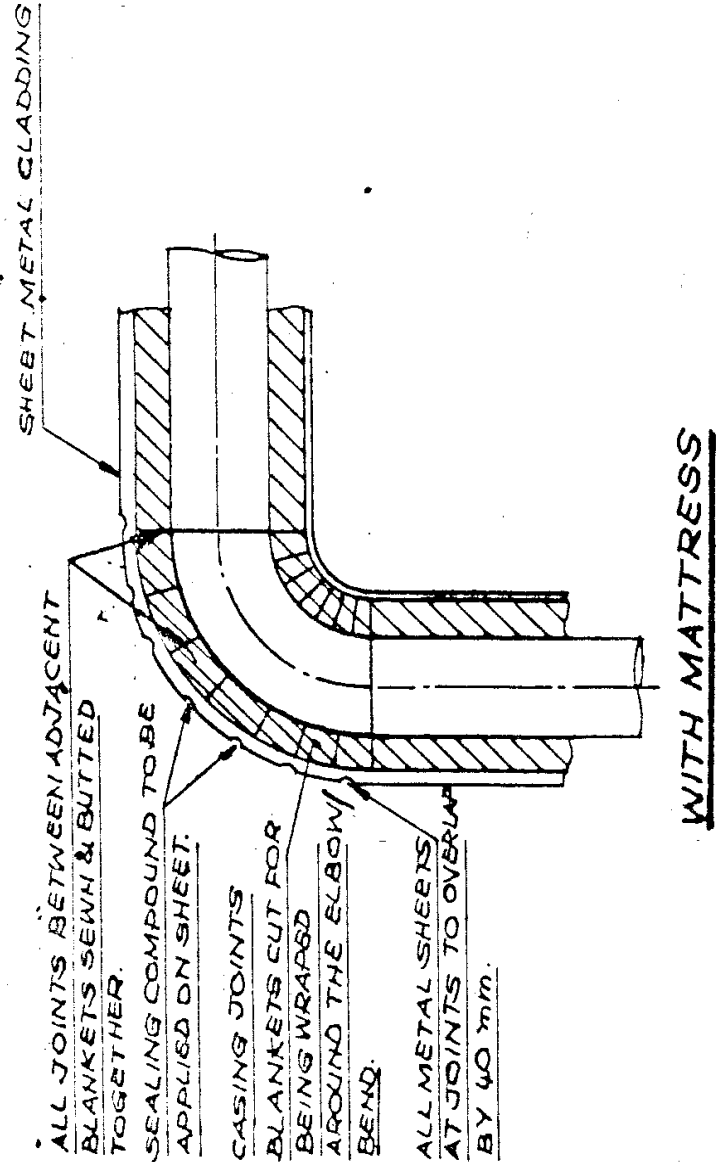
WORKED BY:- *Rigam*

CHECKED BY:- *Rigam*

REV. NO. 04

INVENTORY No. P-5708		SIGN & DATE 22-11-09		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	
REV. NO. 04		WORKED BY:- <i>Rigam</i>		CHECKED BY:- <i>Shan</i>				PRODUCT STANDARD STEAM TURBINE ENGINEERING	
						FORM		ST 29005	
						PAGE 18		OF 23	

FIXING OF INSULATION ON BENDS / ELBOWS



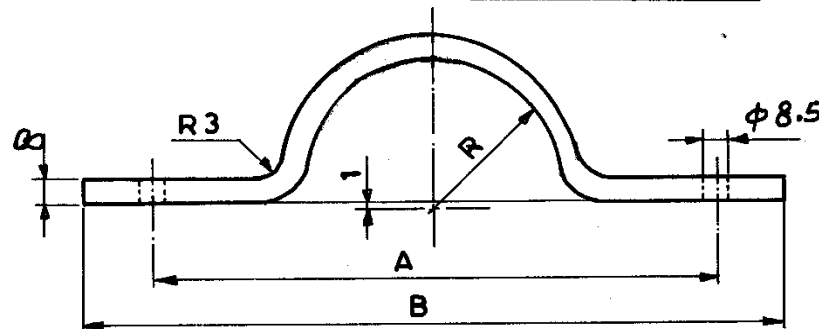


PRODUCT STANDARD
STEAM TURBINE ENGINEERING

ST 29005

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PIPE CLAMPS (ALLOY STEEL)



