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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
1	MAG10BR100	TUBE/PIPE	404	1219	5	M	
2	MAG10BR100	TUBE/PIPE	404	168.3	1	M	
3	MAG10BR100	CAP	404	114.3	1	NO	
4	MAG10BR100	CAP	404	323.8	1	NO	
5	MAG10BR100	FLANGE	404	168.3	1	NO	
6	MAG10BR100	WELDOLET	404	323.9	2	NO	
7	MAG10BR100	ELBOW	404	1219	1	NO	
8	MAG10BR100	TUBE/PIPE	404	1219	2	M	
9	MAG10BR101	ELBOW	404	323.8	2	NO	
10	MAG10BR101	TUBE/PIPE	404	323.8	4	M	
11	MAG10BR102	TUBE/PIPE	362	323.8	2	M	
12	MAG10BR102	ELBOWW	362	323.9	1	NO	
13	MAG10BR102	FLANGE	362	323.9	1	NO	
14	MAG10BR102	FLANGE	362	323.9	1	NO	
15	MAG10BR102	TEE	362	323.9	1	NO	
16	MAG10BR102	TUBE/PIPE	362	323.9	9	M	
17	MAG10BR110	TUBE/PIPE	404	114.3	1	M	
18	MAG10BR110	TUBE/PIPE	404	1219	4	M	
19	MAG10BR110	TUBE/PIPE	404	168.3	1	M	
20	MAG10BR110	CAP	404	114.3	1	NO	
21	MAG10BR110	CAP	404	323.8	1	NO	
22	MAG10BR110	FLANGE	404	168.3	1	NO	
23	MAG10BR110	WELDOLET	404	323.9	2	NO	
24	MAG10BR110	ELBOW	404	1219	1	NO	
25	MAG10BR110	TUBE/PIPE	404	1219	3	M	
26	MAG10BR111	ELBOW	404	323.8	2	NO	
27	MAG10BR111	TUBE/PIPE	404	323.8	4	M	
28	MAG10BR112	ELBOW	362	323.9	1	NO	
29	MAG10BR112	FLANGEGE	362	323.9	1	NO	
30	MAG10BR112	FLANGE	362	323.9	1	NO	
31	MAG10BR112	TEE	362	323.9	1	NO	
32	MAG10BR112	TUBE/PIPE	362	323.9	13	M	
33	MAL01BR001	ELBOW	593	323.8	2	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
34	MAL01BR001	TUBE/PIPE	593	323.8	3	M	
35	MAL01BR001	CAP	593	323.9	1	NO	
36	MAL01BR001	/ELDWELDOLE	593	323.9	4	NO	
37	MAL01BR001	WELDOLET	593	323.9	1	NO	
38	MAL02BR001	ELBOW	593	323.8	1	NO	
39	MAL02BR001	TUBE/PIPE	593	323.8	3	M	
40	MAL02BR001	CAP	593	323.9	1	NO	
41	MAL02BR001	WELDOLET	593	323.9	3	NO	
42	MAL02BR001	WELDOLET	593	323.9	1	NO	
43	MAL03BR001	ELBOW	593	323.8	1	NO	
44	MAL03BR001	TUBE/PIPE	593	323.8	5	M	
45	MAL03BR001	CAP	593	323.9	1	NO	
46	MAL03BR001	WELDOLET	593	323.9	1	NO	
47	MAL03BR001	WELDOLET	593	323.9	5	NO	
48	MAL03BR001	WELDOLET	593	323.9	1	NO	
49	MAL04BR001	ELBOW	593	323.8	2	NO	
50	MAL04BR001	TUBE/PIPE	593	323.8	4	M	
51	MAL04BR001	CAP	593	323.9	1	NO	
52	MAL04BR001	WELDOLET	593	323.9	1	NO	
53	MAL04BR001	WELDOLET	593	323.9	3	NO	
54	MAL04BR001	WELDOLET	593	323.9	2	NO	
55	MAL11BR001	TEE	573	60.3	1	NO	
56	MAL11BR001	BEND	573	60.3	3	NO	
57	MAL11BR001	BEND	573	60.3	1	NO	
58	MAL11BR001	VALVEE	573	60.3	1	NO	
59	MAL11BR001	CAP	573	60.3	1	NO	
60	MAL11BR001	ELBOW	573	60.3	10	NO	
61	MAL11BR001	TUBE/PIPE	573	60.3	2	M	
62	MAL11BR001	TUBE/PIPE	573	60.3	18	M	
63	MAL11BR001	VALVE	573	60.3	1	NO	
64	MAL12BR001	TEE	573	60.3	1	NO	
65	MAL12BR001	BEND	573	60.3	1	NO	
66	MAL12BR001	BEND	573	60.3	9	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
67	MAL12BR001	VALVE	573	60.3	1	NO	
68	MAL12BR001	CAP	573	60.3	1	NO	
69	MAL12BR001	ELBOW	573	60.3	2	NO	
70	MAL12BR001	TUBE/PIPE	573	60.3	1	M	
71	MAL12BR001	TUBE/PIPE	573	60.3	12	M	
72	MAL12BR001	VALVE	573	60.3	1	NO	
73	MAL14BR001	TEE	461	48.3	1	NO	
74	MAL14BR001	BEND	461	48.3	16	NO	
75	MAL14BR001	VALVE	461	48.3	1	NO	
76	MAL14BR001	CAP	461	48.3	1	NO	
77	MAL14BR001	TUBE/PIPE	461	48.3	20	M	
78	MAL14BR001	VALVE	461	48.3	1	NO	
79	MAL19BR001	TEE	573	60.3	1	NO	
80	MAL19BR001	BEND	573	60.3	1	NO	
81	MAL19BR001	BEND	573	60.3	15	NO	
82	MAL19BR001	VALVE	573	60.3	1	NO	
83	MAL19BR001	CAP	573	60.3	1	NO	
84	MAL19BR001	TUBE/PIPE	573	60.3	1	M	
85	MAL19BR001	TUBE/PIPE	573	60.3	18	M	
86	MAL19BR001	VALVE	573	60.3	1	NO	
87	MAL20BR001	TUBE/PIPE	520	60.3	3	M	
88	MAL20BR001	REDU	520	114.3	1	NO	
89	MAL20BR001	VALVE	520	60.3	1	NO	
90	MAL20BR001	CAP	520	60.3	1	NO	
91	MAL20BR001	ELBOW	520	60.3	4	NO	
92	MAL20BR001	VALVE	520	60.3	1	NO	
93	MAL20BR001	TEE	520	60.3	1	NO	
94	MAL20BR001	TUBE/PIPE	520	60.3	20	M	
95	MAL22BR001	ELBOW	461	48.3	2	NO	
96	MAL22BR001	TUBE/PIPE	461	48.3	4	M	
97	MAL22BR002	ELBOW	461	48.3	7	NO	
98	MAL22BR002	TUBE/PIPE	461	48.3	5	M	
99	MAL22BR003	TUBE/PIPE	461	60.3	5	M	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
100	MAL22BR003	REDU	461	60.3	1	NO	
101	MAL22BR003	REDU	461	114.3	1	NO	
102	MAL22BR003	TEE	461	60.3	1	NO	
103	MAL22BR003	VALVE	461	60.3	1	NO	
104	MAL22BR003	CAP	461	60.3	1	NO	
105	MAL22BR003	ELBOW	461	60.3	4	NO	
106	MAL22BR003	VALVE	461	60.3	1	NO	
107	MAL22BR003	TEE	461	60.3	1	NO	
108	MAL22BR003	TUBE/PIPE	461	60.3	15	M	
109	MAL22BR003	TUBE/PIPE	461	60.3	1	M	
110	MAL23BR001	ELBOW	601	33.4	1	NO	
111	MAL23BR001	TUBE/PIPE	601	33.4	2	M	
112	MAL23BR001	TEE	601	60.3	1	NO	
113	MAL23BR001	TEE	601	60.3	1	NO	
114	MAL23BR001	BEND	601	60.3	1	NO	
115	MAL23BR001	BEND	601	33.4	2	NO	
116	MAL23BR001	VALVE	601	33.4	2	NO	
117	MAL23BR001	VALVE	601	60.3	1	NO	
118	MAL23BR001	CAP	601	60.3	1	NO	
119	MAL23BR001	ELBOW	601	60.3	12	NO	
120	MAL23BR001	TUBE/PIPE	601	60.3	1	M	
121	MAL23BR001	TUBE/PIPE	601	60.3	19	M	
122	MAL23BR001	VALVE	601	60.3	1	NO	
123	MAL23BR001	VALVE	601	33.4	1	NO	
124	MAL24BR001	TUBE/PIPE	601	33.4	1	M	
125	MAL24BR001	TEE	601	60.3	1	NO	
126	MAL24BR001	TEE	601	60.3	1	NO	
127	MAL24BR001	BEND	601	33.4	2	NO	
128	MAL24BR001	BEND	601	60.3	2	NO	
129	MAL24BR001	BEND	601	60.3	11	NO	
130	MAL24BR001	BEND	601	33.4	2	NO	
131	MAL24BR001	VALVE	601	33.4	2	NO	
132	MAL24BR001	VALVE	601	60.3	1	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
133	MAL24BR001	CAP	601	60.3	1	NO	
134	MAL24BR001	ELBOW	601	60.3	3	NO	
135	MAL24BR001	TUBE/PIPE	601	60.3	3	M	
136	MAL24BR001	TUBE/PIPE	601	60.3	23	M	
137	MAL24BR001	VALVE	601	60.3	1	NO	
138	MAL24BR001	VALVE	601	33.4	1	NO	
139	MAL25BR001	ELBOW	420	48.3	2	NO	
140	MAL25BR001	TUBE/PIPE	420	48.3	12	M	
141	MAL25BR001	BEND	420	48.3	9	NO	
142	MAL25BR001	CAP	420	48.3	1	NO	
143	MAL25BR001	TEE	420	48.3	1	NO	
144	MAL25BR001	VALVE	420	48.3	1	NO	
145	MAL25BR001	VALVE	420	48.3	1	NO	
146	MAL25BR001	TUBE/PIPE	420	48.3	1	M	
147	MAL26BR001	TEE	601	60.3	1	NO	
148	MAL26BR001	VALVE	601	60.3	1	NO	
149	MAL26BR001	CAP	601	60.3	1	NO	
150	MAL26BR001	ELBOW	601	60.3	10	NO	
151	MAL26BR001	TUBE/PIPE	601	60.3	3	M	
152	MAL26BR001	TUBE/PIPE	601	60.3	13	M	
153	MAL26BR001	VALVE	601	60.3	1	NO	
154	MAL27BR001	TEE	601	60.3	1	NO	
155	MAL27BR001	BEND	601	60.3	10	NO	
156	MAL27BR001	VALVE	601	60.3	1	NO	
157	MAL27BR001	CAP	601	60.3	1	NO	
158	MAL27BR001	ELBOW	601	60.3	1	NO	
159	MAL27BR001	TUBE/PIPE	601	60.3	3	M	
160	MAL27BR001	TUBE/PIPE	601	60.3	16	M	
161	MAL27BR001	VALVE	601	60.3	1	NO	
162	MAL31BR001	REDU	601	60.3	1	NO	
163	MAL31BR001	TEE	601	60.3	1	NO	
164	MAL31BR001	TEE	601	60.3	1	NO	
165	MAL31BR001	BEND	601	60.3	4	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
166	MAL31BR001	VALVE	601	60.3	1	NO	
167	MAL31BR001	CAP	601	60.3	1	NO	
168	MAL31BR001	TUBE/PIPE	601	60.3	5	M	
169	MAL31BR001	TUBE/PIPE	601	60.3	3	M	
170	MAL31BR001	VALVE	601	60.3	1	NO	
171	MAL31BR002	TUBE/PIPE	601	33.4	12	M	
172	MAL31BR002	BEND	601	33.4	6	NO	
173	MAL31BR003	TUBE/PIPE	601	33.4	7	M	
174	MAL31BR003	BEND	601	33.4	3	NO	
175	MAL31BR003	WELDOLET	601	323.9	1	NO	
176	MAL41BR001	TUBE/PIPE	458	60.3	4	M	
177	MAL41BR001	TEE	458	60.3	1	NO	
178	MAL41BR001	BEND	458	60.3	1	NO	
179	MAL41BR001	BEND	458	60.3	8	NO	
180	MAL41BR001	VALVE	458	60.3	1	NO	
181	MAL41BR001	CAP	458	60.3	1	NO	
182	MAL41BR001	TUBE/PIPE	458	60.3	9	M	
183	MAL41BR001	VALVE	458	60.3	1	NO	
184	MAL41BR002	BEND	458	48.3	3	NO	
185	MAL41BR002	BEND	458	48.3	1	NO	
186	MAL41BR002	TUBE/PIPE	458	48.3	6	M	
187	MAL45BR001	TUBE/PIPE	503	60.3	14	M	
188	MAL45BR001	BEND	503	60.3	1	NO	
189	MAL45BR001	BEND	503	60.3	10	NO	
190	MAL45BR001	VALVE	503	60.3	1	NO	
191	MAL45BR001	CAP	503	60.3	1	NO	
192	MAL45BR001	TEE	503	60.3	1	NO	
193	MAL45BR001	VALVE	503	60.3	1	NO	
194	MAL47BR001	TUBE/PIPE	427	60.3	5	M	
195	MAL47BR001	BEND	427	60.3	1	NO	
196	MAL47BR001	BEND	427	60.3	4	NO	
197	MAL47BR001	CAP	427	60.3	1	NO	
198	MAL47BR001	TEE	427	60.3	1	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
199	MAL47BR001	VALVE	427	60.3	1	NO	
200	MAL47BR001	VALVE	427	60.3	1	NO	
201	MAL51BR001	CAP	291	60.3	1	NO	
202	MAL51BR001	TUBE/PIPE	291	60.3	4	M	
203	MAL51BR001	BEND	291	60.3	5	NO	
204	MAL51BR001	VALVE	291	60.3	1	NO	
205	MAL51BR001	TEE	291	60.3	1	NO	
206	MAL51BR001	TEE	291	60.3	1	NO	
207	MAL51BR001	VALVE	291	60.3	1	NO	
208	MAL51BR002	TUBE/PIPE	291	33.4	11	M	
209	MAL51BR002	TEE	291	33.4	1	NO	
210	MAL51BR002	BEND	291	33.4	5	NO	
211	MAL51BR003	TUBE/PIPE	291	33.4	8	M	
212	MAL51BR003	BEND	291	33.4	4	NO	
213	MAL54BR001	CAP	187.3	60.3	1	NO	
214	MAL54BR001	TUBE/PIPE	187.3	60.3	19	M	
215	MAL54BR001	TUBE/PIPE	187.3	73	1	M	
216	MAL54BR001	BEND	187.3	60.3	6	NO	
217	MAL54BR001	VALVE	187.3	60.3	1	NO	
218	MAL54BR001	TEE	187.3	60.3	1	NO	
219	MAL54BR001	VALVE	187.3	60.3	1	NO	
220	MAL55BR001	TUBE/PIPE	121.2	60.3	1	M	
221	MAL55BR001	ELBOW	121.2	60.3	1	NO	
222	MAL55BR001	CAP	121.2	60.3	1	NO	
223	MAL55BR001	TUBE/PIPE	121.2	60.3	26	M	
224	MAL55BR001	TUBE/PIPE	121.2	73	1	M	
225	MAL55BR001	BEND	121.2	60.3	8	NO	
226	MAL55BR001	VALVE	121.2	60.3	1	NO	
227	MAL55BR001	TEE	121.2	60.3	1	NO	
228	MAL55BR001	VALVE	121.2	60.3	1	NO	
229	MAL65BR001	TEE	480	60.3	1	NO	
230	MAL65BR001	BEND	480	60.3	5	NO	
231	MAL65BR001	CAP	480	60.3	1	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
232	MAL65BR001	ELBOW	480	60.3	2	NO	
233	MAL65BR001	TUBE/PIPE	480	60.3	19	M	
234	MAL65BR001	VALVE	480	60.3	1	NO	
235	MAL65BR001	VALVE	480	60.3	1	NO	
236	MAL81BR001	CAP	540	33.4	1	NO	
237	MAL81BR001	TUBE/PIPE	540	33.4	12	M	
238	MAL81BR001	BEND	540	33.4	6	NO	
239	MAL81BR001	VALVE	540	33.4	1	NO	
240	MAL81BR001	TEE	540	33.4	3	NO	
241	MAL81BR001	VALVE	540	33.4	1	NO	
242	MAL81BR001	TUBE/PIPE	540	33.4	1	M	
243	MAL81BR002	TUBE/PIPE	540	33.4	6	M	
244	MAL81BR002	BEND	540	33.4	6	NO	
245	MAL81BR004	TUBE/PIPE	540	33.4	9	M	
246	MAL81BR004	BEND	540	33.4	6	NO	
247	MAL81BR004	INST	540	33.4	1	NO	
248	MAL91BR001	TUBE/PIPE	601	33.4	29	M	
249	MAL91BR001	REDU	601	60.3	1	NO	
250	MAL91BR001	BEND	601	33.4	22	NO	
251	MAL91BR001	INST	601	33.4	1	NO	
252	MAL91BR001	TEE	601	33.4	1	NO	
253	MAL92BR001	TUBE/PIPE	601	33.4	2	M	
254	MAL92BR001	REDU	601	60.3	1	NO	
255	MAL92BR001	BEND	601	33.4	2	NO	
256	MAL92BR001	INST	601	33.4	1	NO	
257	MAL92BR001	TUBE/PIPE	601	60.3	1	M	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
1	LBC41BR001	ELBOW	383	273	2	NO	
2	LBC41BR001	TUBE/PIPE	383	273	2	M	
3	LBC41BR001	ELBOW	383	168.3	6	NO	
4	LBC41BR001	VALVE	383	273	1	NO	
5	LBC41BR001	TUBE/PIPE	383	168.3	11	M	
6	MAM10BR001	TUBE/PIPE	565	48.3	15	M	
7	MAM10BR001	BEND	565	48.3	2	NO	
8	MAM10BR001	BEND	565	48.3	7	NO	
9	MAM10BR002	TUBE/PIPE	565	48.3	17	M	
10	MAM10BR002	BEND	565	48.3	9	NO	
11	MAM10BR003	TUBE/PIPE	565	48.3	31	M	
12	MAM10BR003	BEND	565	48.3	2	NO	
13	MAM10BR003	BEND	565	48.3	8	NO	
14	MAM10BR004	TUBE/PIPE	565	48.3	6	M	
15	MAM10BR004	BEND	565	48.3	5	NO	
16	MAM10BR005	TUBE/PIPE	565	26.7	20	M	
17	MAM10BR005	BEND	565	26.7	1	NO	
18	MAM10BR005	BEND	565	26.7	10	NO	
19	MAM10BR008	TUBE/PIPE	565	60.3	6	M	
20	MAM10BR008	BEND	565	60.3	2	NO	
21	MAM10BR008	BEND	565	60.3	5	NO	
22	MAM10BR008	CAP	565	60.3	1	NO	
23	MAM10BR008	TEE	565	60.3	2	NO	
24	MAM10BR010	TUBE/PIPE	565	60.3	8	M	
25	MAM10BR010	BEND	565	60.3	3	NO	
26	MAM10BR010	BEND	565	60.3	1	NO	
27	MAM10BR010	CAP	565	60.3	1	NO	
28	MAM10BR010	TEE	565	60.3	2	NO	
29	MAM10BR010	TUBE/PIPE	565	60.3	7	M	
30	MAM20BR001	TUBE/PIPE	405	33.4	4	M	
31	MAM20BR001	BEND	405	33.4	5	NO	
32	MAM20BR002	TUBE/PIPE	304	33.4	4	M	
33	MAM20BR002	BEND	304	33.4	5	NO	

