

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN				TO BE FILLED BY BHEL		TO BE FILLED BY BHEL	
VENDOR'S NAME AND ADDRESS		ITEM	THERMAL INSULATION FOR TURBINE INTEGRAL PIPING		QP. NO.:	QA/BE/QP/316/VYI/KRS					
					REV. NO.:	00					
					DRG. NO.:	AS PER DRWAING					
					REV. NO.:	AS PER DRWAING					
					SPEC. NO.:	ST 29005					
					REV. NO.:	04					
		CHARACTERISTICS		CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY	REMARKS
SL. NO.	COMPONENT & OPERATIONS	3	4	5	6	7	8	9	10	11	
1	2										

3.2	Dimensions (Size of netting & Dia / Gauge of Wire)	Major	Measurement	-do-	ST 29005	ST 29005 / Appd BOM	IR	V	P	V	-
3.3	Tensile Test & Elongation	Major	Physical	-do-	IS 6528 / IS 280	IS 6528 / IS 280	TC	V	P	V	-
3.4	Wrapping Test	Major	Physical	-do-	IS 6528 / IS 280	IS 6528 / IS 280	TC	V	P	V	-
3.5	Bend Test	Major	Physical	-do-	IS 6528 / IS 280	IS 6528 / IS 280	TC	V	P	V	-
3.6	Mass of Coating for GI Wire	Major	Measurement	-do-	IS 280	IS 280	TC	V	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.

MANUFACTURER/SUBCONTRACTOR		FOR CUSTOMER USE	
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		APPROVED BY  Aarti Meena अभियन्ता/Engineer युगता अश्वारब/Quality Assurance बी. एच. ई. एल., हरिद्वार BHEL, Haridwar	



THERMAL INSULATION SCHEDULE FOR TG INTEGRAL PIPING

PROJECT: 800 MW

PROJECT STAGE: CONTRACT

SPEC.NO. ST29005 Rev_04

DESIGN PARAMETERS:

- COLD FACE TEMPERATURE: 60 DEG C
- AMBIENT TEMPERATURE: 45 DEG C
- EMISSIVITY OF AL. SHEET: 0.2
- WIND VELOCITY: 0.5 M/S
- ASBESTOS USE IN INSULATION IS NOT PERMITTED.

MATERIALS:

- INSULATION MATERIAL: LIGHTLY RESIN BONDED ROCKWOOL
AS PER IS: 8183
- DENSITY: 1. 100 kg/m³ FOR HOT FACE TEMP. $\leq$ 400°C
2. 150 kg/m³ FOR HOT FACE TEMP. $>$ 400°C
- CLADDING MATERIAL: ALUMINIUM SHEET

**DESIGN HEAT LOSS AT
CLADDING SURFACE:**

AS PER ASTM C 680-89.

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



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



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
36	MAM20BR005	CAP	411	88.9								1		
37		ELBOW	411	88.9		5								
38		WELDOLET	411	88.9									1	
39		TEE	411	88.9			1							
40		TUBE/PIPE	411	88.9	9									
41	MAM20BR006	BEND	459	48.3							5			
42		TUBE/PIPE	459	48.3	5									
43	MAM20BR007	BEND	459	48.3							6			
44		TUBE/PIPE	459	48.3	5									
45	MAM20BR008	CAP	459	114.3								1		
46		ELBOW	459	114.3		2								
47		TEE	459	114.3			4							
48		TUBE/PIPE	459	114.3	11									
49	MAM20BR009	BEND	459	48.3							4			
50		TUBE/PIPE	459	48.3	6									
51	MAM20BR010	BEND	459	48.3							6			
52		TUBE/PIPE	459	48.3	6									
53	MAM30BR001	BEND	574	42.2							7			
54		TUBE/PIPE	574	42.2	5									
55	MAM30BR002	BEND	574	42.2							16			
56		TUBE/PIPE	574	42.2	28									
57	MAM30BR003	BEND	574	42.2							18			
58		TUBE/PIPE	574	42.2	28									
59	MAM30BR004	BEND	574	42.2							7			
60		TUBE/PIPE	574	42.2	5	6								
61	MAM30BR008	CAP	574	60.3								1		
62		BEND	574	60.3		9								
63		TEE	574	60.3			2							
64		TUBE/PIPE	574	60.3	18									
65	MAM30BR010	CAP	574	60.3								1		
66		BEND	574	60.3		5								
67		TEE	574	60.3			2							
68		TUBE/PIPE	574	60.3	20									