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VAR	A	B	R	NB	DESCRIPTION	MATL.SPCN.	UNIT WT.
01	76	91	30	50	PL. 8X50X125	13 Cr Mo 44	0.400
02	88	103	37	65	PL. 8X50X150	↑	0.480
03	183	198	84	150	PL. 8X50X295		0.920
04	234	249	110	200	PL. 8X50X380		1.200
05	288	303	137	250	PL. 8X50X460		1.450
06	371	306	178	350	PL. 8X50X590		1.850
07	421	436	203	400	PL. 8X50X670		2.100
08	473	488	229	450	PL. 8X50X752		2.400
09	523	538	254	500	PL. 8X50X824		2.600
10	626	644	305	600	PL. 8X50X990		3.000
11	123	138	54	100	PL. 8X50X200		0.630
12	129	144	57	100	PL. 8X50X210		0.660
13	174	189	80	150	PL. 8X50X282		0.900
14	339	354	162	300	PL. 8X50X540		1.700
15	365	380	175	350	PL. 8X50X580		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. 8X50X248	↓	0.78
19	730	745	356	700	PL. 8X50X1150	13 Cr Mo 44	3.310

SIGN & DATE

INVENTORY NO.

22/6/09

P-5788

REV. NO. 04

WORKED BY:- *Rizwan*CHECKED BY:- *Kundan*



PRODUCT STANDARD
STEAM TURBINE ENGINEERING

ST 29005

PAGE 22 OF 23

SIGN & DATE

SUPERSEDES
INVENTORY No.

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SIGN & DATE

INVENTORY No.

22/6/89

P-5788

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	APPLICATION	Surface cleanliness	MA	Visual	Random	Specification	Specification	Log Sheet	Surface shall be free from dirt, rust, scale, oil etc. and dried.
		Insulation material appearance.	MA	-do-	-do-	-do-	-do-	-do-	Material shall be uniform and free from cracks, voids 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-	

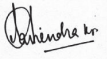
Contd. on page 23

WORKED BY :- *Prigam*REV. NO.
04CHECKED BY :- *[Signature]*

SIGN & DATE	SIGN & DATE	SIGN & DATE		PRODUCT STANDARD STEAM TURBINE ENGINEERING		ST 29005									
						PAGE 23 OF 23									
SUPERSEDES INVENTORY No.	<u>FIELD QUALITY PLAN</u>														
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.			SL NO	COMPONENT/ OPERATION	CHARACTERISTIC CHECKED	CAT	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTAN- CE NORM	FORMAT OF RECORD	REMARKS			
			03	FINISHING	Cladding material thickness	MA	Visual	Random	Appd. Drg & Specif.	Appd. Drg & Specif.	Log Sheet	Surfaces shall be uniform & free from cracks, dents etc.			
			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-					
			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-	-do-			
			Cold face temperature		MA	-do-	-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.			
			INVENTORY No.	1-5788	SIGN & DATE	24/6/88	WORKED BY: - <i>Rigam</i>								
									REV. NO.			04			CHECKED BY: - <i>[Signature]</i>

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN					TO BE FILLED BY BHEL		Project: Panki Package: TG Package Contract No.: 9962-001 Main Supplier: HEPP Haridwar Doc No.: 9962-001-HW-110-QVM-Q-223				
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING	QP. NO.:	QA/BE/QP/316/PNKI									
				REV. NO.:	00									
		DRG. NO.:	412114W4000 & 412114W4001											
		REV. NO.:	AS PER DRWAING											
		SPEC. NO.:	ST 29005											
REV. NO.:	04			Page 1 of 2										
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS		CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
1	2	3		4	5	6	7	8	9	D	10			11