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)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
34	MAM20BR003	TUBE/PIPE	411	48.3	10	M	
35	MAM20BR003	BEND	411	48.3	5	NO	
36	MAM20BR003	FTUB	411	48.3	1	NO	
37	MAM20BR005	ELBOW	405	88.9	3	NO	
38	MAM20BR005	CAP	405	88.9	1	NO	
39	MAM20BR005	TUBE/PIPE	405	33.4	1	M	
40	MAM20BR005	TUBE/PIPE	405	48.3	1	M	
41	MAM20BR005	TUBE/PIPE	405	88.9	9	M	
42	MAM20BR005	BEND	405	33.4	2	NO	
43	MAM20BR005	BEND	405	48.3	1	NO	
44	MAM20BR005	WELDOLET	405	88.9	1	NO	
45	MAM20BR006	TUBE/PIPE	565	48.3	7	M	
46	MAM20BR006	BEND	565	48.3	9	NO	
47	MAM20BR006	FTUB	565	48.3	1	NO	
48	MAM20BR007	ELBOW	565	48.3	7	NO	
49	MAM20BR007	TUBE/PIPE	565	48.3	8	M	
50	MAM20BR007	BEND	565	48.3	1	NO	
51	MAM20BR007	FTUB	565	48.3	1	NO	
52	MAM20BR008	ELBOW	565	114.3	3	NO	
53	MAM20BR008	TUBE/PIPE	565	114.3	10	M	
54	MAM20BR008	BEND	565	114.3	1	NO	
55	MAM20BR008	CAP	565	114.3	1	NO	
56	MAM20BR008	WELDOLET	565	114.3	1	NO	
57	MAM20BR008	TEE	565	114.3	4	NO	
58	MAM20BR009	ELBOW	565	48.3	9	NO	
59	MAM20BR009	TUBE/PIPE	565	48.3	8	M	
60	MAM20BR009	BEND	565	48.3	1	NO	
61	MAM20BR009	FTUB	565	48.3	1	NO	
62	MAM20BR010	TUBE/PIPE	565	48.3	9	M	
63	MAM20BR010	BEND	565	48.3	9	NO	
64	MAM20BR010	FTUB	565	48.3	1	NO	
65	MAM30BR001	TUBE/PIPE	593	42.2	14	M	
66	MAM30BR001	BEND	593	42.2	3	NO	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
67	MAM30BR001	BEND	593	42.2	6	NO	
68	MAM30BR002	TUBE/PIPE	593	42.2	28	M	
69	MAM30BR002	BEND	593	42.2	1	NO	
70	MAM30BR002	BEND	593	42.2	14	NO	
71	MAM30BR003	TUBE/PIPE	593	42.2	43	M	
72	MAM30BR003	BEND	593	42.2	17	NO	
73	MAM30BR004	TUBE/PIPE	593	42.2	5	M	
74	MAM30BR004	BEND	593	42.2	1	NO	
75	MAM30BR008	TUBE/PIPE	593	60.3	9	M	
76	MAM30BR008	BEND	593	60.3	7	NO	
77	MAM30BR008	CAP	593	60.3	1	NO	
78	MAM30BR008	TEE	593	60.3	2	NO	
79	MAM30BR010	TUBE/PIPE	593	60.3	6.5	M	
80	MAM30BR010	BEND	593	60.3	4	NO	
81	MAM30BR010	CAP	593	60.3	1	NO	
82	MAM30BR010	TEE	593	60.3	2	NO	
83	MAM30BR010	TUBE/PIPE	593	60.3	8.5	M	
84	MAM40BR001	TUBE/PIPE	280	33.4	5.5	M	
85	MAM40BR001	BEND	280	33.4	7	NO	
86	MAM40BR002	TUBE/PIPE	280	33.4	1	M	
87	MAM40BR002	BEND	280	60.3	8	NO	
88	MAM40BR002	WELDOLET	280	60.3	1	NO	
89	MAM40BR002	REDU	280	60.3	1	NO	
90	MAM40BR002	TEE	280	60.3	1	NO	
91	MAM40BR002	TUBE/PIPE	280	60.3	12.5	M	
92	MAM40BR003	TUBE/PIPE	280	33.4	5.5	M	
93	MAM40BR003	BEND	280	33.4	7	NO	
94	MAM40BR004	TUBE/PIPE	280	33.4	1	M	
95	MAM40BR004	BEND	280	60.3	3	NO	
96	MAM40BR004	WELDOLET	280	60.3	1	NO	
97	MAM40BR004	REDU	280	60.3	1	NO	
98	MAM40BR004	TEE	280	60.3	1	NO	
99	MAM40BR004	TUBE/PIPE	280	60.3	11	M	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
100	MAM40BR006	ELBOW	280	88.9	1	NO	
101	MAM40BR006	TUBE/PIPE	280	88.9	1	M	
102	MAM40BR006	CAP	280	88.9	1	NO	
103	MAM40BR006	TEE	280	88.9	2	NO	
104	MAW10BR001	ELBOW	470	219.1	3	NO	
105	MAW10BR001	TEE	470	219.1	1	NO	
106	MAW10BR001	TUBE/PIPE	470	219.1	1.5	M	
107	MAW10BR001	VALVE	470	219.1	1	NO	
108	MAW10BR101	ELBOW	335	114.3	2	NO	
109	MAW10BR101	TUBE/PIPE	335	114.3	1	M	
110	MAW10BR101	TEE	335	114.3	1	NO	
111	MAW10BR101	VALVE	335	219.1	1	NO	
112	MAW10BR101	VALVE	335	114.3	1	NO	
113	MAW10BR103	ELBOW	335	114.3	2	NO	
114	MAW10BR103	TUBE/PIPE	335	114.3	1	M	
115	MAW10BR103	REDU	335	219.1	1	NO	
116	MAW10BR103	BEND	335	114.3	1	NO	
117	MAW10BR103	VALVE	335	114.3	1	NO	
118	MAW10BR104	TUBE/PIPE	470	219.1	2	M	
119	MAW10BR104	BEND	470	219.1	2	NO	
120	MAW20BR001	TUBE/PIPE	470	273	1	M	
121	MAW20BR001	ELBOW	470	273	2	NO	
122	MAW20BR001	FLANGE	470	273	1	NO	
123	MAW20BR001	FLANGE	470	273	1	NO	
124	MAW20BR001	REDU	470	323.8	1	NO	
125	MAW20BR001	TEE	470	273	2	NO	
126	MAW20BR001	TUBE/PIPE	470	273	4	M	
127	MAW20BR002	TUBE/PIPE	470	323.9	3.5	M	
128	MAW20BR002	BEND	470	323.9	3	NO	
129	MAW20BR002	WELDOLET	470	323.9	1	NO	
130	MAW20BR002	WELDOLET	470	323.9	1	NO	
131	MAW20BR002	REDU	470	323.8	1	NO	
132	MAW20BR002	TEE	470	323.8	2	NO	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
133	MAW20BR002	TEE	470	323.8	1	NO	
134	MAW20BR003	TEE	501	273.1	1	NO	
135	MAW20BR003	ELBOW	501	273	2	NO	
136	MAW20BR003	FLANGE	501	273	1	NO	
137	MAW20BR003	FLANGE	501	273	1	NO	
138	MAW20BR003	WELDOLET	501	273	1	NO	
139	MAW20BR003	WELDOLET	501	273	2	NO	
140	MAW20BR003	TEE	501	273	1	NO	
141	MAW20BR003	TEE	501	273	1	NO	
142	MAW20BR003	TUBE/PIPE	501	273	11	M	
143	MAW20BR004	TUBE/PIPE	470	88.9	1	M	
144	MAW20BR004	BEND	470	88.9	1	NO	
145	MAW20BR004	FLANGE	470	88.9	1	NO	
146	MAW20BR004	FLANGE	470	88.9	1	NO	
147	MAW20BR004	WELDOLET	470	88.9	1	NO	
148	MAW20BR005	ELBOW	501	33.4	2	NO	
149	MAW20BR005	TUBE/PIPE	501	21.3	1	M	
150	MAW20BR005	TUBE/PIPE	501	33.4	1	M	
151	MAW20BR005	TUBE/PIPE	501	88.9	5	M	
152	MAW20BR005	REDU	501	33.4	2	NO	
153	MAW20BR005	BEND	501	88.9	2	NO	
154	MAW20BR005	BEND	501	88.9	2	NO	
155	MAW20BR005	VALVE	501	16.8	2	NO	
156	MAW20BR005	CAP	501	88.9	1	NO	
157	MAW20BR005	WELDOLET	501	88.9	2	NO	
158	MAW21BR001	ELBOW	470	114.3	3	NO	
159	MAW21BR001	TUBE/PIPE	470	114.3	6	M	
160	MAW21BR001	FLANGE	470	114.3	2	NO	
161	MAW21BR002	ELBOW	470	114.3	3	NO	
162	MAW21BR002	TUBE/PIPE	470	114.3	7	M	
163	MAW21BR002	FLANGE	470	114.3	2	NO	
164	MAW21BR003	TUBE/PIPE	470	168.3	6.5	M	
165	MAW21BR003	REDU	470	168.3	1	NO	