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

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Seal Steam 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
102	MAW20BR004	FLANGE	340	219.1					2					
103		OLET	340	219.1									3	
104		TEE	340	219.1			2							
105		TUBE/PIPE	340	219.1	4									
106	MAW20BR005	VALVE	340	21.3					3					
107		TUBE/PIPE	340	88.9	5									
108		TUBE/PIPE	340	33.4	1									
109		ELBOW	340	88.9		2								
110		BEND	340	33.4							3			
111		FLANGE	340	88.9					2					
112		REDUCER	340	33.4				3						
113	MAW21BR001	TUBE/PIPE	470	141.3	4									
114		TUBE/PIPE	470	114.3	2.5									
115		REDUCER	470	141.3				1						
116		FLANGE	470	114.3					2					
117		ELBOW	470	141.3		2								
118		ELBOW	470	114.3		1								
119		BEND	470	141.3							1			
120		BEND	470	114.3							3			
121	MAW21BR002	TUBE/PIPE	470	141.3	4									
122		TUBE/PIPE	470	114.3	2.5									
123		REDUCER	470	141.3				1						
124		FLANGE	470	114.3					2					
125		ELBOW	470	114.3		2								
126		BEND	470	141.3							2			
127		BEND	470	114.3							3			
128	MAW21BR003	TUBE/PIPE	470	219.1	5.5									
129		TEE	470	219.1			1							
130		REDUCER	470	219.1				1						
131		BEND	470	219.1							3			
132	MAW22BR001	TUBE/PIPE	470	219.1	6									
133		TEE	470	219.1			1							
134		REDUCER	470	219.1				1						
135		BEND	470	219.1							5			



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

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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	WELDOLET	Insulation Thickness (mm) To be filled by vendor
177	MAW24BR002	TUBE/PIPE	470	141.3	2.5								
178		TUBE/PIPE	470	114.3	1.5								
179		REDUCER	470	141.3				1					
180		FLANGE	470	114.3					2				
181		BEND	470	114.3							2		
182		BEND	470	141.3							3		
183	MAW25BR001	TUBE/PIPE	340	141.3	8								
184		TUBE/PIPE	340	114.3	2								
185		REDUCER	340	141.3				1					
186		FLANGE	340	141.3					2				
187		BEND	340	141.3							6		
188		BEND	340	114.3							2		
189	MAW26BR001	TUBE/PIPE	340	141.3	8								
190		TUBE/PIPE	340	114.3	2								
191		REDUCER	340	114.3				1					
192		FLANGE	340	141.3					2				
193		ELBOW	340	141.3		2							
194		BEND	340	114.3							2		
195		BEND	340	141.3							4		
196	MAW27BR001	BEND	340	141.3							5		
197		BEND	340	114.3							2		
198		ELBOW	340	141.3		2							
199		FLANGE	340	141.3					2				
200		REDUCER	340	141.3				1					
201	MAW28BR001	TUBE/PIPE	340	114.3	2								
202		TUBE/PIPE	340	141.3	8								
203		BEND	340	114.3							2		
204		BEND	340	141.3							3		
205		ELBOW	340	141.3		2							
206	MAW28BR001	FLANGE	340	141.3					2				
207		REDUCER	340	141.3				1					
208		TUBE/PIPE	340	114.3	2								
209		TUBE/PIPE	340	141.3	9								
210	MAW50BR003	TUBE/PIPE	530	219.3	0.5								
211		OLET	530	219.3			1					1	
212		FLANGE	530	219.3					2				