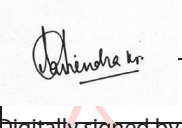
1.0	Material												
1..0	Bonded mineral / Rockwell mattresses	NOTE: NTPC approved Insulation Material Suppliers are - M/s Lloyd Insulation - Daman/ Durgapur/ Jamshedpur, M/s Minwool Rock Fibre, – Rajnandgaon / Hyderabad, M/s Rockwool India – Medak , M/s Lapninus Rockwool – Malanpur & M/s Minsulate manufacturing - Jamshedpur											
1.1	Routine tests												
1.1.1		Chemical Composition	Major	Chemical	1 Sample/lot	Vendor’s Std	Vendor’s Std	TC	√	P	V		
1.1.2		Bulk Density	Major	Physical	Sample As Per IS 8183	IS 3144	IS 8183	TC	√	P	W		
1.1.3		Recovery After Compression	Major	Physical	-do-	IS 8183	IS 8183	TC	√	P	W		
1.1.4		Shot Content	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	W		
1.1.5		Moisture Content and Moisture Absorption	Major	Physical	-do-	IS 3144	IS 8183	TC	√	P	W		
1.1.6		Incombustibility	Major	Thermal	-do-	IS 3144	IS 8183	TC	√	P	W		
1.1.7		Thermal Conductivity or K - Value	Major	Thermal	Sample As Per IS 3144	IS 3346	IS 8183	TC	√	P	W		Refer Note:1
1.1.8		Sulphur Content	Major	Chemical	Sample As Per IS 8183	IS 3144	IS 8183	TC	√	P	W		
1.1.9		Dimensional check	Major	Measurement	-do-	IS 3144	IS 8183	IR	√	P	W		
1.1.10		Fibre Diameter	Major	Measurement	-do-	IS 3144	IS 8183	IR	√	P	W		
1.1.11		Resistance to Vibration & jolting	Major	Physical	-do-	IS 3144	IS 8183	TC	√	P	V		
1.1.12		Heat Resistance	Major	Physical	-do-	IS 3144	IS 8183	TC	√	P	V		
1.1.13		Alkalinity	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	W		
1.1.14		Corrosive Attack / Chloride Content	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	W		
2.0	Sheathing Material-Aluminium Sheet (Gr.19000)												
2.1		Chemical Composition	Major	Analysis	Sample As Per IS 737	IS 737	IS 737	TC	√	P	V		
2.2		Tensile Test & Elongation	Major	Physical	-do-	IS 737	IS 737	TC	√	P	V		
2.3		Bend test	Major	Physical	-do-	IS 737	IS 737	TC	√	P	V		
2.4		Gauging / Thickness	Major	Measurement	-do-	ST 29005	ST 29005 / Appd BOM	IR	√	P	V		
3.0	Galvanised Steel / Stainless Steel Wire for Netting, Binding, Stitching & Lacing												

MANUFACTURER/SUBCONTRACTOR	 Digitally signed by Manindra Kumar Date: 2020.08.06 08:46:34 +05'30'	LEGEND: RECORDS IDENTIFIED WITH (V) 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER TC: TEST CERTIFICATE, IR INSPECTION REPORT, COC CERTIFICATE OF CONFORMANCE INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	APPROVED BY

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN				TO BE FILLED BY BHEL		Project: Panki Package: TG Package Contract No.: 9962-001 Main Supplier: HEPP Haridwar Doc No.: 9962-001-HW-110-QVM-Q-223				
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING		QP. NO.:	QA/BE/QP/316/PNKI							
					REV. NO.:	00							
			DRG. NO.:	412114W4000 & 412114W4001									
			REV. NO.:	AS PER DRWAING									
			SPEC. NO.:	ST 29005									
REV. NO.:	04			Page 2 of 2									
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	

3.1		Chemical Composition	Major	Analysis	Sample As Per IS 6528 / IS 280	IS 6528/IS 280	IS 6528 / IS 280	TC	√	P	V		
3.2		Dimensions (Size of netting & Dia / Gauge of Wire)	Major	Measurement	-do-	ST 29005	ST 29005 / Appd BOM	IR	√	P	V		
3.3		Tensile Test & Elongation	Major	Physical	-do-	IS 6528/ IS 280	IS 6528 / IS 280	TC	√	P	V		
3.4		Wrapping Test	Major	Physical	-do-	IS 6528/ IS 280	IS 6528 / IS 280	TC	√	P	V		
3.5		Bend Test	Major	Physical	-do-	IS 6528 / IS 280	IS 6528 / IS 280	TC	√	P	V		
3.6		Mass of Coating for GI Wire	Major	Measurement	-do-	IS 280	IS 280	TC	√	P	V		
4.0	Straps, Bands & Screws												
4.1		Dimensional	Major	Measurement	--	ST 29005	ST 29005	COC	-	P	-		
4.2		Visual	Major	Physical	--	ST 29005	ST 29005	COC	-	P	-		
5.0	Packing / Marking & Storage												
5.1		Identification (Batch no., Thickness, Density) & Marking	Major	Visual	100%	ST 29005	ST 29005	IR	-	P	V		
5.2		Packing & Despatch	Major	Visual	100%	ST 29005	ST 29005	IR	-	P	-		

NOTE: 1. Samples for Thermal Conductivity or 'K' Value test shall be identified by BHEL / BHEL nominated inspection agency and NTPC once in 12 months irrespective of NTPC ongoing projects and test shall be conducted at (NTPC agreed lab) CBRI Roorkee / IIT Chennai / PIBCO, NEW DELHI. The test report of the same shall be submitted to BHEL & NTPC for review and acceptance.

MANUFACTURER/SUBCONTRACTOR	 Digitally signed by Manindra Kumar Date: 2020.08.06 08:46:50 +05'30'	LEGEND: RECORDS IDENTIFIED WITH (v) 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER TC: TEST CERTIFICATE, IR INSPECTION REPORT, COC CERTIFICATE OF CONFORMANCE INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	
				APPROVED BY