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
166	MAW21BR003	BEND	470	168.3	3	NO	
167	MAW21BR003	TEE	470	168.3	1	NO	
168	MAW22BR001	ELBOW	470	168.3	3	NO	
169	MAW22BR001	TUBE/PIPE	470	168.3	9	M	
170	MAW22BR001	REDU	470	168.3	1	NO	
171	MAW22BR001	TEE	470	168.3	1	NO	
172	MAW22BR002	ELBOW	470	114.3	3	NO	
173	MAW22BR002	TUBE/PIPE	470	114.3	6	M	
174	MAW22BR002	BEND	470	114.3	1	NO	
175	MAW22BR002	FLANGE	470	114.3	2	NO	
176	MAW22BR003	ELBOW	470	114.3	3	NO	
177	MAW22BR003	TUBE/PIPE	470	114.3	5	M	
178	MAW22BR003	BEND	470	114.3	1	NO	
179	MAW22BR003	FLANGE	470	114.3	2	NO	
180	MAW23BR001	ELBOW	470	114.3	4	NO	
181	MAW23BR001	TUBE/PIPE	470	114.3	5.5	M	
182	MAW23BR001	FLANGE	470	114.3	2	NO	
183	MAW23BR002	ELBOW	470	114.3	3	NO	
184	MAW23BR002	TUBE/PIPE	470	114.3	6	M	
185	MAW23BR002	FLANGE	470	114.3	2	NO	
186	MAW23BR003	ELBOW	470	168.3	3	NO	
187	MAW23BR003	TUBE/PIPE	470	168.3	9.5	M	
188	MAW23BR003	REDU	470	168.3	1	NO	
189	MAW23BR003	TEE	470	168.3	1	NO	
190	MAW24BR001	ELBOW	470	141.3	2	NO	
191	MAW24BR001	TUBE/PIPE	470	141.3	5	M	
192	MAW24BR001	REDU	470	141.3	1	NO	
193	MAW24BR002	ELBOW	470	141.3	2	NO	
194	MAW24BR002	TUBE/PIPE	470	141.3	4	M	
195	MAW24BR002	REDU	470	141.3	1	NO	
196	MAW24BR003	ELBOW	470	168.3	7	NO	
197	MAW24BR003	TUBE/PIPE	470	168.3	8.5	M	
198	MAW24BR003	REDU	470	168.3	1	NO	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
199	MAW24BR003	TEE	470	168.3	1	NO	
200	MAW24BR004	ELBOW	470	114.3	2	NO	
201	MAW24BR004	TUBE/PIPE	470	114.3	3	M	
202	MAW24BR004	FLANGE	470	114.3	2	NO	
203	MAW24BR005	ELBOW	470	114.3	2	NO	
204	MAW24BR005	TUBE/PIPE	470	114.3	2.5	M	
205	MAW24BR005	FLANGE	470	114.3	2	NO	
206	MAW25BR001	ELBOW	501	114.3	5	NO	
207	MAW25BR001	TUBE/PIPE	501	114.3	9	M	
208	MAW25BR001	BEND	501	114.3	2	NO	
209	MAW25BR001	FLANGE	501	114.3	2	NO	
210	MAW26BR001	ELBOW	501	114.3	7	NO	
211	MAW26BR001	TUBE/PIPE	501	114.3	9.5	M	
212	MAW26BR001	FLANGE	501	114.3	2	NO	
213	MAW50BR001	ELBOW	280	406.4	1	NO	
214	MAW50BR001	TUBE/PIPE	280	406.4	2	M	
215	MAW50BR001	REDU	280	406.4	1	NO	
216	MAW50BR001	BEND	280	406.4	1	NO	
217	MAW50BR001	ELBOW	280	406.4	1	NO	
218	MAW50BR001	WELDOLET	280	406.4	1	NO	
219	MAW50BR001	WELDOLET	280	406.4	2	NO	
220	MAW50BR001	TEE	280	406.4	1	NO	
221	MAW50BR001	VALVE	280	406.4	1	NO	
222	MAW50BR001	VALVE	280	457.2	1	NO	
223	MAW50BR002	ELBOW	540	457.2	9	NO	
224	MAW50BR002	TUBE/PIPE	540	457.2	12.5	M	
225	MAW50BR002	BEND	540	457.2	2	NO	
226	MAW50BR002	ELBOW	540	457.2	1	NO	
227	MAW50BR002	TEE	540	457	1	NO	
228	MAW50BR002	VALVE	540	457.2	1	NO	
229	MAW50BR003	FLANGE	280	168.3	1	NO	
230	MAW50BR003	TUBE/PIPE	280	168.3	1	M	
231	MAW50BR003	BEND	280	168.3	1	NO	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
232	MAW50BR003	FLANGE	280	168.3	1	NO	
233	MAW50BR003	WELDOLET	280	168.3	1	NO	
234	MAW50BR103	ELBOW	280	406.4	2	NO	
235	MAW50BR103	TUBE/PIPE	280	406.4	1	M	
236	MAW50BR103	VALVE	280	406.4	1	NO	
237	MAW50BR104	ELBOW	540	457.2	2	NO	
238	MAW50BR104	TUBE/PIPE	540	457.2	1.5	M	
239	MAW50BR104	REDU	540	457.2	1	NO	
240	MAW60BR001	ELBOW	430	114.3	2	NO	
241	MAW60BR001	TUBE/PIPE	430	114.3	4	M	
242	MAW60BR001	BEND	430	114.3	1	NO	
243	MAW60BR002	ELBOW	347	114.3	2	NO	
244	MAW60BR002	TUBE/PIPE	347	114.3	4	M	
245	MAW60BR002	BEND	347	114.3	1	NO	
246	MAW60BR003	ELBOW	430	168.3	2	NO	
247	MAW60BR003	TUBE/PIPE	430	168.3	5	M	
248	MAW60BR003	BEND	430	168.3	1	NO	
249	MAW60BR003	CAP	430	168.3	1	NO	
250	MAW60BR003	TEE	430	168.3	2	NO	
251	MAW60BR004	ELBOW	430	114.3	5	NO	
252	MAW60BR004	TUBE/PIPE	430	114.3	5	M	
253	MAW60BR004	BEND	430	114.3	1	NO	
254	MAW60BR005	ELBOW	430	114.3	5	NO	
255	MAW60BR005	TUBE/PIPE	430	114.3	5.5	M	
256	MAW60BR005	BEND	430	114.3	1	NO	
257	MAW60BR006	ELBOW	430	168.3	2	NO	
258	MAW60BR006	TUBE/PIPE	430	168.3	3	M	
259	MAW60BR006	BEND	430	168.3	1	NO	
260	MAW60BR006	CAP	430	168.3	1	NO	
261	MAW60BR006	TEE	430	168.3	2	NO	
262	MAW60BR007	BEND	430	219.1	3	NO	
263	MAW60BR007	CAP	430	219.1	1	NO	
264	MAW60BR007	ELBOW	430	219.1	6	NO	