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

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

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
288	MAW80BR004	TUBE/PIPE	190	33.4	0.5									
289		TUBE/PIPE	190	273	10									
290		TEE	190	273			3							
291		FLANGE	190	60.3					2					
292		ELBOW	190	273		7								
293	MAW80BR005	TUBE/PIPE	190	33.4	3									
294		TEE	190	33.4			1							
295		REDUCER	190	33.4				2						
296		ELBOW	190	33.4		8								
297	MAW80BR006	TUBE/PIPE	190	33.4	3									
298		TEE	190	33.4			1							
299		REDUCER	190	33.4				1						
300		BEND	190	33.4		4								
301	MAW80BR007	ELBOW	190	168.3		3								
302		TUBE/PIPE	190	168.3	3									
303	MAW80BR008	VALVE	190	168.3						1				
304		TUBE/PIPE	190	168.3	3									
305		TEE	190	168.3			1							
306		FLANGE	190	168.3					2					
307		ELBOW	190	168.3		4								
308	MAW80BR009	VALVE	190	168.3						1				
309		TUBE/PIPE	190	168.3	3									
310		ELBOW	190	168.3		3								
311		FLANGE	190	168.3					2					
312	MAW80BR010	TUBE/PIPE	190	219.1	0.5									
313		REDUCER	190	219.1				1						
314	MAW80BR011	TUBE/PIPE	190	219.1	0.5									
315		REDUCER	190	219.1				1						
316	MAW80BR012	TUBE/PIPE	190	33.4	12									
317		TEE	190	219.1			1							
318		BEND	190	33.4							5			
319		ELBOW	190	219.1		2								
320		FLANGE	190	219.1					2					
321		TUBE/PIPE	190	219.1	4									

Bill of Materials for Thermal Insulation of TIP
Seal Steam System

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



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

(Signature)

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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 (M)	Length (mm)	ELBOW	TEE	REDUCER	FLANGE	VALVE	BEND	CAP	WELDOLET	Insulation Thickness (mm) To be filled by vendor
397	MAW86BR002	REDUCER	190	141.3				1						
398		FLANGE	190	141.3					2					
399		VALVE	190	141.3						1				
400		TUBE/PIPE	190	141.3	1						1			
401		BEND	190	141.3							3			
402	MAW87BR001	BEND	190	88.9										
403		TUBE/PIPE	190	88.9	1.5									
404		ELBOW	190	141.3		1								
405		FLANGE	190	141.3					2					
406		VALVE	190	141.3						1				
407	MAW87BR002	REDUCER	190	141.3				1						
408		TUBE/PIPE	190	88.9	1									
409		TUBE/PIPE	190	141.3	2									
410		BEND	190	88.9							3			
411		TUBE/PIPE	190	88.9	1									
412	MAW88BR002	REDUCER	190	141.3				1						
413		FLANGE	190	141.3					2					
414		VALVE	190	141.3						1				
415		TUBE/PIPE	190	141.3	1.5									
416		BEND	190	141.3							2			

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

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

1. This BOM may vary by +/- 3%.
2. TEEs and Reducers are not included in pipe length and are to be considered separately for Thermal Insulation as per the above table. This supercedes Clause 2.5 of ST29005 in this regard.
3. This BOM consists of total 20 (Twenty) pages. Turbine Drainage System = 6 Pages, Seal Steam System = 12 Pages & Overload Piping System = 2 Page.



SPECIAL INSTRUCTIONS:

Checklist for Vendors		BHEL REQUIREMENTS	VENDOR'S CHECKPOINT (To be filled by Vendor) [YES/NO]
SI No			
1		Vendor has indicated insulation thicknesses for all items covered in this document.	
2		Vendor has considered design criteria as per doc no 412114W1000 & ST29005 REV_04.	
3		Vendor has furnished Sample Calculations for min 10 different cases.	
4		Vendor has furnished k-values of insulation mattresses at different mean temperatures ranging from 100-300 °C.	
5		Vendor has furnished BOM containing breakup of quantity of mattresses (in m ²) & Aluminium (in kg, for 18,20 & 22 SWG separately) in their standard format.	

PREPARED BY: NAVNEET (Sr Engg-PED)

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

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

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

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

(Signature)

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

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

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

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

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

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