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
265	MAW60BR007	WELDOLET	430	219.1	1	NO	
266	MAW60BR007	WELDOLET	430	219.1	1	NO	
267	MAW60BR007	TEE	430	219.1	2	NO	
268	MAW60BR007	TUBE/PIPE	430	219.1	15.5	M	
269	MAW60BR008	TUBE/PIPE	430	114.3	1	M	
270	MAW60BR008	TUBE/PIPE	430	48.3	1	M	
271	MAW60BR008	CAP	430	114.3	1	NO	
272	MAW80BR001	TUBE/PIPE	225	141.3	1	M	
273	MAW80BR001	TUBE/PIPE	225	323.8	4	M	
274	MAW80BR001	ELBOW	225	323.9	6	NO	
275	MAW80BR001	FLANGE	225	141.3	1	NO	
276	MAW80BR001	TEE	225	323.9	1	NO	
277	MAW80BR001	TEE	225	323.9	1	NO	
278	MAW80BR001	TEE	225	323.8	1	NO	
279	MAW80BR001	TUBE/PIPE	225	323.9	25	M	
280	MAW80BR001	VALVE	225	323.9	2	NO	
281	MAW80BR002	TUBE/PIPE	310	88.9	1	M	
282	MAW80BR002	BEND	310	88.9	2	NO	
283	MAW80BR002	REDU	310	323.9	1	NO	
284	MAW80BR002	ELBOW	310	323.9	5	NO	
285	MAW80BR002	REDU	310	273.1	1	NO	
286	MAW80BR002	TEE	310	273	1	NO	
287	MAW80BR002	TEE	310	273	1	NO	
288	MAW80BR002	TUBE/PIPE	310	273.1	6.5	M	
289	MAW80BR002	TUBE/PIPE	310	323.9	7	M	
290	MAW80BR003	CAP	310	219.1	1	NO	
291	MAW80BR003	TEE	310	219.1	2	NO	
292	MAW80BR003	TUBE/PIPE	310	219.1	2.5	M	
293	MAW80BR004	TUBE/PIPE	225	33.4	1	M	
294	MAW80BR004	TUBE/PIPE	225	60.3	1	M	
295	MAW80BR004	ELBOW	225	273	5	NO	
296	MAW80BR004	FLANGE	225	60.3	1	NO	
297	MAW80BR004	FLANGE	225	60.3	1	NO	

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
298	MAW80BR004	TUBE/PIPE	225	273.1	5.5	M	
299	MAW80BR005	ELBOW	310	33.4	1	NO	
300	MAW80BR005	TUBE/PIPE	310	33.4	2	M	
301	MAW80BR005	REDU	310	33.4	2	NO	
302	MAW80BR005	BEND	310	33.4	6	NO	
303	MAW80BR005	TEE	310	33.4	1	NO	
304	MAW80BR006	ELBOW	310	33.4	5	NO	
305	MAW80BR006	TUBE/PIPE	310	33.4	3	M	
306	MAW80BR006	REDU	310	33.4	2	NO	
307	MAW80BR006	TEE	310	33.4	1	NO	
308	MAW80BR008	ELBOW	100	168.3	5	NO	
309	MAW80BR008	TUBE/PIPE	100	168.3	9	M	
310	MAW80BR008	REDU	100	219.1	1	NO	
311	MAW80BR008	COUP	100	168.3	1	NO	
312	MAW80BR008	FLANGE	100	168.3	2	NO	
313	MAW80BR008	TEE	100	168.3	1	NO	
314	MAW80BR008	VALVE	100	168.3	1	NO	
315	MAW80BR009	ELBOW	100	168.3	2	NO	
316	MAW80BR009	TUBE/PIPE	100	168.3	1	M	
317	MAW80BR009	REDU	100	219.1	1	NO	
318	MAW80BR009	COUP	100	168.3	1	NO	
319	MAW80BR009	FLANGE	100	168.3	2	NO	
320	MAW80BR009	VALVE	100	168.3	1	NO	
321	MAW80BR012	TUBE/PIPE	100	219.1	1	M	
322	MAW80BR012	TUBE/PIPE	100	33.4	1	M	
323	MAW80BR012	ELBOW	100	219.1	2	NO	
324	MAW80BR012	FLANGE	100	219.1	2	NO	
325	MAW80BR012	TUBE/PIPE	100	219.1	2	M	
326	MAW80BR012	VALVE	100	219.1	1	NO	
327	MAW80BR013	TUBE/PIPE	100	219.1	1	M	
328	MAW80BR013	TUBE/PIPE	100	33.4	1	M	
329	MAW80BR013	TEE	100	219.1	1	NO	
330	MAW80BR013	ELBOW	100	219.1	4	NO	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
331	MAW80BR013	FLANGE	100	219.1	2	NO	
332	MAW80BR013	TUBE/PIPE	100	219.1	7.5	M	
333	MAW80BR013	VALVE	100	219.1	1	NO	
334	MAW80BR020	TUBE/PIPE	100	33.4	10.5	M	
335	MAW80BR020	BEND	100	33.4	6	NO	
336	MAW80BR021	TUBE/PIPE	100	33.4	11.5	M	
337	MAW80BR021	BEND	100	33.4	6	NO	
338	MAW81BR001	ELBOW	310	114.3	2	NO	
339	MAW81BR001	TUBE/PIPE	310	114.3	4	M	
340	MAW81BR001	BEND	310	114.3	1	NO	
341	MAW81BR002	ELBOW	310	114.3	3	NO	
342	MAW81BR002	TUBE/PIPE	310	114.3	4	M	
343	MAW81BR003	ELBOW	310	168.3	2	NO	
344	MAW81BR003	TUBE/PIPE	310	168.3	8	M	
345	MAW81BR003	REDU	310	168.3	1	NO	
346	MAW81BR003	BEND	310	168.3	1	NO	
347	MAW81BR003	FLANGE	310	168.3	2	NO	
348	MAW81BR003	TEE	310	168.3	1	NO	
349	MAW81BR003	VALVE	310	168.3	1	NO	
350	MAW82BR001	ELBOW	310	114.3	3	NO	
351	MAW82BR001	TUBE/PIPE	310	114.3	4	M	
352	MAW82BR001	BEND	310	114.3	1	NO	
353	MAW82BR002	ELBOW	310	114.3	4	NO	
354	MAW82BR002	TUBE/PIPE	310	114.3	4	M	
355	MAW82BR003	ELBOW	310	168.3	4	NO	
356	MAW82BR003	TUBE/PIPE	310	168.3	7.5	M	
357	MAW82BR003	REDU	310	168.3	1	NO	
358	MAW82BR003	BEND	310	168.3	1	NO	
359	MAW82BR003	FLANGE	310	168.3	2	NO	
360	MAW82BR003	TEE	310	168.3	1	NO	
361	MAW82BR003	VALVE	310	168.3	1	NO	
362	MAW83BR001	ELBOW	310	114.3	6	NO	
363	MAW83BR001	TUBE/PIPE	310	114.3	14	M	

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Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement	Insulation Thickness (mm) To be filled by vendor
364	MAW83BR001	BEND	310	114.3	1	NO	
365	MAW83BR001	VALVE	310	114.3	1	NO	
366	MAW83BR001	FLANGE	310	114.3	2	NO	
367	MAW84BR001	ELBOW	310	141.3	2	NO	
368	MAW84BR001	TUBE/PIPE	310	141.3	9.5	M	
369	MAW84BR001	REDU	310	141.3	1	NO	
370	MAW84BR001	BEND	310	141.3	1	NO	
371	MAW84BR001	FLANGE	310	141.3	2	NO	
372	MAW84BR001	VALVEE	310	141.3	1	NO	
373	MAW84BR002	TUBE/PIPE	310	114.3	2	M	
374	MAW85BR001	ELBOW	225	88.9	2	NO	
375	MAW85BR001	TUBE/PIPE	225	88.9	3	M	
376	MAW85BR001	BEND	225	88.9	2	NO	
377	MAW85BR001	VALVE	225	88.9	1	NO	
378	MAW85BR001	FLANGE	225	88.9	2	NO	
379	MAW86BR001	TUBE/PIPE	225	88.9	2.5	M	
380	MAW86BR001	BEND	225	88.9	2	NO	
381	MAW86BR001	VALVE	225	88.9	1	NO	
382	MAW86BR001	FLANGE	225	88.9	2	NO	

Sl No	TAG No of the Line	TYPE	Operating Temperature (deg C)	Pipe OD (mm)	Measurement	Unit of measurement		Insulation Thickness (mm) To be filled by
1	MAA14BR001	BEND	565	219.1	6	NO		
2	MAA14BR001	FTUB	565	229	2	NO		
3	MAA14BR001	WELDOLET	565	60.3	1	NO		
4	MAA14BR001	TUBE/PIPE	565	219.1	11	M		
5	MAA14BR002	BEND	565	219.1	4	NO		
6	MAA14BR002	FTUB	565	229	2	NO		
7	MAA14BR002	WELDOLET	565	60.3	1	NO		
8	MAA14BR002	TUBE/PIPE	565	219.1	12	M		
9	MAA14BR003	ELBOW	520	168.3	7	NO		
10	MAA14BR003	TUBE/PIPE	520	168.3	15	M		
11	MAA14BR003	REDU	520	219.1	1	NO		
12	MAA14BR004	ELBOW	520	168.3	13	NO		
13	MAA14BR004	TUBE/PIPE	520	168.3	21	M		
14	MAA14BR004	REDU	520	219.1	1	NO		

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 25 (Twenty five) pages. Turbine Drainage System = 9 Pages, Seal Steam System = 14 Pages & Overload Piping System = 2 Page.

SPECIAL INSTRUCTIONS:

Checklist for Vendors

Sl No	BHEL REQUIREMENTS	VENDOR's CHECKPOINT (To be filled by Vendor) [YES/NO]
1	***Vendor has indicated insulation thicknesses for all items covered in this document.***	
2	***Vendor has considered design criteria as per doc no 412114W5000 , ST29005 REV_04 & Annexure-1 (Customer Spec.).***	
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 Kg and m^{2}) & Aluminium (in kg, for 18,20 & 22 SWG separately) in their standard format.***	

Rajeev kumar 17.06.2020
PREPARED BY: RAJEEV KUMAR (DY. MANAGER-PED)

ANUJ JAIN Digitally signed by ANUJ JAIN DN: cn=ANUJ JAIN, o=BHEL, ou=HEEP, email=anujjain@bhel.in, c=IN Date: 2020.06.17 11:54:52 +05'30'
APPROVED BY: Sh ANUJ JAIN (DGM-PED)

	THERMAL INSULATION SCHEDULE FOR TURBINE INTEGRAL PIPING TURBINE LAYOUT GROUP	BHEL DOC. NO. 412114W5000
		REV. – 0 / DATE: 11.06.2020
		MATERIAL CODE:-W90313146101

Project		SPEC DOC. NO.
1X660MW BHUSAWAL TPP		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	AS PER 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	Approved by
Rajeev kumar Dy Manager- TL 16/06/2020	Anuj Jain DGM- TL 17/6/2020

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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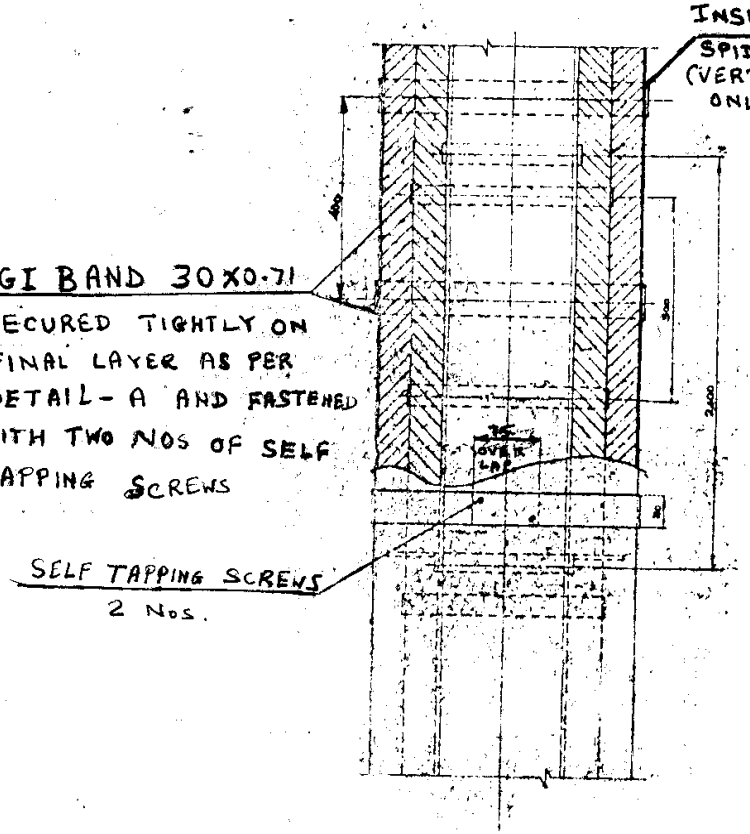
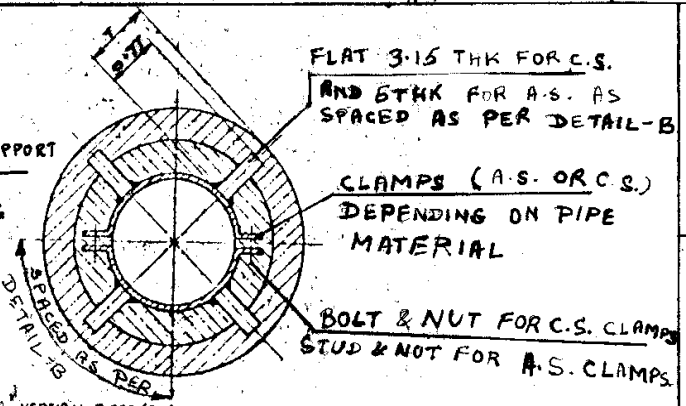
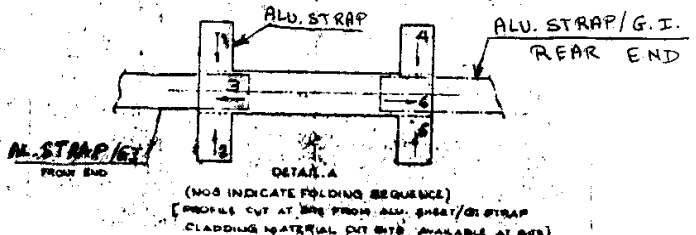
P-5788	22/6/87				

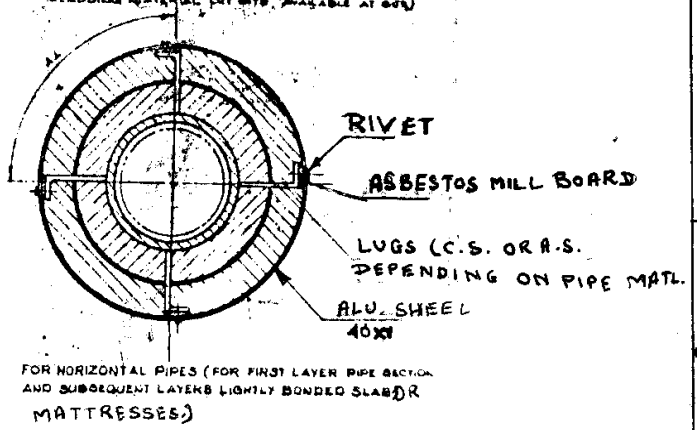
REV. NO 04

WORKED BY:- Rajan CHECKED BY:- Kumar









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PRODUCT STANDARD

STEAM TURBINE ENGINEERING

ST 29005

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FORM

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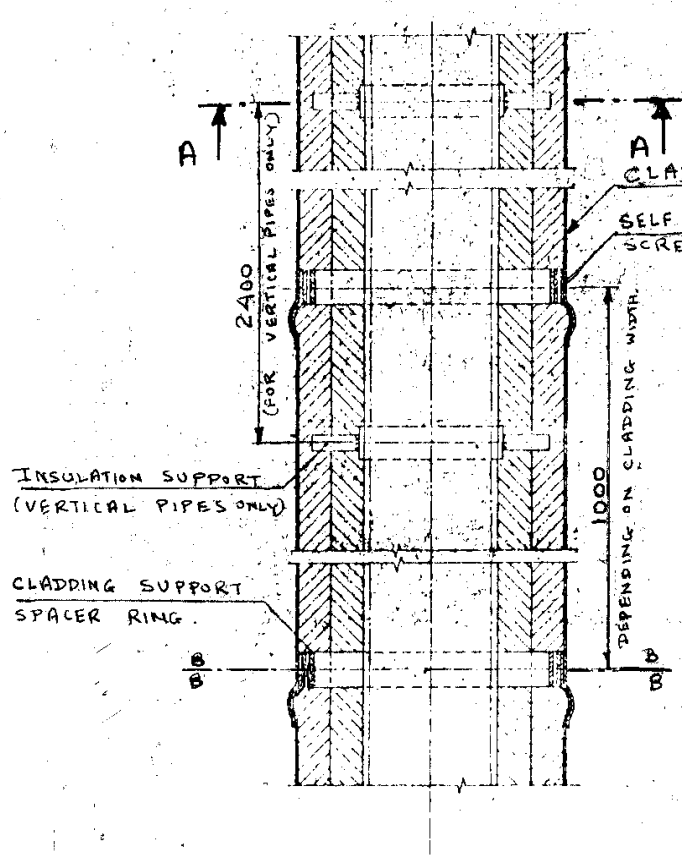
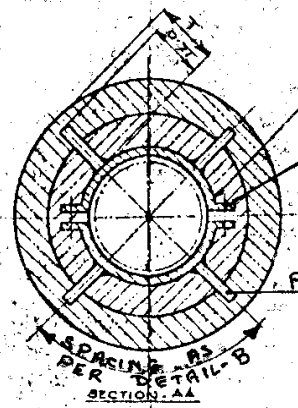
P- 5788	27/2/89				

REV. NO. 04

WORKED BY :- R.G.

CHECKED BY :-





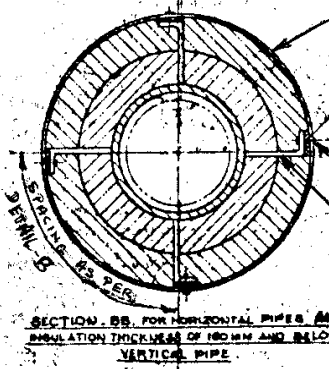
SECTION - AA

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.



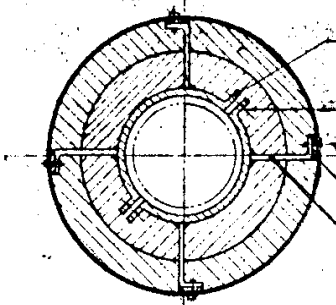
AL. STRAP t=40 TO BE TIGHTLY FASTENED AS PER DETAIL-A

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.

BHEL

STEAM TURBINE ENGINEERING

PRODUCT STANDARD

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FORM

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.

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.

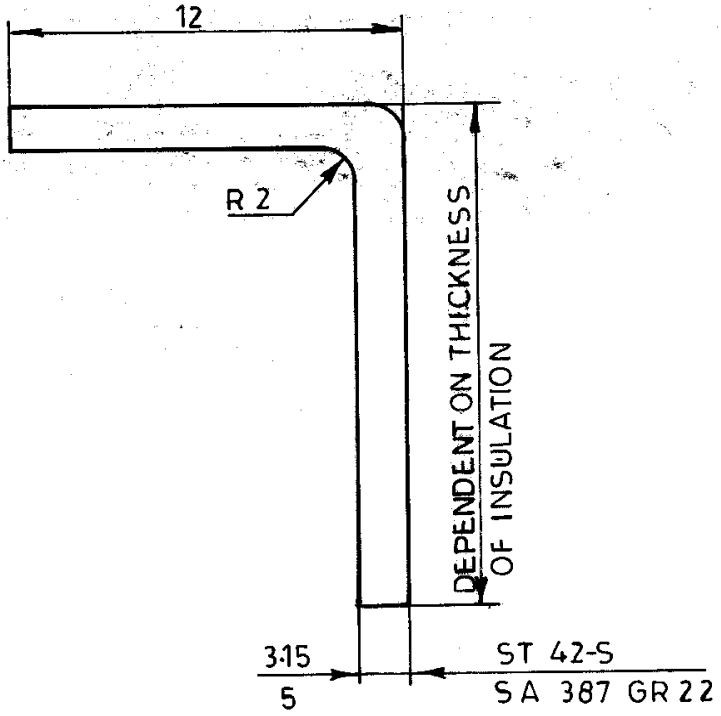
F. CROSS REFERRED STANDARDS :-

IS:737

IS:8183

IS:9842

IS:14164

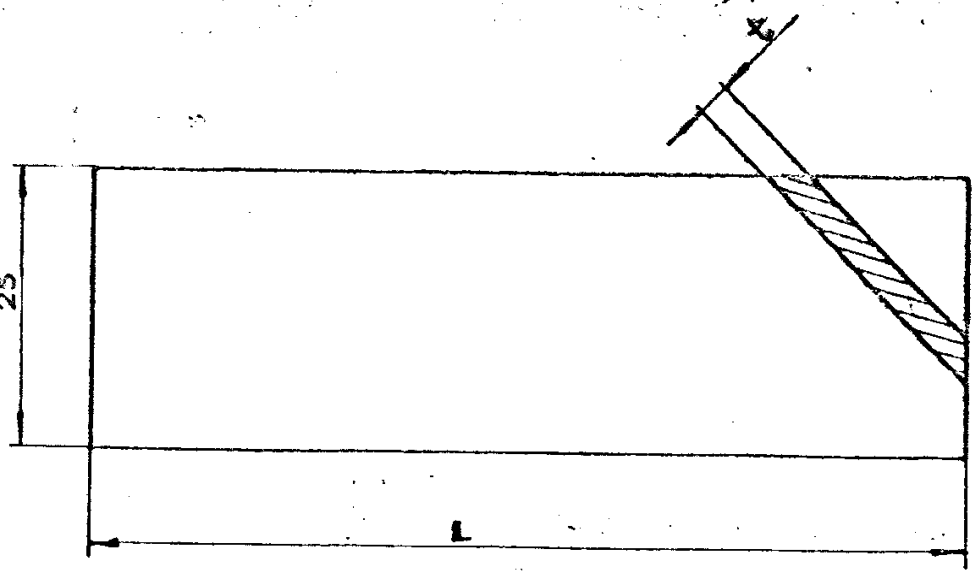


LUGS

REV. NO. 04

WORKED BY:— Rajan

CHECKED BY:—



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

SIGN & DATE 27/6/80

REV. NO 04

WORKED BY:- Rajan

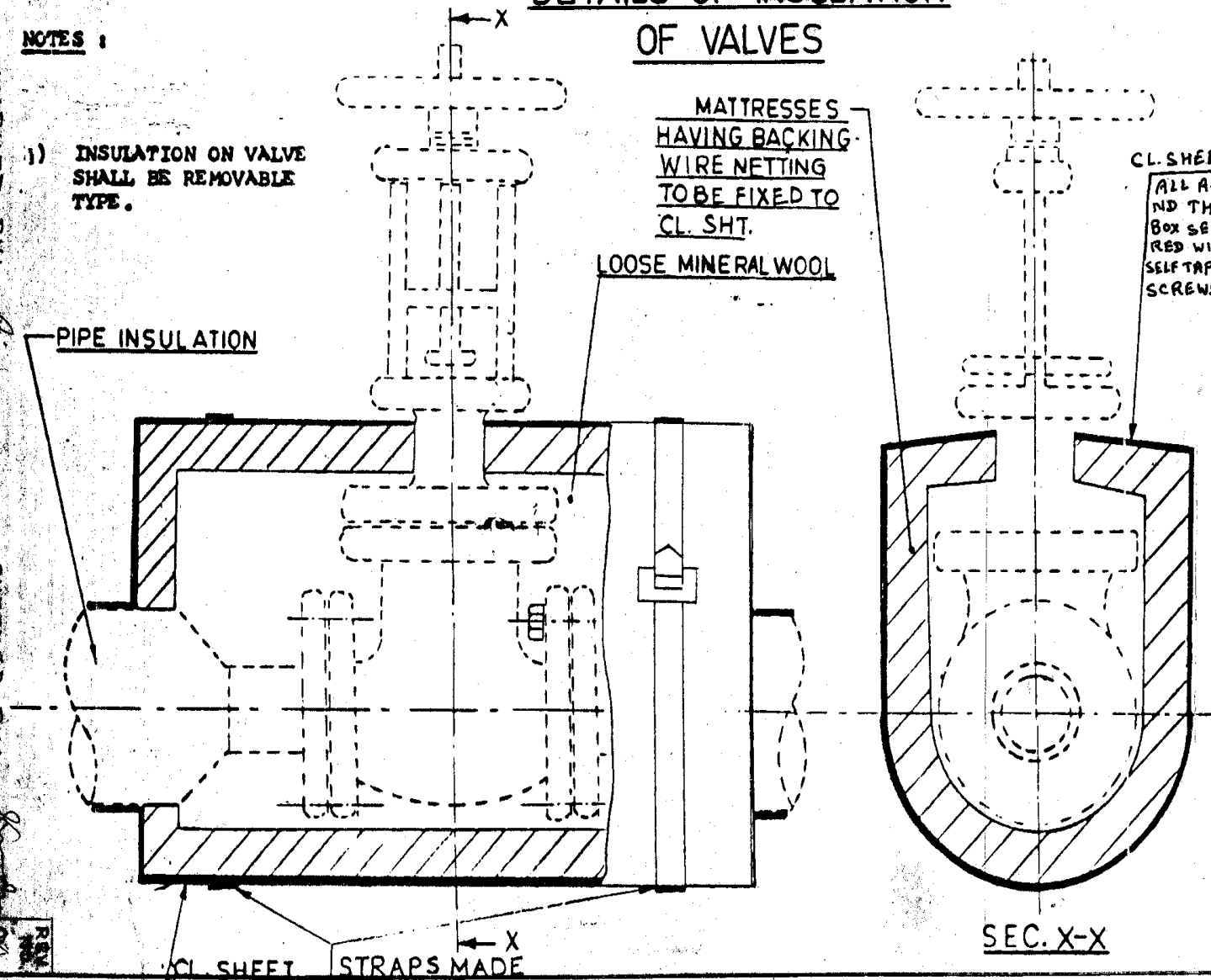
CHECKED BY:-

INVENTORY No.	SIGN & DATE		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 insterest of the company.	SUPERSEDES INVENTORY No.	SIGN & DATE
P-5788	22/6/84				

DETAILS OF INSULATION OF VALVES

NOTES :

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



WORKED BY :- Rajesh

CHECKED BY :- [illegible]

REV. NO. 01

PRODUCT STANDARD

STEAM TURBINE ENGINEERING

ST 29005

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FORM

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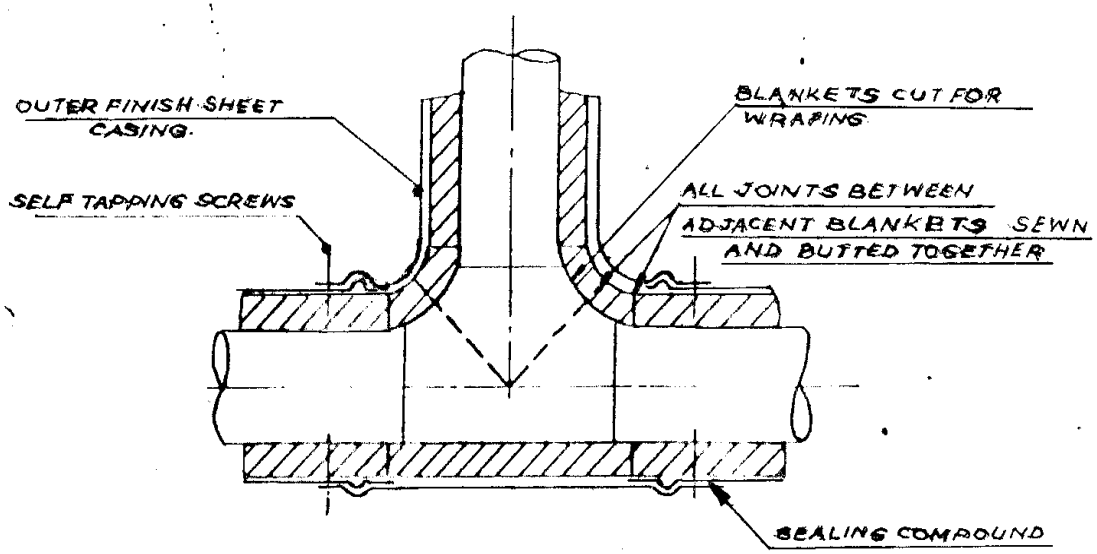
P-5788	25/6/89				

WORKED BY:- Rajan

CHECKED BY:-

REV. NO. 04

FIXING OF INSULATION ON TEES



TEE INSULATION
(WITH MATTRESS INSULATION)

PRODUCT STANDARD

STEAM TURBINE ENGINEERING

ST 29005

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FORM

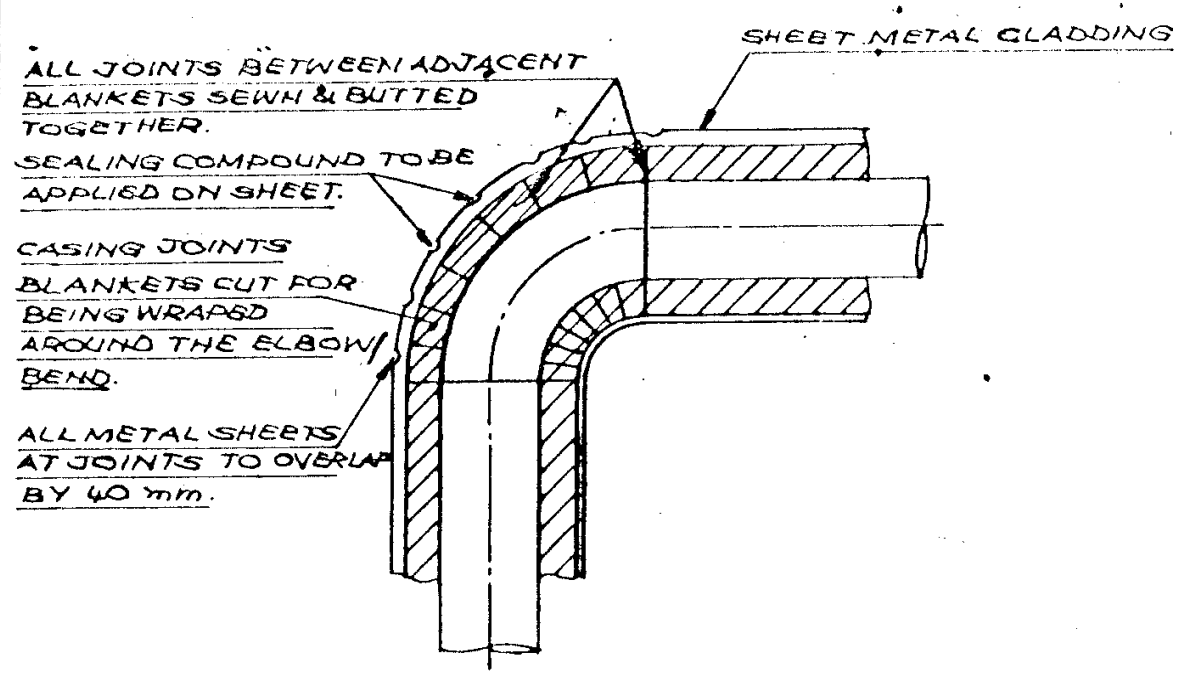
INVENTORY No.	SIGN & DATE		COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the insterest of the company.	SUPERSEDES INVENTORY No.	SIGN & DATE
P-5788	22/4/89				

REV. NO. 04

WORKED BY:- Rajan

CHECKED BY:- [signature]

FIXING OF INSULATION ON BENDS / ELBOWS



WITH MATTRESS

BHEL

PRODUCT STANDARD

STEAM TURBINE ENGINEERING

ST 29005

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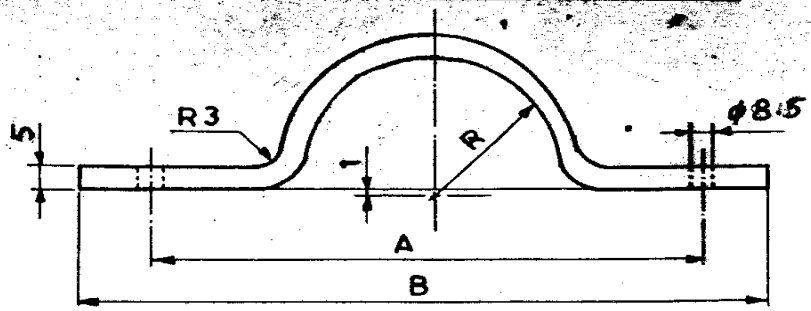
FORM

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

REV. NO. 04

WORKED BY:— Rajan

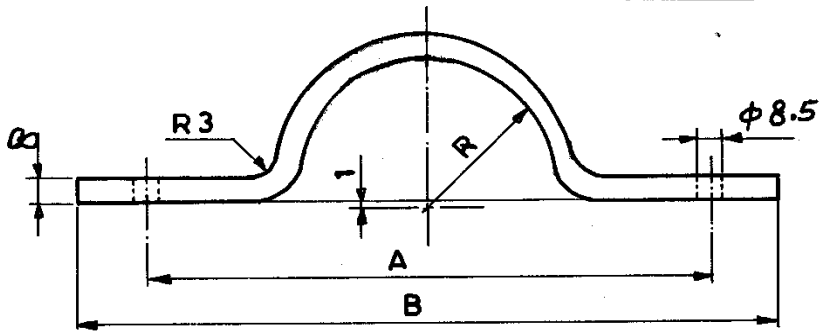
CHECKED BY:— [signature]

FORM

PRODUCT STANDARD
STEAM TURBINE ENGINEERING

ST 29005
PAGE 20 OF 23

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

REV. NO. 04

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 :- [signature]

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 AND ADDRESS	ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING	QP. NO.:	QA/BE/QP/316/BSWL		
				REV. NO.:	00		
		DRG. / DOC NO.:	412114W5000 & 412114W5001				
		REV. NO.:	AS PER DRWAING / DOC.				
		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
										M	B	N	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**D**	**10**			**11**
1.0	Material												
1..0	Bonded mineral / Rockwell mattresses												
1.1	Routine tests												
1.1.1		Chemical Composition	Major	Chemical	1 Sample/lot	Vendor's Std	Vendor's Std	TC	√	P	-	-	
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	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	V	-	
1.1.14		Corrosive Attack / Chloride Content	Major	Chemical	-do-	IS 3144	IS 8183	TC	√	P	V	-	
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												
3.1		Chemical Composition	Major	Analysis	Sample As Per	IS 6528/IS 280	IS 6528 / IS 280	TC	√	P	V	-	

MANUFACTURER/SUBCONTRACTOR		LEGEND: RECORDS IDENTIFIED WITH (√) '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 Digitally signed by Manindra Kumar Date: 2020.06.27 08:22:08 +05'30'

MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN			TO BE FILLED BY BHEL	TO BE FILLED BY BHEL
BHEL	VENDOR'S NAME AND ADDRESS	ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING	QP. NO.:	QA/BE/QP/316/BSWL		
				REV. NO.:	00		
		DRG. / DOC NO.:	412114W5000 & 412114W5001				
		REV. NO.:	AS PER DRWAING / DOC.				
		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**
					IS 6528 / IS 280								
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	-	-	
5.2		Packing & Despatch	Major	Visual	100%	ST 29005	ST 29005	IR	-	P	-	-	

NOTE: 1. Thermal Conductivity or 'K' Value test report on the samples identified and tested in last one year shall be reviewed by BHEL / BHEL nominated inspection agency. However, samples for Thermal Conductivity or 'K' Value test shall be identified by BHEL / BHEL nominated inspection agency from each lot and test shall be conducted at (BHEL agreed lab) CBRI Roorkee / IIT Chennai / PIBCO, NEW DELHI / M/s ISOLLOYD ENGINEERING TECHNOLOGIES LIMITED, BADDI. The test report of the same shall be submitted to BHEL for review and acceptance.

NOTE: 2 BHEL reserves the right for conducting repeat test, if required.

		LEGEND: RECORDS IDENTIFIED WITH (√) '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	
MANUFACTURER/SUBCONTRACTOR				APPROVED BY Digitally signed by Manindra Kumar Date: 2020.06.27 08:22:24 +05'30'